



# How broadband and cell phone access have impacted marriage and divorce in the US

Sheena Murray <sup>1</sup>

Received: 16 October 2018 / Accepted: 31 August 2019 / Published online: 19 September 2019  
© Springer Science+Business Media, LLC, part of Springer Nature 2019

## Abstract

Internet use has lowered search costs in the marriage market, as participants (both single and married) can now search for and gather information more easily on potential partners. Additionally, the internet provides ample entertainment options that may act as a substitute for relationships. This paper extends the literature on internet and marriage by using more recent data, a more refined geographical level, and by including a measure of mobile internet. County-level data provides ample variation in internet access and enables consideration of marriage-market size as measured by population and urban density. Fixed-effect regressions indicate that increases in internet access from 2008–2015, either through broadband or cell phone access, are associated with decreased marriage and increased divorce in rural counties. However, in large metropolitan areas, expansion in internet access is correlated with increases in the married population and decreases in the divorced or separated populations. Regressions on age at marriage and percent of the ever-married population in their first, second, or third marriage suggests that the rise in the married population in urban areas is derived from both an increase in initial uptake of marriage and an increase in re-matching of divorcees in secondary marriage markets.

**Keywords** Marriage · Divorce · Internet · Broadband · Search Frictions · Market thickness

**JEL** J11 · J12 · D83

---

**Supplementary information** The online version of this article (<https://doi.org/10.1007/s11150-019-09464-z>) contains supplementary material, which is available to authorized users.

---

✉ Sheena Murray  
sheena-murray@utc.edu

<sup>1</sup> Department of Finance and Economics, University of Tennessee Chattanooga, 615 McCallie Ave, Chattanooga, TN 37403, USA

## 1 Introduction

The rise of internet has transformed how people meet and stay connected before, during, and after marriage. The proliferation of social media, online dating sites, and even adultery- focused applications easily drive anecdotal and sensationalized evidence to support this claim.<sup>1</sup> There is, however, limited academic research available on the topic, and what does exist has become dated. Existing work reveals that during the 1990s and early 2000s the internet had a positive influence on marriages of individuals under 30 years old and a negligible impact on the average divorce rate in the US (Bellou 2015; Kendall 2011).

Theoretically, the internet represents a sound mechanism for enhancing matching ability. Positive evidence has been identified in the employment market, which is similar to the marriage market in a number of ways. Both markets are characterized by search frictions, imperfect information, continual reassessment, and turnover. The internet has been found to be correlated with shorter durations of unemployment (Kuhn and Skuterud 2004), to provide comparable match quality as print advertisements (Hadass 2004), and to increase the employment searches of those already employed (Stevenson 2008). However, research on the internet's impact on the marriage market is far more limited.

The internet as a search medium allows someone to potentially search both the extensive and intensive margins of the marriage market more efficiently. The internet can increase both the number of people the user can review in a fixed time frame, as well as the observable information available on each potential match. The perception of the internet as an effective tool to meet people has increased in the recent years. Those who claimed "online dating is a good way to meet people" increased from 44 to 59% from 2005 to 2013, and those that claimed "online dating allows people to find a better match" increased from 47 to 53% during the same time period (Pew 2013).

These views have translated into higher usage of the internet in peoples' search for a significant other, with approximately 38% of Americans who are single and claim to be looking for a partner having used online dating at some point in time (Pew 2013). In addition to dating-specific applications, the internet has also decreased search frictions in the traditional marriage market through peoples' use of social media and other online gathering places. The internet has created a number of mechanisms and sites dedicated to bringing people together with shared interests. Sites such as Reddit and Digg have vast discussion platforms or

---

<sup>1</sup> There are dozens of dating sites that can be identified from a quick search, many with reviews by thousands of users. The majority of these sites were founded after 2000 (with Yahoo personals, Match, and Jdate being a few exceptions founded in the late 1990s). Many of these sites service niche markets and cater to preferences over race and religion (BlackPeopleMeet, InterracialMatch, Jdate, ChristianMingle), preference on age (ourTime, SeniorPeopleMeet, SilverSingles), and lifestyle (MeetMe, FarmersOnly, DateMySchool, MilitaryCupid, ProfessionalMatch, EliteSingle, SingleParentMeet). In addition to many of the main sites, such as Match, Zoosk, Tinder, Chemistry, PlentyOfFish, and OkCupid, which cater to both heterosexual and homosexual couples, there are many sites dedicated strictly to the gay community (Adam4Adam, BiCupid, CompatiblePartners, Gaydar, GayRomeo, Grinder).

“communities” where individuals can discuss topics and meet others with common interests online. Additionally, sites such as Meetup facilitate people arranging in-person events in their local communities to meet people with similar interests and hobbies.

Traditional outlets of meeting people are also supported through social media sites, where individuals can be located and contacted after in-person meetings. Sites such as Facebook, Instagram, and Linked-In provide individuals an ability to quickly learn more about potential matches in their social circle, work environment, or those that they expect to meet or recently have met.<sup>2</sup> In a 2013 Pew study, a large percent of those surveyed used the internet: to facilitate relationships and information gathering for romantic purposes, to search for information about past, present, and future dates, to introduce others to investigate locations and events to meet others, to flirt with others, to ask people on dates, and to maintain relationships (Pew 2013).

These same aspects of the internet that facilitate match making also pose a threat to matches. Many claim that the internet can strain a relationship. Decreased communication, Facebook-inspired jealousy, and meeting of exes (or others) online appear to be on the rise (AAML 2010; Pew 2014). Additionally, the increased connectivity of the internet may provide a substitute for intimacy found in relationships. Increased access to pornography, video games, and interactive entertainment has been shown to strain both personal and work relationships (Malcolm and Naufal 2016; Doran and Price 2014; Aguiar et al. 2017; Ahlstrom et al. 2012). Further, even for those interested in matching, an increase in potential matches could decrease the desire to wed, as individuals hold out for better matches in a thicker market.

The existing empirical research on how internet access is affecting marriage and divorce all use state-level variation that pre-dates 2005 (Bellou 2015; Kendall 2011). This paper analyzes the relationship between internet access and marriage and divorce across the US in the most recent decade by using data from the Federal Communications Commission and the American Community Survey. I exploit county-level variation in internet access over time, as measured by both broadband access and cell phone carriers, to identify impacts on the married and divorced population. Additionally, county-level data provides a measure of the marriage market size or denseness; thereby, allowing for testing of theoretical predictions regarding market size and match quality. Lastly, the use of recent data captures the exponential growth of social media usage and cell phone access since the last studies were completed.

---

<sup>2</sup> Social Media continues to expand and change, allowing people to share details of their professional life (Linked-In, founded 2002), personal photos and information (Facebook, founded 2004), videos (YouTube, founded 2005), their thoughts (twitter, founded 2006), their photos (Instagram, founded 2010), and their favorite websites (Pinterest, founded 2010). Additionally, interactive games have brought people together across the internet, from simple games like (words with friends, released 2009), to complex multi-player universes (such as: World of Warcraft, released 2004; League of Legends, released 2009; Call of Duty, released 2010; The Elder scrolls, released 2011) which also allow for chat and voice based discussion with other players.

## 2 Literature

### 2.1 Mechanisms

Theoretical models support that the internet could have large ramifications on marriage and divorce. When modeling marriage (or re-marriage), a dynamic search model is most frequently used (Ashenfelter et al. 1986; Weiss 1997). In the search model, an infinite horizon is assumed and individuals search for compatible partners from a given quality distribution. Individuals continue to search until a partner is found who has a quality value that meets or exceeds their given reservation value. Exit from the search (aka- entrance into marriage) depends on the probability of meeting a partner of high enough quality and the probability of accepting their offer. The probability of meeting a high-value partner depends on search costs, frictions, and the quality of the distribution. The probability of accepting said offer is then determined by search costs, discount rates, reservation value in a single state, and the perceived probability of receiving a higher offer.

The internet, as a medium that reduces search costs and frictions, has potential to affect both phases of exiting the market—the probability of receiving an initial offer, and the probability of accepting said offer. As an individual can search faster and more broadly across the market, the probability of receiving an offer increases, which could increase exit into marriage. However, because search costs are lower, an individual's perceived ability to get a higher offer likely increases as well; thereby, decreasing the likelihood of accepting an offer and decreasing the exit into marriage.

This reduction in search frictions can also affect existing matches by increasing the likelihood of meeting those outside of marriage. The ability to discreetly search for extra-marital matches either within one's social network or on extra-marital targeted sites has the potential to increase the uptake of infidelity. When considering adultery, individuals weigh the benefit of an affair against the cost, where the cost of the affair is the expected loss from the affair multiplied by the probability of being caught (Fair 1978). Therefore, because the internet provides a higher level of anonymity, it likely lowers the perceived risk of being caught, which may increase the probability of engaging in such behavior.

Chiappori and Weiss (2006) constructed a model that predicts that increased access to potential mates in a marriage market is likely to increase divorce. Empirical work confirms this predication, showing that those who have a higher perception of remarrying are more prone to divorce, even when holding marital satisfaction constant (Udry 1981). Furthermore, those in urban areas, who have numerous outside alternatives, have a higher propensity to divorce (South and Lloyd 1995). Divorce also increases as the opportunities for meetings between the sexes increase. The sex ratio at work has been found to positively affect divorce due to a decrease in search costs and increase in access to potential partners associated with more equal sex ratios (McKinnish 2007; Kuroki 2013).

