Temperature, Sexual Behavior, and the Internet: What Can We Learn From Google Searches?

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Abstract

In this paper, we use data from Google Trends to estimate the effect of temperature on a set of sexual and mate-seeking keywords. We find that high temperatures increase searches for pornography but suppress searches for online dating services, while cold temperatures do the opposite. This is consistent with substitution between activity based on temperature – when it is hot, people prefer sexual and mate seeking activities which are more solo, while when it is cold they prefer to seek out another person. We also find dynamic effects for online dating searches, but not pornography. We find no difference across US regions, but we do find that our results are driven by rich states, which are more likely to have higher levels of internet penetration.

Keywords: Google, Sexual Behavior, Temperature.

JEL codes: J10, J13, I12.

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1 Introduction

Fertility is seasonal. In the United States, births peak in the late summer and early fall, and are at their lowest point in late winter and early spring. For example, each there are approximately 20% more births in the peak month (September) relative to the trough month (February). Several theories exist explaining this phenomenon, including timing around the school year (cite), seasonal changes in sexual activity (Fortenberry et al. 1997; Levin, Xu, and Bartkowski 2002; Markey and Markey 2013; Rodgers, Harris, and Vickers 1992; Udry and Morris 1967; Wood et al. 2017), or seasonal fetal loss (Becker 1991; Lam and Miron 1991; Seiver 1989).

Regarding these last two channels, seasonal oscillations in temperature have been hypothesized as a driver of both fetal loss and changes in sexual activity. Specifically, hotter summer temperature have been shown to be correlated with increased fetal loss (Lam and Miron 1994, 1996, Wilde et al 2017, Barreca, Deschenes, and Guldi 2018; Wilde et al 2019). It is also hypothesized that hotter temperatures lead to reductions in sexual activity, perhaps due to decreased libido or disutility from physical exertion while hot. However, this mechanism has not been well studied in the literature, so while this conjecture makes intuitive sense, there is been little evidence to demonstrate its veracity. Part of the reason for the lack of literature in this area is that large amounts of daily data on something as personal as sexual activity is hard to obtain. Talking openly about sexual activity remains taboo for many in the US, and therefore questions asking information on daily sexual activity is something few datasets contain. For example, the Toledo Adolescent Relationship Study or the Relationship Dynamics and Social Life Study have detailed data on sexual activity. However, these are only for one county and for a short time frame.

In this paper, we provide additional evidence on the role of temperature on sexual activity, by analyzing the effect of temperature in the United States on Google search frequency for a set of sexual and mate-seeking keywords. Given the taboos regarding sexual behavior, using Google data to analyze sexual behavior may yield more accurate findings that a self report – people tend to ask Google things they would never ask another persion (Stephens-Davidowitz, 2017). We find that high temperatures increase searches for pornography but supress searches for online dating services, while cold temperatures do the opposite. This is consistent with substitution between activities based on temperature: when it is hot, people prefer sexual and mate seeking activities which are more solo, while when it is cold they prefer to seek out another person. This is consistent with the idea that since people generate heat, one may be less inclined to engage in sexual activity in close proximity to another person when it is hot, and vice versa when it is cold.

Our paper contributes to the literature in several ways. First, we provide one of the first studies to analyze the effect of temperature on sexual activity. Besides this paper, only Wilde et al (2017) and Hajdu and Hajdu (2019) test the effect of temperature on sexual activity directly, but both studies have issues with the data they use. Wilde et al (2017) analyzes data from the Demographic and Health Surveys (DHS) across 30 sub-Saharan Africa countries, and find that higher temperatures are associated with lower reported levels of sexual activity. However, their data is monthly, which makes it hard to determine what the effect of a normal heat wave lasting several days to a week would be. In addition, their measure of sexual activity is a question which asks respondents whether they were sexually active in the past four weeks. As a result, their study cannot determine changes in sexually frequency around the incidence of a heat wave, but rather only if it changes the propensity to be sexually active at all. Hajdu and Hajdu (2019) analyze time use data from Hungary and find no effect of temperature on sexual activity. However, these time use surveys so not ask explicitly about sexual activity. Rather, they analyze the effect of temperature on a variable which measures time spent in "dating and intimacy" which could measure a variety of activites besides sex.

Second, our paper is the first to ask whether temperature causes substitution between sexual activities. This substitution is key to understanding the effect of temperature on fertility seasonality, since temperature may induce changes in the amount of sexual activity, but may also induce substitution between types of sexual activity, and particularly towards types which would not lead to an pregnancy. A third contribution is that understanding how temperature changes the amount and type of sexual activity has implications for public health. Temperarure may affect risky sexual behaviors, which could change patterns of STI transmission and other public health concerns. Finally, our paper contributes to the growing literature on the consequences of climate change, as temperature variation and extreme temperature events are predicted to increase as the climate warms.

2 Conceptual Framework

There are several theoretical reasons why temperature could affect sexual activity and internet search behavior. First, temperature may affect libido directly. It is well understood that libido is highly sensitive to injury, disease, or other biological discomforts such as hunger or sleep deprivation. This phenomenon has roots in evolutionary biology, where biological systems which are secondary to the immediate survival of an organism are priortized lower than more essential ones. Generally speaking, reproductive systems have a fairly low priority, which is responsible for phenomena such as menstruation ceasing during periods of malnutrition, or diminished release of sex hormones among those of ill health. Therefore, it is plausible that being uncomfortably hot or cold may reduce libido in order to allow the organism to focus on maintaining its body temperature.

Second, temperature could affect testosterone production, which could change sexual aggesiveness, particularly in males. It is well established that sperm production in the testes is highly sensitive to temperature. The testes are optimally kept several degrees cooler than the rest of the body, which is one of the reasons they reside outside the main abdominal cavity, as opposed to female reproductive organs which reside within. As a result, it has been clearly established that male sperm quality and fecundity is adversely affected by fevers due to its effect on testicular temperature. In addition, men seeking fertility treatments are often counseled to avoid hot tubs, saunas, hot showers or baths, and tight fitting pants in order to reduce the temperature of the testes and promote sperm production. However, although testosterone is also produced in the testes, less is known regarding whether temperature has similar effects on testosterone production as it does sperm production.