Given the internet provides greater access to potential partners and lowers search costs, these articles support that increases in internet access may have a positive impact on both union formation and divorce. In a survey of matrimonial attorneys, 62% felt that the internet had played a substantial role in marital dissolution cases in the last year. Additionally, 42% of their divorce cases in the previous year involved

one party meeting a new love interest over the internet (AAML 2002). This evidence was further perpetuated in pop-culture by the highly publicized hack of Ashley Madison in August of 2015.<sup>3</sup>

There has also been a proliferation of online chat rooms for married individuals. “Cyber affairs” where individuals meet online and maintain emotionally intimate relationships through online communication are relatively new but increasing in occurrence (Mileham 2007). There are also multiple dating site’s oriented towards married individuals or that facilitate casual sexual encounters, regardless of marital status.<sup>4</sup> Additionally, the ability to stay connected to those within one’s past-and-present social circles has also increased. Approximately one third of internet users aged 18–34 use social networking sites, such as Facebook or Twitter, to check-up on people they have previously dated. This behavior appears to continue through one’s lifetime, with 29% of 35–44 and 21% of 45–54 year olds also admitting to checking up on past love interests (Pew 2013).

The internet also provides access to entertainment and levels of interaction not previously available outside of relationships. As such, these resources may be a viable substitute for an intimate relationship for some individuals, and raises the reservation value of staying single. The rise of pornography and gaming have been documented to lower relationship satisfaction for frequent users (Ahlstrom et al. 2012; Doran and Price 2014). Additionally, it has been found that heavy consumption of either form of entertainment tend to deter young men from forming and upholding commitments (Aguiar et al. 2017; Manning 2006; Malcom and Naufal 2016).

The impact of the internet on matching will likely vary by the characteristics of the marriage market. In a dynamic matching model, as the distribution of potential partners moves from infinite to finite, it is predicted that participants’ reservation values will lower. It further predicts that as reservation values lower, it may hasten marriage and lower the expected gains, which may result in a higher number of marginal marriages (Ashenfelter et al. 1986). Consequently, marriages in communities with high search costs and a low number of potential partners may have a married population that is more susceptible to destabilizing shocks from increases in market thickness.

If consistent with these theoretical predictions, the decrease in search costs facilitated by the internet should decrease marital uptake and destabilize existing marriages in finite marriage markets. Rural areas are characterized by counties that have no urban epicenter, and consequently are more likely to have higher cost to travel and search for potential mates. Additionally, rural counties have the least number of citizens and represent a realistically finite pool of potential mates.

Marriages in communities where choices are already perceived as infinite may be less sensitive to shocks in search costs. Urban areas have a high number of potential

---

<sup>3</sup> Ashley Madison was founded in 2002, and was a website dedicated to matching those seeking extra marital affairs online, which claimed over 30 million worldwide users. Although that number was inflated by one-time users, curious viewers, and the now infamous company generated profiles, researchers were able to verify close to 100,000 frequent users in the US alone (Chohaney and Panozzo 2016).

<sup>4</sup> There are multiple dating sites that cater to extra-marital searches and specifically allow a user to specify “married” under their relationship status (Gleeden, AshleyMadison, AdultFriendFinder). These sites are in addition to the many casual-sex sites that exist (GetItOn, IhookUp, Xmatch, FriendFinderX, and Passion).

partners, higher rates of divorce, and the higher population density provides greater anonymity when engaging in extra-marital behavior. Consequently, urban marriages may be less sensitive to the reductions in search costs provided by the internet. Inversely, major metropolitan areas are also characterized by the large customer bases required for the virtuous-cycle that many social networking and dating applications rely on to succeed. This is consistent with the recently released list of counties within the United States with the most users of the dating application Tinder per-capita, where all 15 counties were in Metropolitan Statistical Areas (Lebowitz 2016). Because many of these applications find their customer base in urban areas, initial matching or re-matching could potentially be impacted at a higher rate in urban centers than in rural ones.

## 2.2 Existing empirical studies

Bellou (2015) presents the most encompassing empirical study to date on the impact of internet access on marriage in the United States. From 1990–2005 marital status of citizens aged 21 to 30 years old are measured via the Current Population Survey and state-level rates on broadband access are taken from the Federal Communication Commission. A linear probability model is run on individual-level data with the dependent variable equal to 1 if the respondent is married, and the independent variable of interest is the state-level internet access. A robust vector of individual and state-level controls are included. The data show that the expansion of internet availability is associated with a significant increase in the probability of being married for those 21 to 30 years old. Notably, this impact is even larger for those who live in central cities, and amongst the black community (Bellou 2015).

Research on the destabilizing effects of the internet on marriage has found mixed results. A higher level of Facebook membership per-capita is associated with higher divorce rates, even after controlling for fixed effects and demographic controls (Valenzuela et al. 2013).<sup>5</sup> Additionally, individual level regressions consistently associate higher usage of social networking sites with lower rankings of marital satisfaction and happiness, and a higher probability of claiming trouble in a marriage or considering divorce (Valenzuela et al. 2013). However, these findings are not causal, as individuals who are already in poor marriages may seek a substitute for relationships and intimacy on the internet.

Using a more exogenous measure of social media usage, Kendall (2011) uses broadband uptake, as measured by purchasing patterns in the CPS, to estimate the state-level divorce rate from 1998–2003. Overall, the impact of internet expansion on divorce rates is found to be positive but negligible in fixed effect models. Given the construction of the data, Kendall cannot disaggregate by age, race, or urban density. Consequently, the estimate of an average treatment effect may partially explain the negligible finding, as the internet likely does not impact divorce rates of individuals of all age, race, and location the same.

The previous studies all use data prior to 2005 and have become dated considering the pace at which new technologies have been adopted. Both access to the internet

<sup>5</sup> Using state-level data on per-capita Facebook memberships, their impact is measured on the divorce rate from each state as reported by the National Center for Health Statistics.

and the tasks accomplishable on the internet have changed drastically in the last 10 years. Since Facebook was founded in 2004, the use of social media has grown over 800%, and it now plays a significant role in courtship for many (Perrin 2015). Furthermore, the release of the iPhone in 2007 revolutionized the ease by which people could access the internet.

Smartphones have been a large driver of technology adoption and are important to consider when constructing measures of internet access. Due to income constraint, phones are the primary source of internet for some, with as many as 19% of individuals either having limited access to the internet, or only access through their phone (Pew 2015a, b). From 2011–2015 smartphone ownership increased from 35 to 68%, while computer ownership actually plateaued at around 73% (Anderson 2015). Smartphone ownership amongst those aged 18–29 is even higher at 86%, with the majority of these users claiming to use their phones more frequently for internet and social networking related activities than for phone calls (Anderson 2015).

For optimal discreetness from family members, many reserve their online dating or social network activities to their phones. It is reasonable to assume the majority of people engaging in online affairs are not doing so from a communal desk-top computer. These acts are likely isolated to private laptops and personal tablets or cell phones. This is supported by a survey of matrimonial lawyers, which shows that 97% of those surveyed had observed an increase in evidence being taken off of phones (AAML 2015). Additionally, a number of services for dating are made specifically for phones as they cater to their convenience and ability to use GPS features to enhance matching.<sup>6</sup> Therefore, including a measure of cell phones is significant when measuring technology adoption and its impact on demographic patterns.

### 3 Contribution

I extend the literature on internet and marriage by using more recent data and a more refined geographical level, as well as including a measure of mobile internet. All current studies to date use data prior to 2005, and in 2005 only 7% of Americans claimed to use social media, but by 2015 approximately 69% of Americans and 90% of those aged 18–29 engaged with social media (Perrin 2015). The use of county-level data provides more variation in the measure of home and mobile internet access than observed at the state-level. Furthermore, the use of county-level data enables consideration of market size as measured by population and urban density. Search frictions and reservation values are predicted to be inversely related to total population and population density; therefore, the impact of internet access should be allowed to vary by market size. This paper contributes by providing an empirical test of this theoretical prediction and showing the existence of heterogeneous effects. Lastly, the use of mobile data variables provide a more accurate measure of internet uptake. There has been a momentous growth in cellphone adoption since the last studies were completed, and measuring access to mobile internet is important to capture the significance and ubiquity of cellphones in modern matching.

---

<sup>6</sup> Certain online dating sites work almost exclusively through cell phone applications - such as Grindr (founded 2009), Tinder (founded 2012), or Bumble (founded 2014).

Additionally, I contribute to the existing literature by examining the relationship between internet access and marital status across multiple age ranges and marital order. Existing studies on the internet's impacts on marriage focus on those under 30, while studies on divorce do not include a measure of age. People of different age ranges face marriage markets of different thickness within their counties, and they have different observed propensities for technology usages. Therefore, a more thorough examination of the impact of internet on marriage demographics by age is warranted and illustrative. Finally, in order to place the findings on married and divorced populations in a broader context, I incorporate data on median age at first marriage and the percent of the ever-married population in their first, second, or third-plus marriage. The additional regressions determine if the internet is primarily facilitating initial matching or if it is also aiding older generations re-matching in secondary marriage markets.

## 4 Data

I use the American Community Survey (ACS), which surveys close to 300,000 households monthly to provide a total sample of 3.5 million participants a year. This survey provides information on smaller geographical units of measurement such as counties, census tracts, and Metropolitan Statistical Areas (MSAs). This is the first survey in three decades to collect annual data on marital demographics at the county-level.<sup>7</sup> I focus on the continental United States, omitting Alaska and Puerto Rico.

Because the unit of observation is at the county-level I use the five-year averages produced by the ACS to increase statistical accuracy and reduce the margin of error on estimates. Multi-year estimates are the only type of estimates available for geographical areas with populations of less than 65,000 (US Census 2009).<sup>8</sup> These five-year averages are used for the years of 2010–2015, with the three-year average used for 2008 and 2009, as the five-year averages were not yet available.<sup>9</sup>

Taking averages over this long a time period will mask much of the variation in the data; therefore, I will focus on changes across the sample time period by analyzing averages from years 2009 and 2013. In Fig. 1, the distribution of county-level percentages of the population who is married and divorced is shown in 2009

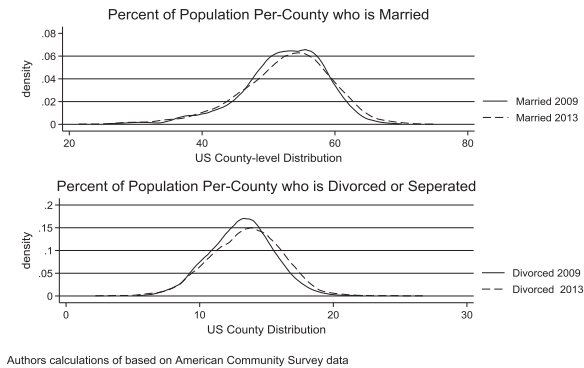
---

<sup>7</sup> Prior to the ACS, the only annual measure of marriage and divorce that exists at the county-level pre-date 1988 in hard copy form in the National Vital Health Statistics, Volume 3, Marriage and Divorce. State-level measures of marriage and divorce are available annually through the National Vital Health Statistics, but county measures are only calculated in the decennial census.