Third, in addition to inducing changes in the overall desire for sexual activity, temperature may also change the type of sexual activities in which individuals engage. For example, individuals may find sexual activities which involve close proximity to another person more enjoyable when it is cold, whereas being close to another heat-generating entitiy may be less desirable when it is hot. Therefore, rates of internet pornography use, or solo or mutual mastrubation may increase with higher temperatures as it allows individuals to engage in sexual activities which maintain more distance between partners. Conversely, hugging, spooning, or certain types of sexual intercourse which involve close proximity between partners may increase when it is cold.

Fourth, beyond temperature specifically, different types of weather may affect the propensity for couples to meet for sexual activities. For example, heavy rain, wind, or snow may prevent couples from meeting through shutdown in transit services, or the disutility of walking or biking during adverse weather conditions – including heat waves and cold snaps.

3 Data

This article utilizes two types of data: data on temperature, and data on google searches, each of which are separately described in this section.

3.A Google Search Data

Our data on keyword search frequency comes from Google Trends, a public website which allows users with weekly keyword search frequency, stratified by physical locations ranging from as large as a country to as small as a Metropolitan Statistical Area (MSA) in the US. Data for smaller geographic areas can be more difficult to use, however, since the data are suppressed unless the overall search volume reaches a minimum threshold. For this paper, we use data from the state level in the United States to ensure a wide selection of available search terms. Google reports data beginning in 2004. As a result, our first observation is the week beginning Jan 4th, 2004, and ends on the week ending Jan 3rd, 2015, giving us 574 weekly observations per state across 49 states.[1]

Choosing a set of keywords for which to analyze search frequency is not straightforward. Words associated with sexual activity generally have multiple meanings, which meanings can also change over time. For example, the searches for the word "breast" may be sexual in some contexts, yet nonsexual in others, such as individuals seeking information on breast cancer or screenings. Another example is the word "Tinder": before 2012,

[1]The missing state is Delaware, for which the temperature data were not reported.

most searches for this keyword were probably related to camping or firewood, while afterward 2012 this word became quickly associated with mate-seeking behavior. Yet another example is the word “rubber” which could refer to a condom, or to the industrial material rubber.

To provide a basis for which keywords to use, we follow Markey and Markey (2013) who used a series of 25 sex and mate-seeking keywords to analyze seasonality in sexual behavior in the United States. This set of keywords were chosen by Markey and Markey (2010) using a methodology designed to minimize the change each chosen keyword could be conflated with non-sexual uses. They were also chose to be consistent over the sample period. Using the example above, the word “Tinder” would be inappropriate since it only became a word associated with mate-seeking in 2012, while our data cover the entire timeframe from 2004 - 2015. These keywords are divided into three groups: pornography,[2] prostitution,[3] and online dating,[4] each of which measure very different forms of sex and mate-seeking behaviors. In order to control for seasonal changes in overall internet searches, they use a set of 21 control words divided into three groups which do not have any inherent seasonal trends or sexual connoatations in the United States: pets[5], popular websites[6], and car parts[7].

Google Trends does not provide information on the actual number of searches, but rather provides a relative search index which reports aggregate searches as a percentage of the most searched term and time period. From this we create two measures for each keyword grouping: and aggregate search volume measure, and a standardized measure. The aggregate method simply totals the overall search volume for the group of keywords. The standardized method calculates percentage changes from each keyword’s average, and then takes the mean of those deviations over all keywords in the subgroup. Each method has advantages and disadvantages. For example, an advantage of the aggregate method is that it measures the actual number of keyword searches in a subgroup – but which also means this measure can also be dominated by one or two heavily searched words. For the standardized measure, the advantage is that it measures the average percentage increase over a large subset of search terms, but the disadvantage is that is doesn’t measure the percentage change in overall actual searches in the subgroup. Fortunately, our main results are robust to either method.

After the overall search indicies are calculated for each subgroup, we then divide the sex and mating keyword search volume by the control keyword search volume, creating a ratio of sex and mating searches to control searches. These relative search indices are used

[2]The set of pornography keywords are “porn”, “boobs”, “xvideos”, “tits”, “sex”, “pussy”, “hentai”, “xxx”, “nude”, and “milf”.

[3]The set of prostitution keywords are “call girl”, “escort”, “massage parlor”, “brothel”, and “prostitute”.

[4]The set of online dating keywords are “eHarmony”, “Yahoo Personals”, “AOL Personals”, “Plenty of Fish”, “Zoosk”, “Singles Net”, “Friend Finder”, “JDate”, “Match.com”, and “Okcupid”.

[5]The set of pets keywords are “dog”, “cat”, “hamster”, “fish”, “snake”, “ferret”, and “bird”.

[6]The set of popular website keywords are “Yahoo”, “Facebook”, “Youtube”, “Hotmail”, “Google”, “MySpace”, and “eBay”.

[7]The set of car parts keywords are “tires”, “brakes”, “windshield”, “hoods”, “engine”, “headlight”, and “horn”.

as the dependent variable in our regressions.

3.B Temperature Data

Temperature data come from the Global Historical Climatology Network (GHCN), a database of weather station data maintained by the National Climatic Data Center (NCDC) at the National Oceanic and Atmospheric Administration (NOAA) in the United States. Specifically, we use the daily temperature series, which contains data on the high and low temperatures for every weather station in the US over our sample period.

Our unit of observation for the search data is the state-week, but for the temperature data it is the station-day. Therefore, we not only need to aggregate the temperature data over time, but also over space – neither of which are straightforward. For example, a regression of sexual activity on a simple average temperature would ignore likely significant non-linear effects of temperature. We follow the best-practices methodology outlined in the review article by Dell et al. (2014) to create a series of temperature bins to non-parametrically estimate the effect of temperature on searches.

Specifically, for each station we begin by averaging the daily high and low temperatures to create a daily average. We then take the mean of the daily averages across each state to get a state-day observation. The distribution of these state-day temperature averages are plotted in Figure 1, and has a few notable characteristics. First, they tend to follow a normal distribution, implying there is sizable support for each of our main temperature bins between -15° and 32.5° C. Second, the lack of many observatons outside the range of -15° and 32.5° C may seem surprising at first glance, especially since temperatures in the US can fall far outside this range. The explanation for this is two fold. First, these data are averages across entire states, so extreme outliers in some parts of a state will be counterbalanced by cooler temperatures in others. Second, these temperatures are averages of the daily highs and daily lows. So while it might reach 50° C in Death Valley, Cailfornia, the average temperature recorded in our dataset – even if we did not also average across an entire state – will be much lower since it will be averaged with the overnight low in Death Valley for that specific day. In results not shown, we repeat our analysis using just the high and just the low temperature, and show that our results are robust to these variations in temperature measurement.

Afterwards, we create a set of variables, one for each $2.5°$ C temperature bin between $-15°$ and $32.5°$ C, and define each binned variable to be the number of days in a given week that a states average temperature fell within that bin. We also create one bin for temperatures below $-15°$ C, and one for above $32.5°$ C. This allows us to test for the effect of each temperature temperature range separately and non-parametrically, in order to allow for non-linear effects as flexibly and possibly.

4 Empirical Specification

Formally, we estimate the following regression equation:

$$Y_{swy} = \alpha_{sm} + \gamma_y + \sum_{g \neq r}^{G} \beta_g T_{swy}^{g} + \epsilon_{swy}, \tag{1}$$

where Y_{swy} is the search index of interest in state s in week w in year y. In order to simultaneously control for time invariant regional differences and seasonality, we include a state-month fixed effect α_{sm}. This effect is pivotal to our identification strategy, since temperature and seasonality are clearly linked. By comparing search term frequency across the same month in the same state but across years, we are only using the month- and state-specific random temperature deviations from the state-month specfic mean to identify our effect, stripping out the variation in temperature due to seasonality. In fact, what we do is even more conservative: this methodology also controls for any other confounding variable which is common to that state-month, such as seasonality in the composition of who uses the internet and for what purposes. We also include year fixed effects γ_y to control for generalized changes in internet use or keyword search composition common to the entire US over time. This regression follows the more recent best-practices statistical methodology as outlined in Dell et al (2014).

The β_gs in the summation term in (1) are our coefficients of interest. Each β_g represents the effect of one extra day whose average temperature falls within bin g on the search index of interest. Each of these coefficients is interpreted at the effect relative to an additional day of temperature which falls into a reference temperature bin, which is ommitted from the regression to avoid the dummy variable trap. Formally, T_{swy}^{g} is defined as the number of days the average temperature in state s fell within temperature bin g in week w of year y. We define temperature bins by 2.5° increments between -30°C and 40°C, but in order to get enough support for some bins we collapsed all bins above 32.5°C into one bin, and similarly all the bins below -15°C into one bin. Finally, for power concerns we merged every two bins into one except for the reference bin (20°C - 22.5°C), making 12 bins, most of which have a width of 5°C.[8] The reference bin is indexed by r. Finally, standard errors ϵ_{swy} are clustered at the state level to adjust for the fact that the error term may be correlated across observations within the same state.

We also test for dynamic effects of temperature shocks. The most flexible methodology to do this is to allow every temperature bin to have an independent dynamic effect, or to estimate:

$$Y_{sw} = \alpha_{sm} + \gamma_y + \sum_{g \neq r}^{G} \sum_{i=0}^{10} \phi_{w-i,g} T_{s,w-i,g} + \nu_{sw} \tag{2}$$

This is the same regression as (1), except it now incorporates 10 time lags for each temperature bin. Since there are now 110 ϕ coefficients, for clarity in some regressions we collapse

[8] For clarity, our bins in Celsius are less than -15°, -15° to -10°, -10° to -5°, -5° to 0°, 0° to 5°, 5° to 10°, 10° to 15°, 15° to 20°, 20° to 22.5° (the reference bin), 22.5° to 27.5°, 27.5° to 32.5°, and greater than 32.5°.

all bins below 5°C one bin to simply report the dynamic effects of "cold" temperatures:

$$Y_{sw} = \alpha_{sm} + \gamma_y + \sum_{g \neq r}^{G>5} \sum_{i=0}^{10} \phi_{w-i,g} T_{s,w-i,g} + \sum_{i=0}^{10} \psi_{s,w-i}^{<5} T_{s,w-i}^{<5} + \nu_{sw} \tag{3}$$

Additionally, in other regressions we add interaction terms with certain state-level variables to see how the effect of temperature is heterogeneous to these covariates:

$$Y_{sw} = \alpha_{sm} + \gamma_y + \sum_{g \neq r}^{G} \beta_g T_{swg} + \sum_{g \neq r}^{G} \theta_g T_{swg} \cdot H_s + u_{sw} \tag{4}$$

where H_s references the time-invariant state-level covariate. In this article, we consider whether our effects are heterogenous across US Census region. We also consider heterogeneous effects of state income, where state income is given by the Bureau of Economic Analysis in 2015.

5 Results

5.A Main Effects

Our results are reported in Figures 2 - 7. For each keyword set, we report two sets of coefficients in separate panels, one for each method of search aggregation – aggregate in Panel A and standardized in Panel B – as outlined in the Data section. Each figure plots the estimated β_g coefficients for each temperature bin, along with corresponding upper and lower 95% confidence intervals.