<sup>8</sup> Data is accumulated over a 5-year (60 month) period to create an annual estimate. For example, the 2010 estimate is created by the ACS from surveys completed between 2005–2009, and 2011 estimate is created from surveys completed between 2006–2010. As such, there is overlap in the compilation of months for each estimate and although labeled for the year the data is released, it includes estimates of the variables as sampled and averaged over the years prior. See further information at: <https://www.census.gov/programs-surveys/acs/guidance/handbooks/general.html>.

<sup>9</sup> Three-year averages only include counties with a population above 20,000, therefore 1,349 counties are missing during those years.





**Fig. 1** Distribution of married and divorced populations per-county

and 2013.<sup>10</sup> During this period, there was a slight increase in the number of counties that have a higher proportion of their population who is married, and a more notable increase in the number of counties with greater percentages of the population who are divorced or separated.<sup>11</sup>

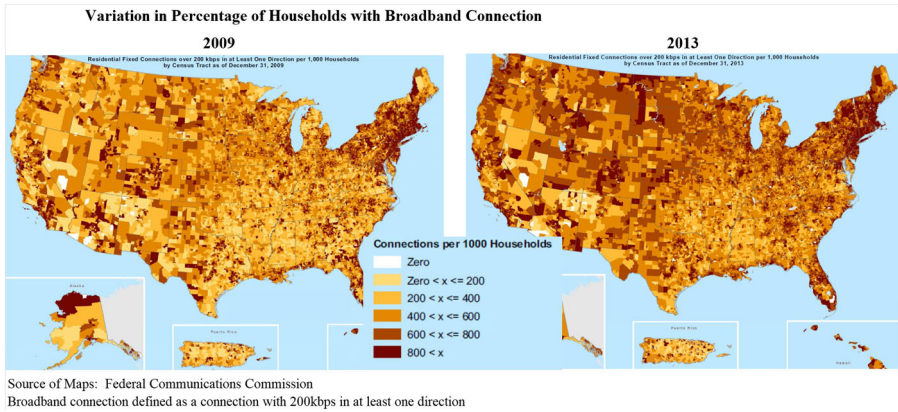
The ACS records are merged with county-level data collected by the Federal Communications Commission (FCC). The FCC collects data from internet providers on high-speed internet connections (over 200 kbps in at least one direction) via Form 477. From this information, they publish data on the connections per 1,000 households in five, quintile based, categories. As seen in Fig. 2, there was great deal of broadband expansion across counties in the US during the sample period, with many counties becoming more densely shaded, representing counties where more than 60 or 80% of households have broadband.

It is worth briefly distinguishing the specific use and measure of high-speed internet, not simply internet access, in this paper. Household access to the internet dates back to the 1990s with the first Netscape internet browsing program released in 1994. However, the ubiquity of the internet in day-to-day activities did not arise until the speed, quality, and ease of access was improved through broadband and mobile technologies. This paper utilizes variation in high-speed internet access and mobile data plans only and does not measure variation in low-speed internet or in non-data based mobile communication.

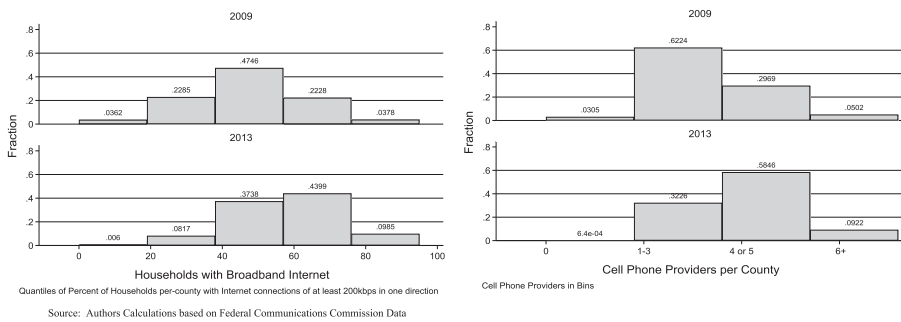
Figure 3 shows the distribution of broadband access by quintile in the year 2009 and 2013 in the left-hand histogram. The first quintile indicates counties in the distribution where between 0 and 20% of households have broadband, the second quintile is counties where between 21–40% of households have broadband, and the fifth quintile which represents counties where between 81–100% of households have broadband. Over the central four years of the study period, there was a large

<sup>10</sup> The annual ACS survey does not ask retrospective questions and only contains data on current marital status. As such, there is minimal ability to interpret someone's "ever" marital status from their current marital status. Similarly, the divorced population consists only of those who consider their current marital status to be divorced, not those who are ever-divorced.

<sup>11</sup> To view the distribution of married and divorced population across different types of counties (rural versus small and large MSAs) see Appendix Fig. A1.



**Fig. 2** Variation in percentage of households by county with broadband connection. Source of maps: Federal Communications Commission. Broadband connection defined a a connection with 200 Kbps in at least one direction



**Fig. 3** Percent of households with broadband & number of cell phone providers per county in 2009 & 2013. Source: authors calculations based on Federal Communications Commission Data

proportion of counties that increased their access from the second quintile to the third and fourth, and many in the third quintile that moved to the fourth and fifth quintile. In Appendix Fig. 2, the broadband distribution for urban and rural counties is shown. As can be seen in the figures, there is variation in broadband access both across counties, and within each urban-rural category of county.

Unlike broadband access, the percentage of individuals with a cell phone is not something that the FCC tracks. This measure would likely be riddled with measurement error as many individuals have multiple phones, both work and personal. The FCC does, however, track the number of cell phone providers in a county that provide mobile data plans above 200 kbps in at least one direction (a.k.a smartphone plans). This measure will be used as a proxy for cell phone usage, as it provides a measure for market saturation and affordability.

In the United States there are five main Mobile Network Operators (MNOs) which maintain the infrastructure and deliver service to consumers.<sup>12</sup> Beyond these MNOs there are numerous Mobile Virtual Network Operators (MVNOs) who lease access to the network services from these primary carriers and re-package it for sale to consumers.<sup>13</sup> The expansion of MNOs within a county directly expands infrastructure and creates competition amongst firms, while an expansion of MVNOs provides competition, variety, and lower-grade options from which consumers can choose. An increase in carriers provides consumers with choices in their package and bundling options (such as minutes, data limits, data speed, hotspot streaming, video resolution, and family plans), which allows more consumers to find a carrier that fits their needs. For example, MVNOs commonly offer cheaper plans with lower download speeds, international options, and pre-paid contract options for those with low credit scores (Villas-Boas 2018).

Research supports these claims, and has shown that the number of providers of mobile technology increases consumer uptake at a statistically significant rate (Gruber 2001; Lee et al. 2011). Increased competition in the telecommunications industry has also been shown to lower costs and increase quality and speed of service (Höfler 2007). While an increase in download speed was found to be a significant driver of mobile uptake, and particularly of consumers who exclusively use mobile internet connections (Manlove and Whitacre 2008). Therefore, a measure of the number of carriers in the county can act as a reasonable proxy for consumer uptake.

The FCC truncates the data distributed to the public by combining 1–3 carriers into one category and reporting the raw number of carriers only when there are zero or more than three. The right-hand histograms in Fig. 3 shows the number of cell phone carriers offering data plans collapsed into three categories - low, medium, and high - representing 1–3 carriers, 4 or 5 carriers, and more than 6 carriers. As seen in Fig. 3, there was a great deal of expansion in cell phone carriers over the sample period.<sup>14</sup> Appendix Fig. 3 shows the distribution of cell phone providers by county for urban and rural counties. Similar to Appendix Fig. 2, the distributions by urban

---

<sup>12</sup> MNOs ranked by number of subscribers: Verizon, AT&T, T-Mobile, Sprint, and US Cellular. For more information see: [https://en.wikipedia.org/wiki/List\\_of\\_mobile\\_network\\_operators\\_of\\_the\\_Americas#United\\_States](https://en.wikipedia.org/wiki/List_of_mobile_network_operators_of_the_Americas#United_States).

<sup>13</sup> There are 139 MVNOs operating within the US, which serve approximately 36 million consumers as of 2016. Some primary MVNOs are: Boost Mobile, Consumer Cellular, Cellular Abroad, Cricket Wireless, Metro Wireless, Straight Talk, Virgin Mobile, Walmart Family Mobile, Xfinity Mobile, with TracFone being the largest MVNO in the US. For more information see: [https://en.wikipedia.org/wiki/mobile\\_virtula\\_network\\_operator.com](https://en.wikipedia.org/wiki/mobile_virtula_network_operator.com).

<sup>14</sup> In 2014, the FCC changed Form 447 and began collecting a different measurement for mobile broadband data. Consequently, post 2013 there is not a consistent measurement for this variable. Therefore, for years 2014 and 2015 the number of data providers in 2013 is assumed and imputed for the missing variables. This censors any change in the variable after 2013 and assumes that counties with a high number of carriers do not lose carriers. The binary variable created for the empirical specification (High mobile access) equals 1 when a county has 4 or more smart phone carriers. The imputation of 2013 value assumes that counties who achieve 4 or more carriers by 2013 do not fall below this threshold in 2014 or 2015. Furthermore, it stops any county from achieving High mobile status in 2014 or 2015 who had not done so by 2013. During the three years leading up to and including 2013, approximately 2.26% of counties lost their High Mobile status on average per year, while approximately 10% of counties gained High Mobile status. Therefore, censoring the data works against identifying an effect for the High Mobile variable as the measurement error is likely negative.

classification show an increase in carriers for both rural and large MSA counties alike.