Figure 2 reports the effect of temperature on the overall keyword set used in Markey and Markey (2013), combining the pornography, prostitution, and online dating sets into one. As shown in Panel A, there is little to no effect of colder temperatures on searches for this overall keyword set when using the aggregate method. However, warmer temperatures cause a clear and highly significant increase in sex and mate-seeking keyword searches. In order to understand the magnitude of these coefficients, remember that they represent the percentage increase in *weekly* searches for an additional *day* in that temperature range. Therefore, as suggested by our figure, one additional day above 32.5°C increases weekly searches for sex and mate-seeking keywords by approximatey 1.5% relative to a 20-22.5°C day. If every day of the week were above 32.5°C, this would represent a $1.5 \cdot 7 = 10.5\%$ increase in weekly searches relative to a week where each day was 20-22.5°C. The effects for each temperature bin above 20-22.5°C are progressively larger, and all are significant at the 1% level.

Figure 2 Panel B reports the same results, but for the standardized keyword aggregation method. Using this methodology, we find similar effects of hot days on keyword search frequency, but now we also find negative effects for colder temperatures. All but one coefficient on the temperature bins below 15°C are significant at the 10% level, while

3 are significant at the 5%. Additionally, the gradient of these coefficients with respect to temperature is clearly upward sloping, implying that higher temperatures increase searches for this keyword set throughout the temperature spectrum.

We now separate out each of the three keyword sets individually in order to determine whether there are hetergeneous changes in the types of sex and mate-seeking keywords searched as temperature rises. We begin with Figure 3, which shows the effects of temperature on pornography related Google searches alone. In Panels A and B, we find similar results to those in Figure 2: the gradient of the coefficients with respect to temperature increases significantly across the temperature spectrum. Using the aggregate search method in Panel A, we find strong and statistically significanct increases in pornography searches between days above 22.5°C relative to 20-22.5°C days, while days below 15°C cause marginally fewer searches. Using the standardized searches method in Panel B, we find the same gradient, but shifted down slightly such that the effects of hot days are less significant and those of cold days are more.

Figure 4 shows the effect of temperature on the set of prostitution related keywords. In neither Panel A nor B, we do not find any significant effects of either hot or cold temperatures on searches for prostitution related keywords.

Figure 5 analyzes the effect for online dating keywords. Interestingly, in both Panels A and B, we show that the effect of temperature on online dating is the exact opposite of that for pornography searches: colder temperatures *increase* searches for online dating, while cold temperatures *decreased* searches for pornography. For both the aggregate method in Panel A and the standardized method in Panel B, temperatures below 0°C increase searches for online dating, which increases are significant at the 10% level. Warmer temperatures do not have a significant effect on these searches.

This finding suggests heat induces substitution between sexual activities. Specifically, when temperatures are low, our results suggest people tend to pursue romantic and sexual activities which involve seeking out another person, potentially because close proximity to another heat-producing human is more enjoyable in the cold than in the heat. The same rationale may also explain why pornography searches rise when it is hot: as research has shown the majority of pornography consumption is done alone (cite), substituting a sexual experience with another heat-generating human for a more solo experience may be more enticing when it is hot.

5.B Dynamic Effects and Heterogeneity

For the remainer of this article, we examine how our main findings vary intertemporally and heterogeneously across different state subgroups. We being by analyzing whether our estimated temperature effects persist over time. Since we do not find any effect of temperature for the prostitution keyword subgroup, we omit them from the following analysis. In addition, we do not consider the combined subset of all keywords used in Markey and Markey (2013), since our results have demonstated that the effect of temperature on different word groups is highly variable.

Figure 6 reports results from our estimation of equation (3). In this equation, we begin with estimating 110 different ϕ coefficients – ten period effects for each of the 11 non-omitted temperature bins. However, for reporting tractability we collapse each temperature bin below 5°C into one, such that we can report a single set of dynamic coefficients, representing the effect of "cold" days (below 5°C) relative to a 20-22.5°C day over time. In addition, for tractability we only report results for our standardized keyword aggregation method. Results for the aggregate method (available upon request) are not qualitatively different from those using the standardized method.

Panel A of Figure 6 reports the dynamic effects of temperature on pornography keyword searches, while Panel B reports them for online dating keywords. As shown in the figure, the two keyword sets have very different dynamic effects. For example, pornography searches in Panel A only vary with concurrent temperature: in the week of the temperature shock (week 0), there is a large and statistically significant decrease in searches for pornography keywords, consistent with the findings in Figure 3. However, these effects do not persist beyond the concurrent period. This is a fairly intuitive finding, as there are few theoretical reasons to believe that temperature-induced reductions in pornographic searches should continue to persist after the cold snap dissipates.

In Panel B, however, we see a much different pattern. Consistent with the results in Figure 5, online dating searches due to cold weather increase in the concurrent period. However, these searches continue to persist – which changes are significant at the 5% level – periodically for the next 5 weeks. After 5 weeks (not shown on the figure) these effects mitigate back to zero. These results are also intuitive: if one goes onto an online dating site during a cold snap, the individual may make social connections which induce him or her back onto the site in the future.

Next, we test for heterogeneous effects by state-level income. Our measure of state income comes from GDP per capita measures in 2015 produced by the Bureau of Economic Analysis, and does not vary over time in order to capture the overall level of income difference in the US by state, and is not intended to show the effect of annual variation in income, such as from an economic recession or expansion. Specifically, we estimate equation (4), which corresponds to our main regression equation (1), but with additional interaction terms for state-level income.

The reported coefficients are difficult to interpret for several reasons. For example, there are both level effects given by the β_gs, as well as interaction effects given by the θ_gs, which only make sense when both used in conjunction with each other, but also interpreted at a given income level. Therefore, in Figure 7 we report our predicted coefficients after appropriately combining coefficients and evaluating three different income levels: the 25th income percentile state, the median income state, and the 75th income percentile state. In Panel A, we report the results of temperature on pornographic keyword searches for these three state groups. In Panel B, we show the corresponding effects for online dating keyword searches.