Hardwired and mobile connections are both important to measure overall use of high-speed internet. Household connections include DSL, cable, and fiber optic internet connections, while mobile connections measure access to cellular data-plan carriers. However, the devices that people use over these connections are not restricted across the two access methods. When at home, cellular phones utilize household broadband through Wi-Fi routers in order to increase speed and save mobile data. Additionally, individuals can use cellular phones as “hot spots” to provide internet access via their mobile data plan to their non-cellular devices such as tablets or laptops.

Lastly, I incorporate data from the urban-rural classification scheme created by the National Center for Health Statistics (NCHS). This continuum provides three separate urban density measures, based around Metropolitan Statistical Areas.<sup>15</sup> Large MSA counties are center or fringe counties in an MSA with a population of one-million or more. Small MSA counties are center or fringe in MSAs with a population of 50,000 to 999,999. Lastly, rural counties are those that do not fall within, or adjacent to, an MSA and have no urban center.

Because this analysis will allow for heterogeneous impact by market size, the descriptive statistics (as measured in 2013) are presented by level of urban density, using the three categories described above. Table 1 shows that rural counties make up the largest percent of the sample at almost 63% of all counties, however, they only account for 15% of the overall US population.

The percent of the population that is either married or divorced-or-separated varies very little across all the three MSA categories. It should be noted that rural counties marriage/divorce measures have the highest standard errors because they are prone to suffer the most measurement error due to smaller sampling. Rural counties have the lowest median income at approximately \$43,000 in 2013, along with the highest number of citizens with a high school degree as their highest form of education.

Over 80% of the US population live in small and large metropolitan areas. By 2013, counties in MSAs had greater broadband access, with 61 and 74% of counties versus 37% of rural counties classified as high access, with 60% or more of households with broadband accounts. Similarly, urban counties are more likely to have a high number of mobile data providers, with over 80% of small and large MSA counties having four or more providers offering smartphone plans. Urban areas are also characterized by higher unemployment rates, higher median income, and a higher proportion of college graduates.

Marriage market thickness varies greatly by geographical location in the US. When considering market size and density, population density is highly correlated with NCHS’s urban-rural classification. The average population per county is increasing in its MSA status. Rural counties have on average 23,500 people, while

---

<sup>15</sup> Metropolitan Statistical Areas, defined by Office of Management and Budget, consist of the county or counties associated with at least one urbanized area of at least 50,000 people, plus adjacent counties that have a high degree of social and economic integration with the core, as measured through commuting ties.

**Table 1** Descriptive statistics by metropolitan status

	USA	Rural counties	Small metropolitan counties	Large metropolitan counties
Observations	3132	1969	729	434
Sample as % of total counties	100	62.9	23.3	13.9
Sample as % of total population	100	15.07	30.34	54.59
Variables	Mean	Mean	Mean	Mean
Total population	97,876 (311,229)	23,469 (21,905)	127,569 (150,409)	385,573 (742,009)
Population density	259.40 (1,728)	43.35 (106)	220.20 (340)	1,305 (4,475)
Median population density	45.25	26.47	115.24	325
Percent population married	53.01 (7.14)	53.51 (7.25)	51.82 (6.52)	52.73 (7.40)
Percent population divorced/separated	13.34 (2.72)	13.45 (2.94)	13.45 (2.34)	12.67 (2.17)
Low broadband = 1	0.102	0.135	0.048	0.044
<i>Between 1–40% HH have BB</i>	(0.30)	(0.34)	(0.21)	(0.21)
Medium broadband= 1	0.420	0.496	0.335	0.214
<i>Between 40–60% HH have BB</i>	(0.49)	(0.50)	(0.47)	(0.41)
High broadband = 1	0.479	0.369	0.617	0.742
<i>60% or more of HH have BB</i>	(0.50)	(0.48)	(0.49)	(0.44)
High mobile data = 1	0.665	0.520	0.889	0.952
<i>4 or more Cell Phone Data Carriers</i>	(0.47)	(0.50)	(0.31)	(0.22)
Unemployment rate	8.64 (3.77)	8.519 (4.21)	8.827 (2.97)	8.872 (2.62)
Median income (2015\$)	47,071 (12,249)	42,903 (8,893)	49,400 (9,530)	62,066 (16,102)
Percent highschool grad	34.98 (6.99)	36.62 (6.24)	33.20 (6.82)	30.52 (7.76)
Percent Some College	29.69 (5.36)	29.60 (5.70)	30.22 (4.77)	29.19 (4.55)
Percent college grad & above	19.45 (8.75)	16.81 (6.45)	21.95 (8.65)	27.26 (11.62)
Percent white	83.97 (16.64)	85.45 (17.29)	82.82 (14.29)	79.18 (16.23)
Percent black	8.99 (14.58)	7.83 (15.01)	10.21 (13.24)	12.23 (14.12)
Percent Asian	1.16 (2.56)	0.59 (1.65)	1.54 (2.50)	3.10 (4.37)

Data measured in 2013

Internet and cell phone measures taken from the Federal Communications Commission

All other data measures taken from the American Community Survey

counties in small MSAs and large MSAs have 127,500 and 385,600 people respectively.

This increase in population is not due to MSA counties being larger in size, as both the mean and median population density are also increasing across MSA status. Due to the skewed nature of the population distributions, both measures of density

are presented in Table 1. Counties in small MSAs have approximately 5 times the people per square mile than rural counties, at 220 people versus 43. Counties in large MSAs, have a population density average of 1305 people per square mile, which is almost 5 times denser than counties in small MSAs.

## 5 Empirical specification

In the first specification, presented below in Eq. 1, an average impact of high-speed internet access is measured across all counties, regardless of urban density levels. A fixed effect methodology is employed to identify the impact of high-speed internet access both within and across counties.

$$\begin{aligned} \text{Percent of population by marital status}_{c,y} = & \\ \alpha + \beta_1 \text{BroadBand}_{\text{Med},y} + \beta_2 \text{Broadband}_{\text{High},y} + \beta_3 \text{Mobile}_{\text{high}} & \quad (1) \\ + X_{c,y} \beta_4 + \text{County} + \text{Year} + \text{State} \times \text{Time} + \varepsilon_{c,y} & \end{aligned}$$

The dependent variable of interest is the percent of the population that is married, or the percent of the population that is divorced or separated.<sup>16</sup> The key independent variables of interest are broadband access rates and mobile data providers, as measured by a series of dummy variables. I collapse the FCC provided quintiles into three ranking: less than 40% of households with internet (low), between 40–60% with internet (medium), and above 60% with internet access (high).<sup>17</sup> The low category, below 40%, is the reference group. Mobile data access is measured by a dummy variable equal to one when there are 4 or more providers of mobile data plans in a county.

Specification 2, shown in Eq. 2, adds the interaction terms between the urban and rural measurements and the broadband and mobile access dummy variables. Dummy variables indicating a county is in a small or large metropolitan statistical area are used, with rural being the omitted category. This model allows for differing affects by market size, because market density is theorized to affect search frictions and reservation values (Ashenfelter et al. 1986; Chiappori and Weiss 2006). Additionally, a disproportionally positive relationship has already been found between internet usage in urban areas and marital uptake of those under 30 years of age (Bellou 2015). The metropolitan dummies are not included separately in the regression as their status is time invariant and they would not be

<sup>16</sup> There does not exist a measure of marriage or divorce rates, or any measure of flow of these variables. Only the stock of married or divorced populations are measured by current census surveys.

<sup>17</sup> For alternate specifications treating access to broadband as continuous or in discrete quintile dummies, see Appendix Tables A6 and A7, and the discussion in the robustness section. The low, medium, and high categorization appears to most accurately reflect variation in the data shown in Fig. 3.

identified due to the county-level fixed effects.

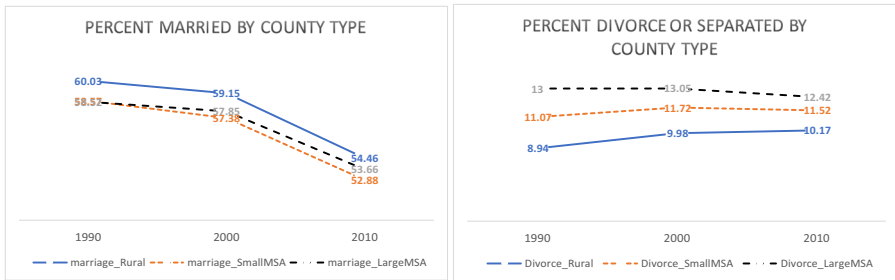
$$\begin{aligned}
 & \text{Percent of population by marital status}_{c,y} \\
 &= \alpha + \beta_1 BB_{\text{Med},c,y} + \beta_2 BB_{\text{high},c,y} + \beta_3 BB_{\text{Med}} \times \text{MetroSmall}_{c,y} \\
 & \quad + \beta_4 BB_{\text{high}} \times \text{MetroSmall}_{c,y} + \beta_5 BB_{\text{Med}} \times \text{MetroLarge}_{c,y} \\
 & \quad + \beta_6 BB_{\text{high}} \times \text{MetroLarge}_{c,y} + \beta_7 \text{Mobile}_{\text{high}} + \beta_8 \text{Mobile}_{\text{high}} \times \text{MetroSmall}_{c,y} \\
 & \quad + \beta_9 \text{Mobile}_{\text{High}} \times \text{MetroLarge}_{c,y} + X_{c,y}\beta_{10} + \text{County} + \text{Year} + \text{State} \times \text{Time} + \varepsilon_{c,y}
 \end{aligned} \tag{2}$$

In the final regressions, the Y variable in specification 1 and 2 is changed from the overall percent of the population having a given marital status to the percent of the population in specific age ranges, as measured by the ACS, who have a given marital status. To look for differing effects by age, the percent of the population meeting a marital status aged 20 to 34, 35 to 44, and 45 to 54 are regressed separately on broadband and mobile data access. If access to technology is changing the markets through a reduction in search frictions it should be most observable in the coefficients of the younger generations, as they are more aggressive adopters of social media and online dating, which are the tools by which search costs have decreased (Perrin 2015; Pew 2013). Also, it is possible that those in older age brackets will be significantly impacted by the internet. Researchers have shown disproportional impacts of the internet on relationship formation for those who face thinner marriage markets, such as, blacks and homosexuals (Rosenfeld and Thomas 2012; Bellou 2015). Similarly, because older individuals also face thinner marriage markets, they may use the internet at a higher rate to increase search efficiency.