In Panel A, we show that the effect of temperature on pornographic keyword searches is highly variable by income group. While all three groups show an increasing effect of temperature on keyword searches, the effect for poor states is significantly smaller than for rich states. Specifically, for states near the 25th income percentile the increase in pornographic searches is not significant for any temperture bin even at the 10% level. In contrast, for states at the 75th percentile of income there are significant effects of temperature at very cold and very hot temperatures at the 1% significance level. In addition, the degree of variability of seaches is monotonically increasing in income levels. In contrast, in Panel B we find no heterogeneity in the effect of temperature on searches by income for online dating keywords. All three groups of states show significant increases in online dating searches when cold, but no effect at hotter temperatures.

Finally, in results not shown we test for heterogeneous effects for our pornography and online data results by US region.[9] We find no heterogeneous effects across these regional groups, and these results are available upon request.

6 Discussion and Conclusion

In this paper, we test whether temperature effects the frequency of sex and mate-seeking keyword search behavior on the internet. We find that it does, but that the effect varies by keyword group. For example, we find that higher temperatures increase searches for pornographic content, while depressing searches for online dating sites. In cold temperatures, the opposite occurs. This suggests heat induces substitution between sexual activities: in warmer temperatures, individuals opt for sexual or mate-seeking activities which are more solo, while in colder temperatures they seek activites which involve other people.

Our paper makes several important contributions to the literature. First, it is one of the few studies to measure the relationship between sexual activity and temperature. Second, it provides a cautionary tale against inferring too much from internet search data. For example, the increase in porn searches may lead one to conclude that temperature does not reduce libido, and therefore the negative relationship between temperature and fertility is not be driven by changes in sexual behavior during heat waves. Since our results suggest the *increase* in the consumption of pornography may actually be caused by a *decrease* in traditional sexual activity, this study provides a cautionary tale regarding the extent to which search data may be used to infer behavior. Ultimately, search data provides a glimpse into what people are thinking – but yields no information on why they think those things.

[9]The US Census Bureau divides the US into four major regions: Northeast, South, Midwest, and Pacific.

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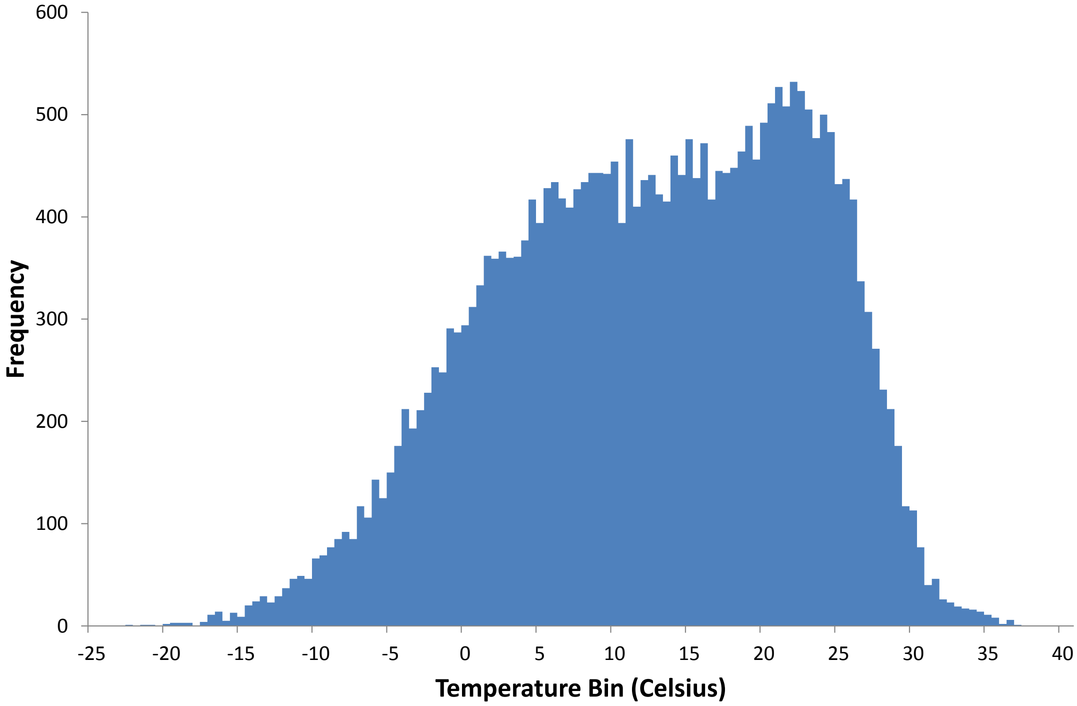
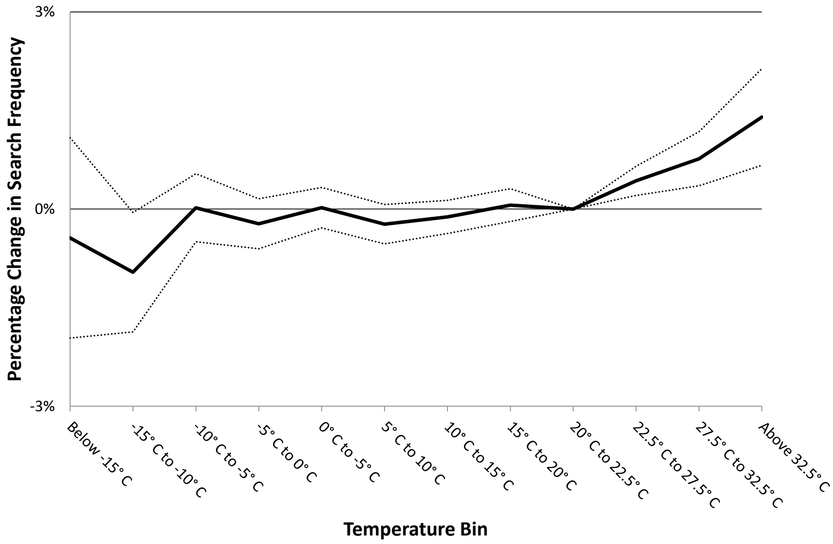
Figure 1: Daily Temperature Distribution