## 5.1 Identification

For the regression models to identify an unbiased or causal impact of internet on marriage, or divorce, certain conditions must be met. First, it must be true that the patterns that drive broadband and mobile uptake are exogenous to marital patterns. The decision to purchase a home internet connection or a smartphone plan is likely driven by many variables, such as increased ease and access to information, entertainment, education, and employment opportunities. Although access to social media and dating resources may be among these reasons, it is likely not the only or primary motivation for purchasing an access plan. However, a person's desire to be more "connected" will drive their internet-uptake, and as such, a truly causal relationship cannot be estimated. The measure of internet used in this paper is binary, and only captures if a broadband connection or multiple mobile-carriers exists. I do not estimate the marginal benefit of data used, or gigabyte transferred, which would have a far more endogenous relationship to marriage market activities and outcomes. Although some endogeneity between personal relationships and internet purchase likely still exists in determining even the binary relationship. Consequently, it will impair the ability to estimate a truly causal relationship, but the presence of selection bias can still be reduced as much as possible with robust controls.

In addition to exogeneity of key independent variables, an unbiased estimate also relies on the underlying assumption that marital statistics in urban and rural counties



Source: Author Calculations of data taken from the US Decennial Census

**Fig. 4** Pre-sample marriage and divorce distribution for urban and rural counties

had similarly trending patterns prior to changes in high-speed internet access. Unfortunately, prior to the ACS, marriage data at the county-level was only collected during the Decennial Census. Consequently, it is impossible to analyze annual pre-internet trends on marriage and divorce at the county-level. However, data from the 1990, 2000, and 2010 census are presented in Fig. 4.

The 1990s represent a decade prior to high-speed internet access. Dial-up internet was relatively common in the late 90s, with the first internet browser (Netscape) being released in 1994. In 2000, only 2.5% of households in America had a fixed broadband connection (ITU, n.d.). Figure 4 shows that the percentage of the population that is married has been on the decline since 1990 across all three types of counties. The decline was reasonably consistent and evenly spread across all three types of county classification; thereby, supporting the assumption of parallel trends. The percent of the population that is divorced has been more stable over the three decades presented, with the variation across each decade staying within one-percent of the previous Decennial Census's estimate. For additional information on the estimated level, standard deviation, and percent change between each census see Appendix Table A1.

Lastly, any variable that is both correlated with internet and mobile access as well as marriage patterns could undermine the identification of internet on marriage. For example, if people are more prone to purchase internet access and to marry during good economic periods. Or, if young and unmarried individuals are more likely to migrate to internet heavy areas. Consequently, vector X must contain a number of control variables to account for any other possible variable that could be driving the relationship between internet and marriage.

As economic conditions are known to affect both marriage and divorce (Schaller 2013; Hellerstein et al. 2013) and are also likely correlated with an ability to purchase broadband, both the county-level unemployment rate and the median income are included as control variables. Education is also shown to affect the stability of marriage (Hellerstein et al. 2013) and one's technology usage (Anderson 2015); therefore, I control for education by including measures of the percent of the population with a high school diploma, some college, and a bachelor's degree or above.

Migration patterns could also undermine the identification of internet on marriage patterns, if migrants tend to settle in internet heavy areas and have a different marital



distribution than locals. Consequently, the percent of the population that lived in a different county, state, or country in the prior year are included as independent variables to measure changes in migrant densities over-time in each county.

Age affects technology usage (Anderson 2015), and is also known to affect how sensitive marriages are to exogenous shocks (Schaller 2013). Additionally, the presence of children may affect the stability of marriages as well as motivate individuals to purchase household access to broadband instead of just mobile access. Consequently, the general age distribution of each county is controlled for by including the percent of the total population in six different age brackets, including those below the age of 19.<sup>18</sup> Lastly, racial demographics are controlled for by variables that measure the percent of the population that is white, black, or Asian.

All specifications also include county-level fixed effects to demean marital status averages over time at the county level, year dummies to demean national-level annual-averages in marital status, and state-time trends to demean changing demographic trends over time at the state level. Lastly, the standard errors are clustered at the observation level to allow for correlation between the error terms of a county over time.

## 6 Primary results

Table 2 presents the results for specification 1 and 2 with marriage results presented in the left panel (1a–4a) and divorce in the right (1b–4b). For ease of comparison between divorce and marriage and across interaction specifications, the column number represents the right-hand variable specification, while all “a” columns have marriage on the left-hand side and all “b” columns divorce. All regressions contain county and year fixed effects, a state time trend, and the vector of controls.<sup>19</sup> As can be seen in column 1a, the average correlation between broadband access and marriage is negative, negligible, and not statistically significant. However, when interaction terms are introduced in columns 2a and 4a there are positive and highly statistically significant associations in urban regions, and negative and statistically insignificant associations in rural and small MSA areas.

Column 2a reports that rural counties experienced negative trends during internet expansion, but the coefficients are negligible and not statistically different from zero. However, large urban areas experienced significant gains in the married population as internet access expanded. A county in a large MSA with medium broadband access is predicted to have 0.60 percentage point (p.p.) higher married population over rural counties with low access. Large urban counties with high access have 0.76 p.p. greater married population over rural counties with low access, and 0.16 p.p. greater married population than a large urban county with medium access. It appears that urban counties with increased internet access, and therefore lower search frictions and greater information, have a greater share of the population that is married.

<sup>18</sup> Categories are those measured by the ACS, 0–19, 20–34, 35–49, 50–54, 55–65, 65+.

<sup>19</sup> For regression specifications with the fixed effects and controls added in a stepwise fashion see Appendix Table A2.

**Table 2** Broadband & mobile access on marriage & divorce/separation

	Y = percent of population married			Y = percent of population divorced/separated				
	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
BB medium	-0.0408 (0.0939)	-0.0550 (0.1069)	-0.0369 (0.0942)	-0.0485 (0.1080)	0.0612 (0.0533)	0.0942 (0.0618)	0.0563 (0.0533)	0.0836 (0.0617)
40-60% HH have BB								
BB high	-0.0476 (0.1156)	-0.0734 (0.1400)	-0.0439 (0.1161)	-0.0626 (0.1428)	0.0881 (0.0616)	0.1421+ (0.0742)	0.0835 (0.0616)	0.1237+ (0.0745)
60%+ HH have BB								
Mobile high			-0.0683 (0.0712)	-0.0788 (0.0904)			0.0852* (0.0398)	0.1095* (0.0498)
Carriers >= 4								
BBmed × MSAsmall		-0.1667 (0.2520)		-0.1616 (0.2498)		-0.0590 (0.1340)		-0.0396 (0.1345)
BBhigh × MSAsmall		-0.1995 (0.2703)		-0.1956 (0.2679)		-0.0618 (0.1485)		-0.0222 (0.1491)
MobileHigh × MSAsmall				-0.0252 (0.1465)				-0.0934 (0.0773)
BBmed × MSAlarge		0.6546* (0.2754)		0.5967* (0.2707)		-0.4255* (0.2054)		-0.3986+ (0.2051)
BBhigh × MSAlarge		0.8340** (0.3014)		0.7553* (0.2981)		-0.5942** (0.2149)		-0.5458* (0.2144)
MobileHigh × MSAlarge				0.4073* (0.1984)				-0.1342 (0.1336)
County FE	X	X	X	X	X	X	X	X
Year dummies	X	X	X	X	X	X	X	X
State × time trend	X	X	X	X	X	X	X	X
Vector of controls <sup>a</sup>	X	X	X	X	X	X	X	X
Observations	22,016	22,016	22,016	22,016	22,016	22,016	22,016	22,016
R-squared	0.9517	0.9517	0.9517	0.9517	0.8860	0.8861	0.8860	0.8862

Robust standard errors, clustered at observation level, are presented in parentheses

\*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ ; + $p < 0.10$

<sup>a</sup>Control Variables include: Current Unemployment Rate, Median Household Income, Percent of People New to County in Last Year (from other county, state, or abroad), Percent of People who have a High School Degree, Percent of People with Some College, Percent of People with College or above, Percent of People per Age by Bracket (0-19, 20-34, 35-44, 45-54, 55-64, 64+), and the percent of people who are black, white, or Asian

The coefficient estimates on broadband are stable to the inclusion of cell phone carriers, which are included in columns 3a and 4a.<sup>20</sup> Furthermore, a consistent trend is observed with close to zero impact of cell phone coverage expansion in rural and small metropolitan counties, and positive association in large metropolitan regions. A large MSA county with high phone access and high internet access, is predicted to have a greater married population relative to a rural county with *low* mobile carriers and broadband access by 1.02 p.p.<sup>21</sup> Given an average population of 385,500 in a large MSA county, this increased percentage would translate to approximately 3,932 additional married people per county. If comparing a large MSA with high access to a rural county with *high* mobile and broadband access this would be an overall net increase in the married population of 1.16 p.p. in a large MSA county, or 4,472 additional married people.<sup>22</sup>

Cohabitation rates exhibit similar patterns to those of marriage but are only collected at the household level. Although the coefficients on cohabitation, presented in Appendix Table A4, differ slightly in their interpretation and the percent of the total population they represent, their magnitude and signs are consistent with those observed in Table 2, columns 1a–4a. An increase in internet access is associated with a decrease in cohabitation rates in rural counties and an increase in cohabitation rates in large MSA counties.<sup>23</sup>

In the right-hand panel of Table 2 the influence of broadband and mobile data access on the percent of the population that report being either divorced or separated is presented in columns 1b–4b. As I am attempting to measure whether the internet is destabilizing to existing marriages, I have chosen to include both divorced and separated individuals. Results using a sample of only the divorced population are similar and reported in Appendix Table A5.