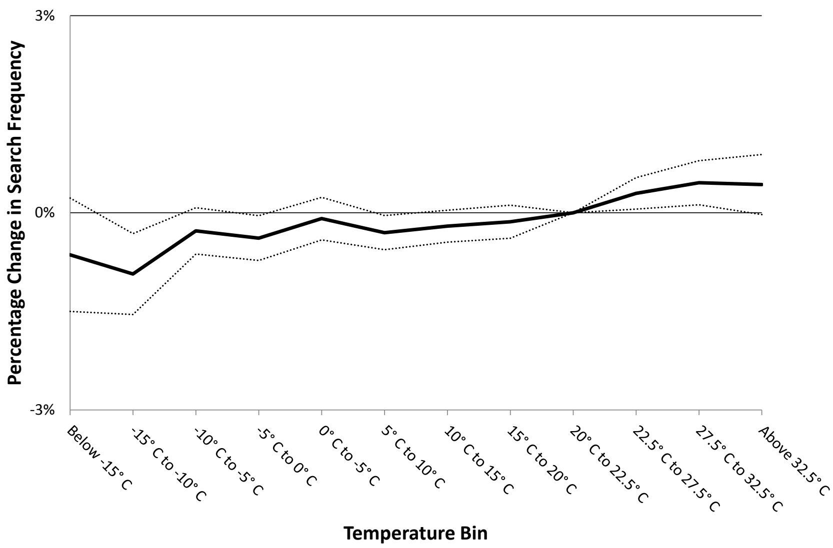
Notes: Description here.

Figure 2: Temperature and Sex and Mate-Seeking Keywords

Panel A: Aggregate Searches



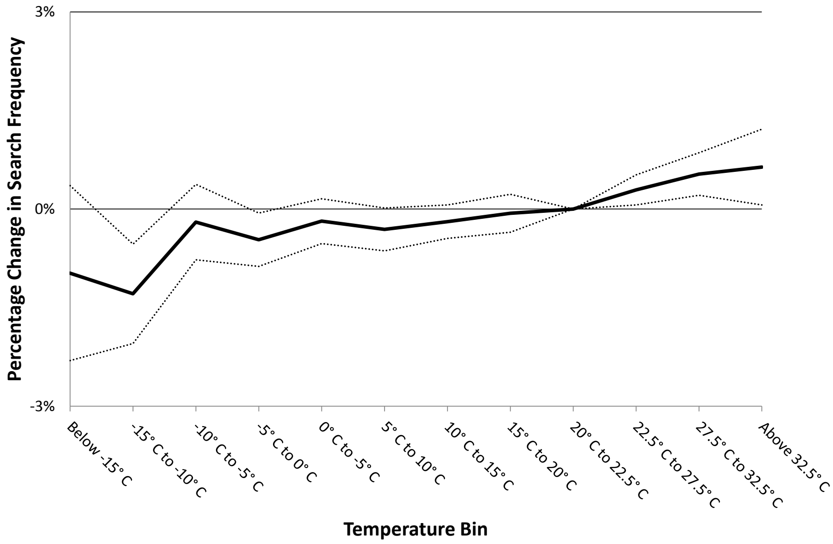
Panel B: Standardized Searches



Notes: Description here.