Consistent with Kendall (2011), the un-interacted model, presented in column 1b, shows that broadband access has a positive but statistically insignificant relationship with divorce. When access is interacted with market size in column 2b results are shown to also vary by population density. Unlike broadband's insignificant association with marriage in rural areas, its association with divorce and separation is statistically significant in both rural and large MSAs at a 10 and 5% level respectively. Broadband access appears to barely affect small metropolitan areas (those counties within an MSA with a population below 999,999) as the sum of their interactions with the broadband dummies result in positive but small coefficients across all specifications.

A rural county is predicted to have a greater proportion of their population considered divorced or separated if they have higher broadband access, while a large urban county is predicted to have less. Focusing on column 2b, a rural county with

<sup>20</sup> To view regression results with mobile measures entered without broadband view Appendix Table A3.

<sup>21</sup> Estimate determined as follows:  $-0.626 \times (\text{BB high} = 1) + -0.0788 \times (\text{Mobile High} = 1) + 0.7553 (\text{BB high} = 1 \times \text{MSA large} = 1) + 0.4073 \times (\text{Mobile High} = 1 \times \text{MSA large} = 1) = 1.0212$ .

<sup>22</sup> Estimate determined as follows:  $1.0212 - (-0.626 \times (\text{BB high} = 1) + -0.0788 \times (\text{Mobile High} = 1)) = 1.1626$ .

<sup>23</sup> As the findings in Table A4 indicate, internet access is highly statistically significant in predicting same-sex cohabitation rates, which further supports the hypothesis that the internet plays a more central role to those facing thin marriage markets.

high access is predicted to have 0.14 p.p. more divorcees than if they had low access, or approximately 33 more divorcees in a rural county with a population of 23,500. A large urban county with medium broadband access is predicted to have 0.33 p.p. fewer divorced or separated people than a rural county with low broadband access. A large urban county with high access is predicted to have 0.44 p.p. fewer divorce or separated people than a rural county with low access. Therefore, an increase in internet access in a large MSA from medium to high access will have an overall net effect of decreasing the divorced population by 0.11 p.p, the equivalent of approximately 4240 people, or 2120 couples.

When mobile internet access is included, in columns 3b and 4b, the magnitude of all coefficients decreases slightly, but the overall trend and significance of the variables remains the same. Access to phone carriers are estimated to further increase divorce in rural counties by a statistically significant 0.11 p.p, to have almost no net-effect in small MSAs, and to decrease the divorced and separated population insignificantly in large MSAs.

Given the magnitudes of the population centers, with 54% of the US population residing in large MSA counties and only 15% residing in rural counties, these findings represent a net gain to the overall population who is married, and net decline in the divorced or separated population in the US.

## 7 Results by age

In order to analyze the impact of the internet on marital patterns by age, I run the regressions separately for each age group. Population by marital status is not consistently measured by the ACS over time. Depending on the year, the ACS categorizes those married by either overall age, or by age and gender. The years of 2010–2012 used a different algorithm during the sample years to determine the average, regardless of gender, and the values cannot be combined with the estimates of the other sample years. Combining the two different sampling techniques creates noise due to different calculation methodologies and attenuates the estimates. To maintain the largest percent of the sample, population by age and gender is used for the years of 2008, 2009, 2013, 2014, and 2015. For years 2010–2012 marital status by age is measured for all, regardless of gender, and regression results using the smaller sample are discussed in the robustness section, and viewable in Appendix Tables A8.

Results for the percent of the population married by age cohort are presented in Table 3.<sup>24</sup> Broadband access is highly statistically significant in predicting the married population for those aged 20–34. The same overall geographical pattern is observed as in the primary specification: a negative impact to rural citizens and larger in magnitude and positive effect on citizens 20–34 years of age in large urban counties.

Column 1a shows that a rural county with high broadband access and high phone services would have 1.36 p.p. *fewer* married people aged 20–34 than a rural county

<sup>24</sup> Results for these age groupings by gender are similar to the overall results and are presented in Appendix Tables A9 and A10.

**Table 3** Broadband & mobile access on marriage & divorce by age

Variables	Y = percent of population married			Y = percent of pop divorced/ separated		
	(1a)	(2a)	(3a)	(1b)	(2b)	(3b)
	20–34	35– 44	45–54	20–34	35–44	45–54
BB medium	–0.3106	–0.2081	0.1288	–0.0722	0.1376	–0.1157
<i>40–60% HH have BB</i>	(0.3097)	(0.2845)	(0.2678)	(0.1290)	(0.2283)	(0.2003)
BB high	–0.7144+	–0.5210	0.0250	0.0318	0.2412	–0.0640
<i>60% + HH have BB</i>	(0.3696)	(0.3581)	(0.3231)	(0.1537)	(0.2788)	(0.2383)
Mobile high	–0.6486*	–0.2468	–0.7389**	0.1243	0.2315	0.3746+
<i>Carriers &gt;= 4</i>	(0.3300)	(0.3195)	(0.2786)	(0.1333)	(0.2427)	(0.2217)
BBmed × MSAsmall	–1.1874	–0.3894	–0.4598	–0.1498	–0.1920	0.2357
	(0.7441)	(0.6470)	(0.5837)	(0.2858)	(0.4736)	(0.4488)
BBhigh × MSAsmall	–0.7107	–0.1611	–0.4199	–0.2270	–0.2542	0.1091
	(0.7750)	(0.6874)	(0.6084)	(0.2965)	(0.5180)	(0.4817)
MobileHigh × MSAsmall	0.9402*	0.4773	0.8436*	–0.0633	–0.5728+	–0.5645*
	(0.4300)	(0.4363)	(0.3719)	(0.1713)	(0.3141)	(0.2845)
BBmed × MSAlarge	2.1442*	0.8299	0.9917	–0.2008	–0.5852	–0.1171
	(1.0714)	(1.0736)	(0.8039)	(0.3796)	(0.6174)	(0.6792)
BBhigh × MSAlarge	2.8153*	2.1319+	1.8499*	–0.2551	–1.0448	–0.5298
	(1.1323)	(1.2507)	(0.9213)	(0.3921)	(0.6510)	(0.7358)
MobileHigh × MSAlarge	1.3985*	0.6935	0.9953+	0.0928	–0.5103	–0.2939
	(0.7123)	(0.7679)	(0.5919)	(0.2678)	(0.5253)	(0.5065)
County FE	X	X	X	X	X	X
Year dummies	X	X	X	X	X	X
State × time trend	X	X	X	X	X	X
Vector of controls <sup>a</sup>	X	X	X	X	X	X
Observations	12,622	12,622	12,622	12,622	12,622	12,622
R-squared	0.9087	0.9014	0.9011	0.8069	0.8013	0.8058

Robust standard errors, clustered at observation level, are presented in parentheses

\*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ ; + $p < 0.10$

<sup>a</sup> Control Variables include: Current Unemployment Rate, Median Household Income, Percent of People New To County In Last Year (from other county, state, or abroad), Percent of People who have a High School Degree, Percent of People with Some College, Percent of People with College or above, Percent of People per Age by Bracket (0–19, 20–34, 35–44, 45–54, 55–64, 64+), and the percent of people who are black, white, or Asian

Sample Years: 2008, 2009, 2013, 2014, 2015. A different measure for marriage by age was taken in years 2010–2012, and marriage results using that sample are shown in Appendix Table A7

with low access. An urban center with high broadband access and a high number of mobile data providers would have 2.85 p.p. *more* of its 20–34-year-olds married relative to a rural county with low access. On average approximately 34% of 20–34-year olds are married, therefore a 2.85 p.p. increase from the mean is equivalent to an approximate 8.4% increase in the married population of this cohort.

For those aged 35–44 years old, there are smaller impacts on the married population in urban and rural areas alike. For rural counties and small MSAs, broadband and mobile-data expansion is associated with a negligible and statistically insignificant decrease in the married population in this age range. For those in large MSAs, technological access appears to have a statistically significant correlation with the population of married individuals aged 35–44. A county in a large MSA with high broadband access is predicted to have approximately 1.61 p.p. more married individuals aged 35–44 than rural counties with low access.

The results are generally the strongest in the younger age groups, and the coefficient values diminish for those in older age ranges. This is consistent with the monotonic decrease in usage of technology by generation (Perrin 2015; PEW 2013). Despite being lower in magnitude, there is a highly statistically significant relationship between cell phone access and the married population aged 45–54 across all geographies. Increased mobile providers are associated with a decrease in the married population in this cohort in rural areas by 0.74 p.p. and increases in the married populations in small and large metropolitan areas by 0.10 p.p. and 0.26 p.p. respectively. This finding supports the hypothesis of higher use of the internet by participants in thinner marriage markets.<sup>25</sup>

Columns 1b–3b in Table 3 presents the results of the divorced or separated regressions by age. Findings indicate that broadband access is associated with statistically insignificant decreases in the divorced population in urban areas across all age ranges. This is consistent with the gains to marriage shown in urban areas amongst those of all ages shown in the left-hand panel of the same table. The results in Table 3 indicate that internet access is associated with greater divorced populations in rural counties across for all ages. This finding is consistent with the theory that rural areas may have the most marginal marriages and therefore may have a higher likelihood of being destabilized by the decrease in search frictions and increase in entertainment options provided by internet access.