Figure 3: Temperature and Pornography Keywords

Panel A: Aggregate Searches



Panel B: Standardized Searches

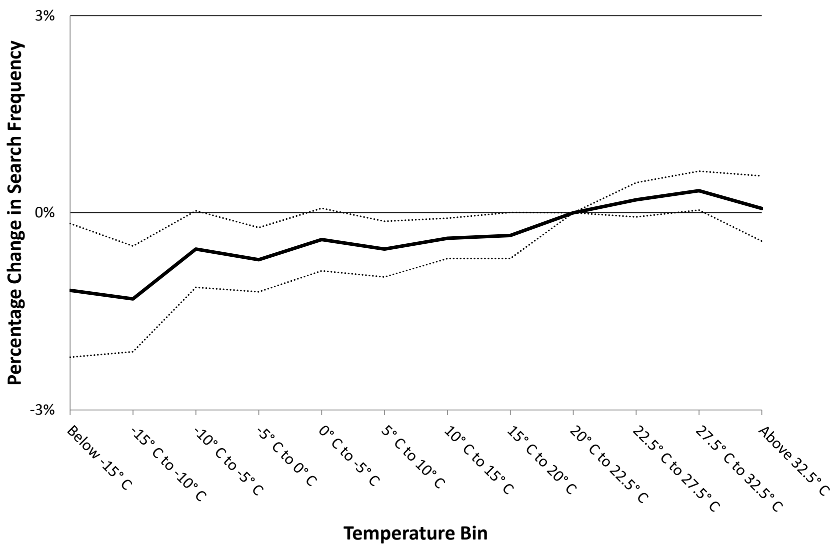


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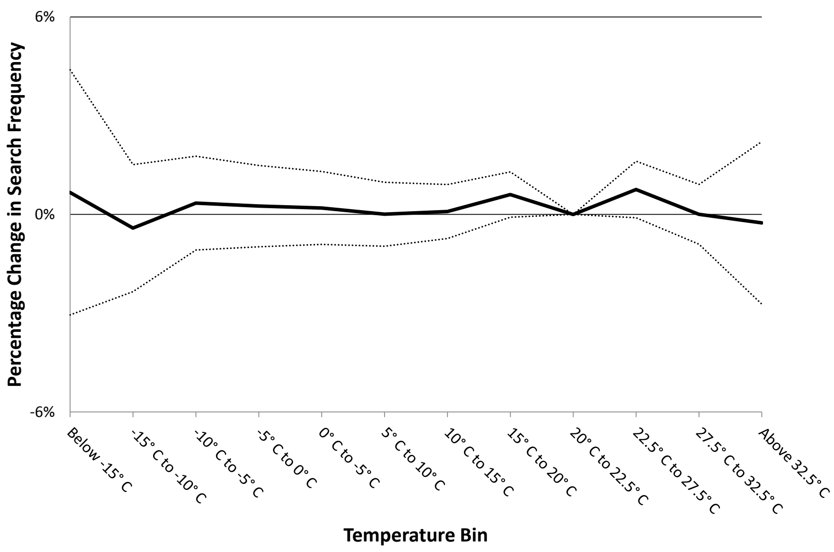
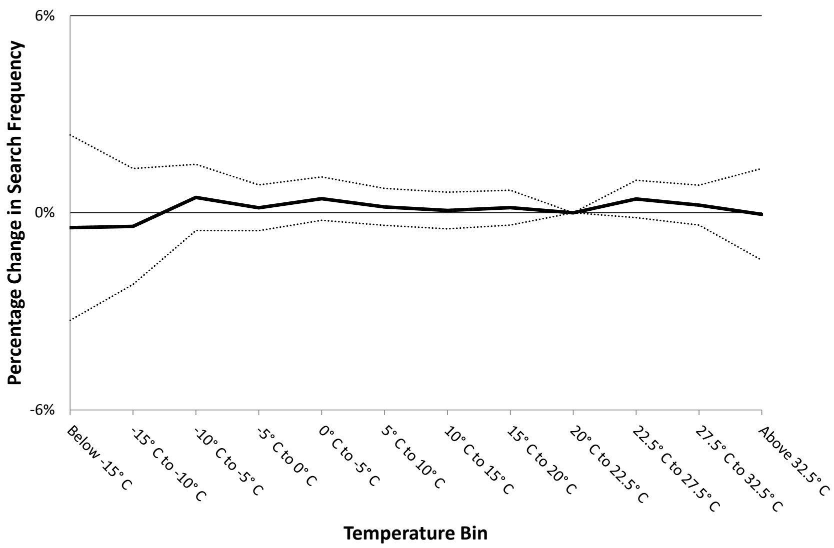
Figure 4: Temperature and Prostitution Keywords

Panel A: Aggregate Searches



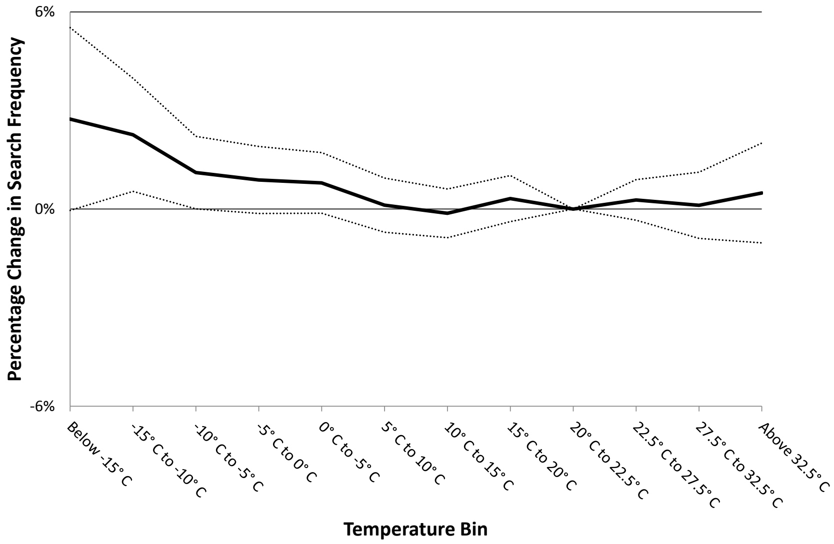
Panel B: Standardized Searches



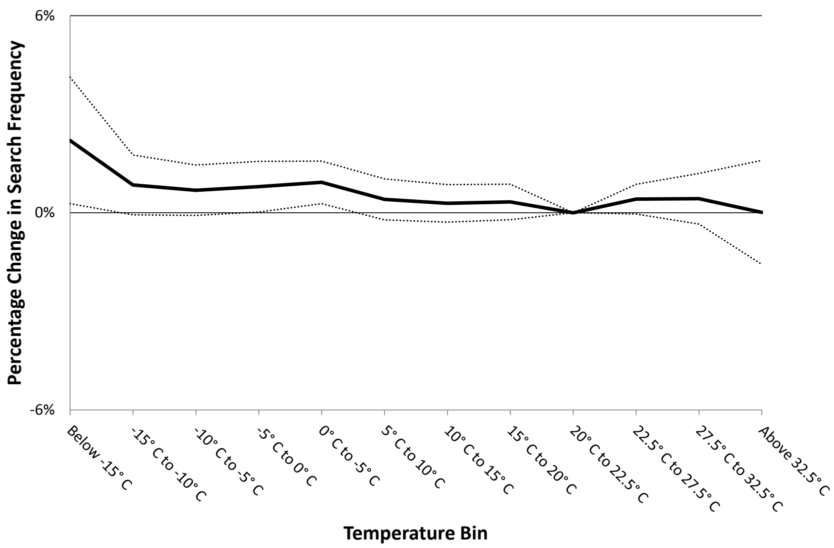
Notes: Description here.