For those aged 20 to 34, who would primarily be in their first marriages, the correlation between expansion of broadband and cell phone carriers on divorce appears to be negligible. Access to the internet appears to have had mixed results for those aged 35 to 44, with a positive association with divorce in rural areas, but an overall negative association with divorce populations in this age range in large MSAs. The coefficients have the largest magnitude for those 35–44, but are imprecisely estimated and statistically insignificant.

Generally, there is no impact of broadband expansion observed on divorce for those in the older age range with the exception of mobile data. Mobile data again appears significant to those aged 45 to 54. Increases in mobile data plan carriers are associated with a statistically significant increase in the divorced or separated population in this age range in rural areas, and a statistically significant decrease in the divorcee population aged 45 to 54 in small MSAs. However, there are negligible net effects on divorcee populations in large MSAs. The divorce and separation results

<sup>25</sup> Female marriage results for those aged 45–54, shown in Appendix Table A10, show larger coefficients than the gender-neutral results reported in Table 3. This further supports the thin market hypothesis. Women tend to marry those closer to their own age than men, and consequently face fewer potential matches than individuals who have a broader age range for acceptable mates.

by age range are separated by gender in Appendix Tables A9 and A10. These results show that the statistical decline in divorcees observed in the 45 to 54 age range in small MSAs are likely driven by men, which have a larger and statistically significant decrease in divorced population, while female results for those aged 45–54 show a negligible decline in female divorcees in small cities.

## 8 Robustness checks

The primary findings are consistent across several linear and non-linear specifications. Regression results treating the quintile access data as continuous, such that a one-unit increase in access represents a 20% increase in broadband access, are presented in Appendix Table A6. Results show consistent coefficients and statistical significance with a linear estimation resulting in slightly higher net impact values when assuming above 60% broadband access.

A regression that allows each quintile to be a discrete dummy variable, with the omitted quintile being access between 0 and 20% of households, is presented in Appendix Table A7. This regression showed no statistical significance but does show a generally monotonic trend where higher quintiles have larger coefficients. Furthermore, all interaction terms have the same sign as those in the primary findings.

Because the ACS does not measure marriage by age range consistently, the years of 2010–2012 were omitted from the primary results. The data on marriage by age during these years was not collected conditional on gender, and therefore, cannot be combined with the gender specific estimates taken in other years. Regressions by age are run on the alternate sample years and presented in Appendix Table A7. Generally similar results are observed, with slightly greater magnitude in small MSAs. As discussed in the primary results, the age specific regressions were also run on gender specific rates and are presented in Appendix Tables A9 and A10.

Instead of depending on the urban scheme as published by the National Center for Health Statistics (NCHS) to classify thickness of marriage markets, I also construct rankings based on population density. Because the NCHS scheme uses commuter and employment data to measure integration, it is selected as the primary specification. However, two different density rankings were created and tested for robustness. Findings are presented in Tables A11 and A12. Although the magnitudes of the coefficients vary by each measure of marriage market thickness, the patterns are consistent with the primary findings. In sum, I consistently find that the internet is associated with destabilization of marriage in low density counties and increased marriage in counties with a high population-density.

## 9 Results on number of marriages

The primary findings, both in aggregate and by age range, indicate that internet access has been associated with larger gains in magnitude and statistical significance for the married population than the divorced population. However, this positive impact on matching may partially contribute to the minor effects found on the divorced population in urban areas. If re-matching increases while divorce rates rise,

it would decrease those in the population classified as divorced or separated at any given time. Therefore, the possibility that the internet is increasing the churn rate of marriage cannot be ruled out with the county-level data.

Questions on age at marriage, marital tenure, or number of marriages are not reported at the county-level. The American Community Survey only began asking questions of this nature and calculating state-level statistics in 2011. Although county-level variation would be ideal, data on median age at first marriage and percentage of the ever-married population who has had one, two, or three-plus marriages are collected at the state-level from 2011 to 2015.

To merge this data with the existing county-level data on internet access and mobile phone carriers, the access variables are aggregated to the state-level and are weighted by the population of each county. Consequently, the state-level internet access variable measures the average internet access a typical person in the state receives. To align with the primary regression specification, a dummy variable for high broadband access is created to indicate a state where more than 80% of the population has internet access. Due to the later sample period and the population weighting, both low and medium access are combined as the omitted category. Additionally, a dummy variable is created to measure high mobile access, which is equal to 1 when there are more than 4 carriers on average in the state. Lastly, the same robust vector of controls on income, unemployment, education levels, and age distributions is aggregated to the state-level.

Because marital changes associated with expansion of high-speed internet are found to vary with MSA status in the first half of this paper, the percentage of the state's population that resides in large MSAs is calculated for each state, and titled *Metro Proportion*. The variable *Metro Proportion* ranges from 0 to 1 and has a mean value of 0.38 in 2013. The full distribution of the variable can be seen in Appendix Fig. A4. There is a great deal of variation in urban density across states. There are two "states" in the dataset where 100% of the population resides in a large MSA, Washington DC and Rhode Island, 12 states where 0% of the population resides in large MSAs, approximately 20 states where more than 50% of the population live in large MSAs, and 6 states with more than 75% of their total population in MSAs with over one-million citizens.<sup>26</sup>

Next, an analysis of the average number of marriages is conducted to determine if the increased married population, and decreased divorcee population, observed in urban areas in the county-level results, is motivated by the internet making marriages more stable, or by the internet increasing initial marriage uptake, or because it is also facilitating re-matching upon separation.<sup>27</sup> Of the ever-married population in the US, approximately 74% are in their first marriage, 20% in their second marriage, and 6% in their third plus marriage. The percentage of the ever-married population in their first, second, or third-plus marriage is remarkably similar across the genders, as can be seen in Appendix Table A13.

---

<sup>26</sup> The 12 states with no MSAs over one-million people are: Alaska, Hawaii, Idaho, Iowa, Maine, Montana, Nebraska, New Mexico, North Dakota, South Dakota, Vermont, Wyoming. The 6 states with 75% or more in large MSAs are: California, DC, Maryland, New Jersey, New York, and Rhode Island.

<sup>27</sup> For brevity, only results on marital order are reported in the text of the paper, but the internet's association with age of marriage is also explored and presented in the Appendix Tables A13, A14 & A15.



**Table 4** Broadband & mobile access on number of marriages

Variables	(1)	(2)	(3)
	% Ever married in marriage number		
	One	Two	Three plus
Metro proportion	-241.0847	93.8208	147.2657
% of State residents in large MSA	(271.7128)	(222.5607)	(120.7463)
BB high	0.0165	0.0037	-0.0202
80% + HH have BB	(0.3468)	(0.2912)	(0.1925)
Mobile High	0.4578	-0.0136	-0.4442
Carriers > 4	(0.7346)	(0.5166)	(0.2710)
BBhigh * MetroProportion	0.6561	-0.5742	-0.0819
	(0.7370)	(0.6193)	(0.3933)
MobileHigh × MetroProportion	-0.3608	-0.7523	1.1131*
	(1.3348)	(1.0129)	(0.5116)
State FE	X	X	X
Year dummies	X	X	X
State time trend	X	X	X
Vector of controls <sup>a</sup>	X	X	X
Observations	255	255	255
R-squared	0.9961	0.9907	0.9959

Robust standard errors, clustered by observation level in parentheses

\*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ ; + $p < 0.10$

<sup>a</sup>Control Variables include: Current Unemployment Rate, Median Household Income, Percent of People New To State In Last Year (from other state or abroad), Percent of People who have a High School Degree, Percent of People with Some College, Percent of People with College or above, Percent of People per Age by Bracket (0–19, 20–34, 35–44, 45–54, 55–64, 64+), and the percent of people who are black, white, or Asian

In Table 4, columns 1–3, results are presented for specifications that regress the percent of the ever-married population that has been married once, twice, and three-plus times on a series of dummy variables that indicate high broadband and mobile access, and their interactions with metropolitan proportion. Because the metro proportion is time varying with population, it is now identified despite the state-level fixed effects. The percentage of the state that is in a large metropolitan area is negatively related to the proportion of the ever-married population who is married once, but positively related to second and third-plus marriages, indicating higher-order marriages are more common in more urbanized states.

Broadband and cell phone access have no statistical significance on first marriages but are positively associated with the percent in their first marriage across all types of states. The internet and mobile phone carriers are estimated to have negligible and negative impacts on those in second marriages, as the coefficients on the dummy variables for access in column 3 are generally the lowest in magnitude across the three marital populations.

Mobile access appears to have had a statistically significant and large impact on those married three-plus times.<sup>28</sup> Results show a net gain of 0.67 p.p. of people in their third plus marriage in an entirely urban state that has high cell-phone access. Given a base level average of approximately 5.60% of the ever-married population being married three-plus times, a net increase of 0.67 p.p. is equivalent to a 11.94% increase from the mean.<sup>29</sup>

This finding is consistent with the county-level results that indicate mobile phone carriers are significant in determining both the married and divorced population for those aged 45–54 years old, as people in this age range are more prone to have a higher marital order. The coefficient on mobile access in metropolitan areas provides support that high-speed internet may be facilitating re-matching in the secondary marriage market. Therefore, the lower percent of the population currently divorced at the county-level is at least partially explained by divorcees re-matching.<sup>30</sup>

## 10 Discussion

The exact mechanisms that brought these individuals together on the internet are not determined in this paper. Current data from the FCC only measures internet access and does not measure how much those connections are utilized or track what resources and services are being accessed on the internet. Additionally, as discussed before, the self-selection into internet purchase impairs the ability to declare a causal relationship, but a statistically significant association is clear. It is not known if these results are being driven by online dating, social media, entertainment options, or the general increase in communication that these and other technologies afford. It would be extremely challenging to differentiate the role that each of these individual services has on marriage and divorce. Therefore, the internet is analyzed here as a packaged service that provides access to multiple methods that facilitate relationships or provide substitutes for them.