Figure 5: Temperature and Online Dating Keywords

Panel A: Aggregate Searches



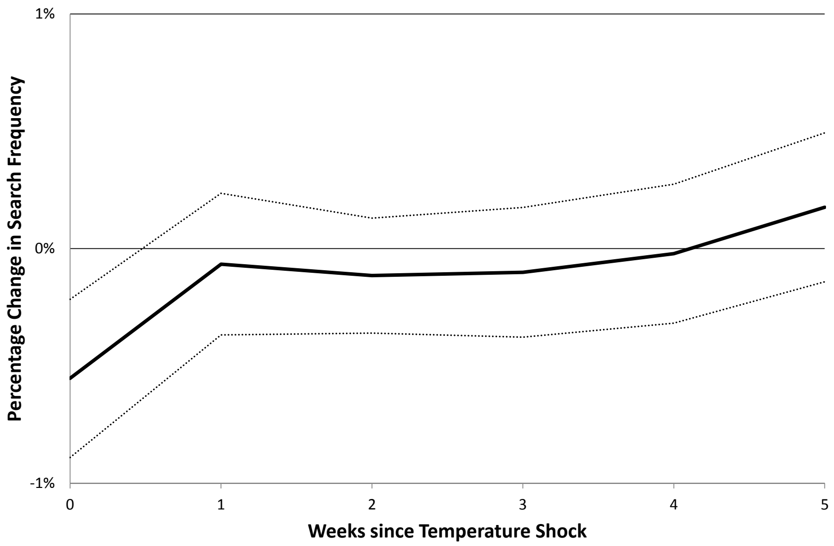
Panel B: Standardized Searches



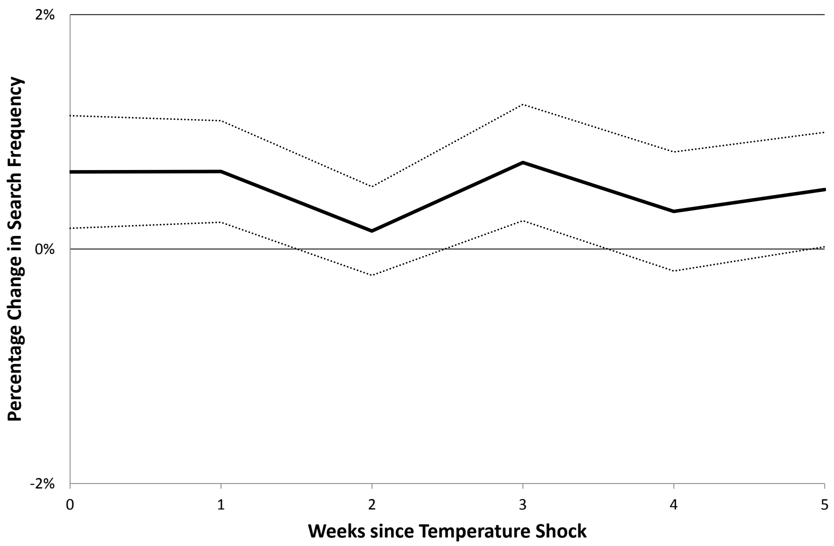
Notes: Description here.

Figure 6: Dynamic Effects

Panel A: Pornography Keywords



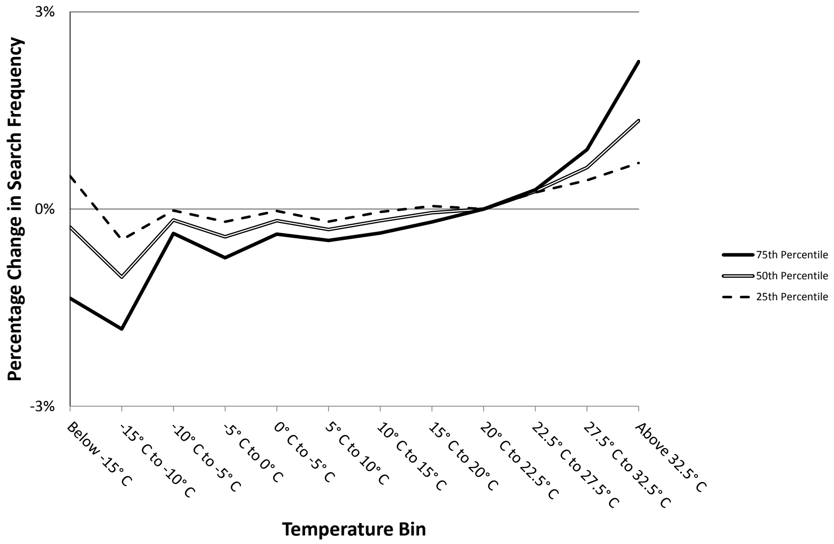
Panel B: Online Dating Keywords



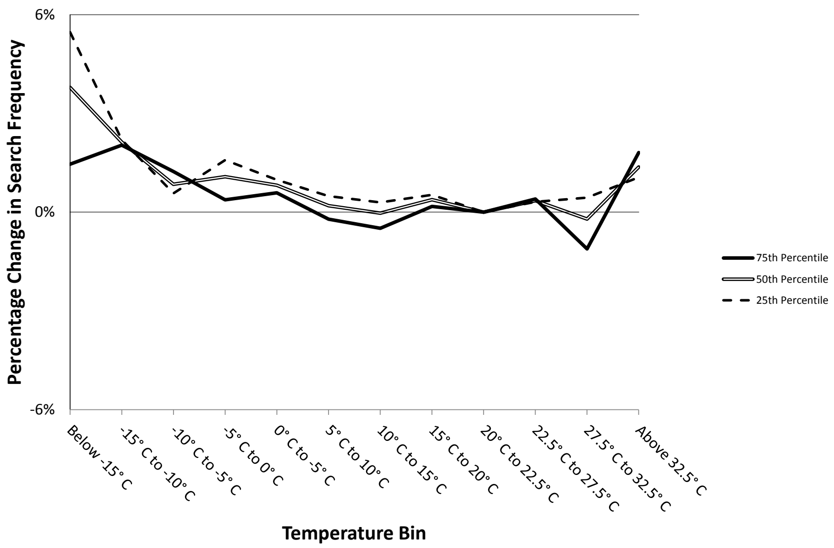
Notes: Description here.

Figure 7: Heterogeneity by State Income

Panel A: Pornography Keywords



Panel B: Online Dating Keywords



Notes: Description here.