The internet, and high-speed access to it, continues to expand and become more affordable. There are many local initiatives to provide free internet access in cities and counties, with almost 100 cities across the nation currently offering some form of free internet in public spaces.<sup>31</sup> Additionally, in 2016 the Lifeline Program for the low income, which subsidized telephone services, was expanded to include

---

<sup>28</sup> Similar to the results found on number of marriages, only mobile access has a statistically significant relationship with median age at first marriage. As shown in Table A14, and discussed in the appendix, primarily rural states that expanded mobile access experienced a statistically significant decline in age at first marriage while primarily urban states experienced an increase in median age at first marriage.

<sup>29</sup> In Table A16, number of marriages is regressed on the continuous measure of broadband access. Similar results are found to those in Table 4, with slightly higher magnitude of coefficients on mobile phone carriers.

<sup>30</sup> In Appendix Table A17, the regressions for number of marriages are presented by gender. Similar patterns are observed across both genders, but a larger decrease in second marriages are observed for women, while a larger increase in third-plus marriages are observed for men.

<sup>31</sup> [https://en.wikipedia.org/wiki/Municipal\\_wireless\\_network#North\\_America](https://en.wikipedia.org/wiki/Municipal_wireless_network#North_America).

broadband services.<sup>32</sup> Whenever determining the overall benefit of social programs, it is important to consider any externalities that may be created. In this case, as internet access expands in urban areas, it appears to increase people's ability to match initially and to re-match after a divorce. Given the documented positive impacts that marriage has on income, consumption, and health outcomes this could be considered a positive externality of internet expansion.

## 11 Conclusion

Examining the impact of the combined resources provided by the internet, which all lower search frictions, is informative to market theory. The internet also provides access to alternative options for entertainment and intimacy outside of traditional matching. The findings of increased divorce and decreased marriage in rural areas that experienced gains in high-speed internet is consistent with theoretical matching models where finite markets are predicted to be more susceptible to destabilization from increases in market thickness or decreases in search costs.

Findings show that in metropolitan areas, with over one-million citizens, additional internet access is associated with a decrease in the divorced population and a larger in magnitude increase in the married population, particularly for those under the age of 34. The internet appears to be facilitating initial matching in urban marriage markets. This finding is consistent with the high technology use of younger generations, and the large customer base required for many social media and dating sites to be successful.

Internet expansion in large MSAs was also correlated with a higher married proportion of people aged 45–54. Additionally, primarily urban states that experienced gains in mobile carriers have a larger percent of the ever-married population in their third-plus marriage. These findings support that in addition to facilitating initial matching, the internet is also facilitating re-matching in the secondary marriage market. Therefore, this study provides limited evidence that the internet is associated with a higher churn rate in the marriage market in urban areas. Given the concentration of citizens in large MSAs, with approximately 55% of America's population residing in these counties, the overall correlation rate between internet use and marriage is positive with mobile and broadband internet expansion associated with a larger percent of the total population in the US being married.

### Compliance with ethical standards

**Conflict of interest** The author declares that she has no conflict of interest.

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

<sup>32</sup> <https://www.fcc.gov/general/lifeline-program-low-income-consumers>.

## References

- AAML (2002). Is the internet bad for your marriage? Online affairs, pornographic site playing greater role in divorces. <http://www.pnewswire.com/news-releases/is-the-internet-bad-for-your-marriage-online-affairs-pornographic-sites-playing-greater-role-in-divorces-76826727.html>.
- AAML (2010). Big surge in social networking evidence says survey of nation's top divorce lawyers. <http://aaml.org/about=the-academy/press/press-release/e-discovery/big-surge-in-social-networking-evidence>.
- AAML (2015). Huge increase of texts and app evidence in divorces say nations top layers. <http://aaml.org/about-the-academy/press/press-release/divorce/huge-increase-text-and-app-evidence-divorces-say-nat>.
- Aguiar, M., Bils, M., Charles, K., & Kofi, E. (2017). *Leisure luxuries and the labor supply of young men*. NBER Working Paper (23552)
- Ahlstrom, M., Lundberg, N., Zabriskie, R., Eggett, D., & Lindsay, G. (2012). Me, my spouse, and my avatar. *Journal of Leisure Research*, 44(1), 1–22.
- Anderson, M. (2015). *Pew Research Center: technology device ownership—2015*. <http://www.pewinternet.org/2015/10/29/technology-device-ownership-2015>.
- Montgomery, M. & Trussell, J. (1987). Models of marital status and childbearing, ch. 03, p. 205–271 in Ashenfelter, O. and Layard, R. eds, *Handbook of Labor Economics*, Vol. 1, Elsevier. <https://EconPapers.repec.org/RePEc:eee:labchp:1-03>.
- Bellou, A. (2015). The impact of internet diffusion on marriage rates: evidence from the broadband market. *Journal of Population Economics*, 28(2), 265–297.
- Census, US. (2009). *A compass for understanding and using american community survey data*. Washington, DC: US Government Printing Office.
- Chiappori, P. A., & Weiss, Y. (2006). Divorce, remarriage, and welfare: a general equilibrium approach. *Journal of the European Economic Association*, 4(2–3), 415–426.
- Chohaney, M., & Panozzo, K. (2016). Infidelity and the internet: the geography of Ashley Madison Usership in the United States. *Geographical review*. <https://doi.org/10.1111/gere.12225>.
- Doran, K., & Price, J. (2014). Pornography and marriage. *Journal of Family and Economic Issues*, 35, 489–498.
- Fair, R. C. (1978). A theory of extramarital affairs. *Journal of Political Economy*, 86(1 Feb), 45–61.
- Gruber, H. (2001). Competition and innovation. the diffusion of mobile telecommunications in Central and Eastern Europe. *Information Economics and Policy*, 13, 19–34.
- Hadass, Y. (2004). *The effect of internet recruiting on the matching of workers and employers*. <https://ssrn.com/abstract=497262> or <https://doi.org/10.2139/ssrn.497262>.
- Hellerstein, J., Morrill, M., & Zou, B. (2013). Business cycles and divorce: evidence from microdata. *Economics Letters*, 118(1), 68–70.
- Höfler, F. (2007). Cost and benefits from infrastructure competition. estimating welfare effects from broadband access competition. *Telecommunications Policy*, 31, 401–418.
- ITU (n.d.). “Fixed (wired)-broadband subscriptions per 100 inhabitants”, Dynamic Report, ITU ITC EYE, International Telecommunication Union. Retrieved from: <http://www.itu.int/net4/itu-d/icteye/>.
- Kendall, T. (2011). The relationship between internet access and divorce rate. *Journal of Family Economic Issues*, 32(3), 449–460.
- Kuhn, P., & Skuterud, M. (2004). Internet job search and unemployment durations. *The American Economic Review*, 94(1), 218–232.
- Kuroki, M. (2013). Opposite-sex coworkers and marital infidelity. *Economics Letters*, 118(1), 71–73.
- Lebowitz, S. (2016). The 15 US cities where its easiest to find a date. *Business Insider*. Retrieved from: <https://www.businessinsider.com/most-active-cities-on-tinder-2016-9>.
- Lee, S., Marcu, M., & Lee, S. (2011). An empirical analysis of fixed and mobile broadband diffusion. *Information Economics and Policy*, 23, 227–233.
- Malcom, M., & Naufal, G. (2016). Are Pornography and Marriage Substitutes for Young Men? *Eastern Economics Journal*, 42, 317–334.
- Manlove, J., & Whitacre, B. (2008). Understanding the trend to mobile-only internet connections: a decomposition analysis. *Telecommunications Policy*, 43(1), 76–87.
- Manning, J. (2006). The impact of internet pornography on marriage and the family: a review of the research. *Sexual Addiction & Compulsivity*, 13, 131–165.
- McKinnish, T. G. (2007). Sexually integrated workplaces and divorce—another form of on-the-job search. *Journal of Human Resources*, 42(2), 331–352.

- Mileham, B. L. A. (2007). Online infidelity in internet chat rooms: an ethnographic exploration. *Computers in Human Behavior*, 23(1), 11–31.
- Perrin, A. (2015). Pew Research Center: social networking usage, 2005–2015. <http://www.pewinternet.org/2015/10/08/2015Social-Networking-Usage-2005-2015/>.
- Pew Research Center (2013). Online dating & relationships. <http://pewinternet.org/Reports/2013/Online-Dating.aspx>.
- Pew Research Center (2014). Couples, the internet, and social media. <http://pewinternet.org/Reports/2014/Couples-and-the-internet.aspx>.
- Pew Research Center (2015a). The smartphone difference. <http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/>.
- Pew Research Center (2015b). Home Broadband 2015. <http://www.pewinternet.org/2015/12/21/2015/Home-Broadband-2015/>.
- Rosenfeld, M., & Thomas, R. (2012). Searching for a mate: the rise of the internet as a social intermediary. *American Sociological Review*, 77(4), 523–547.
- Schaller, J. (2013). For richer, if not for poorer? marriage and divorce over the business cycle. *Journal of Population Economics*, 26(3), 1007–1033.
- South, S. J., & Lloyd, K. M. (1995). Spousal alternatives and marital dissolution. *American Sociological Review*, 60(1), 21–35.
- Stevenson, B. (2008). *The internet and job search*. National Bureau of Economic Research, Working Paper Series (13886). Retrieved from: <https://www.nber.org/papers/w13886>.
- Udry, J. R. (1981). Marital alternatives and marital disruption. *Journal of Marriage and the Family*, 43(4), 889–897.
- Valenzuela, S., Halpren, D., & Katz, J. (2013). *Facebook, marriage well-being and divorce: survey and state-level evidence from the United States*. Paper presented at the National Communication Association, Washington DC.
- Villas-Boas, A. (2018). Here's how the 'unlimited' plans from Verizon, AT&T, Sprint and T-mobile compare. *Business Insider*. Retrieved from: <https://www.businessinsider.com/unlimited-plans-comparison-verizon-att-sprint-tmobile-2018-2>.
- Weiss, Y. (1997). Chap 3: the formation and dissolution of families: why marry? Who marries whom? And What happens upon divorce? In *The handbook of population and family economics*, 1(A) (pp. 81–123).