PERSPECTIVES

PHOENIX CENTER FOR ADVANCED LEGAL & ECONOMIC PUBLIC POLICY STUDIES

# Unintended Consequences of Age Verification Laws: Evidence from Search Behavior

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State-level age verification laws that require adult content websites to verify users' identities have proliferated across the United States since 2023.[1] In response to these laws, now codified in twenty-five states, many adult content platforms—including Pornhub (one of the nation's most visited adult content website)—have blocked access to all users in many affected states rather than implement age verification systems.[2] Though these laws were challenged on First Amendment grounds, the Supreme Court in *Free Speech Coalition v. Paxton* (2025) recently affirmed their constitutionality.[3] Reasoning that because restricting minors' access to adult content has a long tradition in the United States, the Court applied an intermediate scrutiny standard rather than a strict scrutiny standard, holding that the Texas age verification law served an important government interest and that age verification was substantially related to achieving that purpose.[4]

Yet while restricting minors' access to adult content may be sensible, these state age verification laws are easily circumvented by Virtual Private Networks ("VPNs"), whereby a user in a restricted state simply digitally relocates to an unrestricted state or even another nation. Some research reveals sizable and immediate increases in VPN use after a state passes an age verification law, and circumvention by minors of these laws is a recognized problem.[5] In fact, some U.S. states, and the United Kingdom (which has an age-verification law), are contemplating a ban on VPNs due to circumvention of these laws by minors.[6]

***The availability of VPNs ...suggests that the effectiveness of state-level age verification laws is questionable. If anything, because minors are especially adept at using VPNs, age verification laws may do more to impede the First Amendment rights of adults than to curb the access of minors to adult content. Moreover, some VPNs, especially free ones, pose significant privacy and security risks, so the costs of the restrictions may exceed the benefits.***

Here, I apply an event study design with weekly Google Trends data on two search terms: (1) "VPN," to capture attempts to circumvent the regulation using technology; and (2) "free porn" to capture efforts to find substitutes to Pornhub (and other blocked sites). Lang, *et al.* (2025) conduct a comparable empirical analysis for a variety of search terms, so replication is a portion of this PERSPECTIVE's contribution.[7]

I document sizable, immediate, and statistically significant increases in both searches, with the "VPN" search persisting for about 20 weeks and

the "free porn" search showing no signs of decay. The availability of VPNs and alternative sites that ignore the law suggests that the effectiveness of state-level age verification laws is questionable. If anything, because minors are especially adept at using VPNs, age verification laws may do more to impede the First Amendment rights of adults than to curb the access of minors to adult content. Moreover, some VPNs, especially free ones, pose significant privacy and security risks, so the costs of the restrictions may exceed the benefits.

***... the evidence on age-verification laws for adult content suggests a regulatory failure with costs exceeding benefits.***

**Conceptual Framework**

In *Free Speech Coalition v. Paxton*, the Supreme Court applied intermediate rather than strict scrutiny to Texas's age verification law for adult content websites. The Court's reasoning rested on the historical tradition of restricting minors' access to sexually explicit material.[8] Under intermediate scrutiny, the law must (1) serve an important government interest and (2) be substantially related to achieving that purpose.[9] While protecting minors from exposure to pornography clearly qualifies as an important interest, the "substantially related" prong requires closer examination of the law's actual effectiveness and costs.

A simple economic framework can illuminate the constitutional calculus. Say there are $m$ minors in a state and they suffer an average net harm from adult content equal to $h$. Also, there are $a$ adults who experience average net benefits $b$ from access to the content; $h$ and $b$ need not be equal. The value $b$ is not to be taken lightly, and should not be limited to the enjoyment of consuming adult content. Rather, the comparison is between a policy goal of protecting minors versus a *constitutional right of adults*. As the Supreme Court observed in *Reno v. ACLU,*

> It is true that we have repeatedly recognized the governmental interest in protecting children from harmful materials. But that interest does not justify an unnecessarily broad suppression of speech addressed to adults. As we have explained, the Government may not "reduce the adult population ... to ... only what is fit for children." "Regardless of the strength of the government's interest" in protecting children, "the level of discourse reaching a mailbox simply cannot be limited to that which would be suitable for a sandbox."[10]

Indeed, noted the Court,

> the mere fact that a statutory regulation of speech was enacted for the important purpose of protecting children from exposure to sexually explicit material does not foreclose inquiry into its validity. *** [That] inquiry embodies an 'over-arching commitment' to make sure that Congress has designed its statute to accomplish its purpose "without imposing an unnecessarily great restriction on speech."[11]

The law's actual performance depends on two parameters: ε, the minor deterrence rate (the share of minors deterred from accessing adult content), and ω, the adult deterrence rate. The law passes intermediate scrutiny when,

$$\frac{\varepsilon \cdot m \cdot h}{\omega \cdot a \cdot b} > 1 \qquad (1)$$

or,

$$\frac{\varepsilon}{\omega} > \frac{a \cdot b}{m \cdot h} \quad . \qquad (2)$$

Studies show that 19-37% minors intentionally access porn (say 30%), while for adults the shares are 91.5% of males and 60.2% of females (about 75%).[12] Minors between the ages of 13-17 account for 6.6% of the population, while adults between 18-64 account for 65.6% of the population. Thus,

we have $m/a = 0.04$.[13] Plugging these figures in, we have,

$$\varepsilon > 25\left(\frac{b}{h}\right)\omega \quad , \tag{3}$$

where $b/h \leq 1$. If $b$ and $h$ are equal, where a basic constitutional right carries as much weight as does the harm to minors, then $\varepsilon$ must exceed $25\omega$ to satisfy the benefit-cost condition; this seems unlikely. Even if $b/h = 0.20$, so that the net harm of excluding a minor is five-times larger than the lost net benefit of excluding an adult, the benefit-cost condition requires that $\varepsilon > 5\omega$, which also seems unlikely. Survey evidence suggests that 32% of adult Americans used VPNs in 2025, with 40% of the 18-29 demographic doing so; use is higher for younger people.[14] Another survey found that 41% of minors aged 11 to 14 regularly used VPNs.[15] There is little reason to suspect that minors are less adept than adults at using VPNs to bypass age-verification laws. At these (static) figures for VPN use, the ratio $\varepsilon/\omega$ is 1.25, which requires $b/h$ to be 0.05 ($h$ is 20-times larger than $b$) to meet the benefit-cost condition.

A restriction that imposes substantial costs on adults while achieving minimal success at its stated objective of protecting minors is not "substantially related" to that objective, regardless of how important the objective may be. This framework suggests that the constitutional question turns critically on empirical measurements of circumvention rates and deterrent effects.

There is no evidence (to date) of VPN circumvention by age with which to form ideas about $\varepsilon$ and $\omega$. Still, some empirical evidence on increased interest in VPNs, or accessing adult content by other means, is worth evaluating.

**Empirical Analysis**

I construct a panel dataset covering all 50 states plus the District of Columbia using weekly Google Trends data for the two search terms from January-2022 through September-2025.[16] Treatment dates correspond to when Pornhub blocked access in each state, creating a staggered adoption design with variation in treatment timing across states. Pornhub is not blocked in Louisiana (despite the state's age-verification law), so the effective date of the law is used as the treatment date. As the data are weekly, the treatment date is the week in which the block occurred.

***The pattern aligns with expected behavioral responses to adult sites shutting down in response to age verification laws: an immediate panic as users discover access is blocked, sustained elevated interest as users research and implement VPN solutions, then decay as early adopters find workarounds and word spreads about alternative methods or sites.***

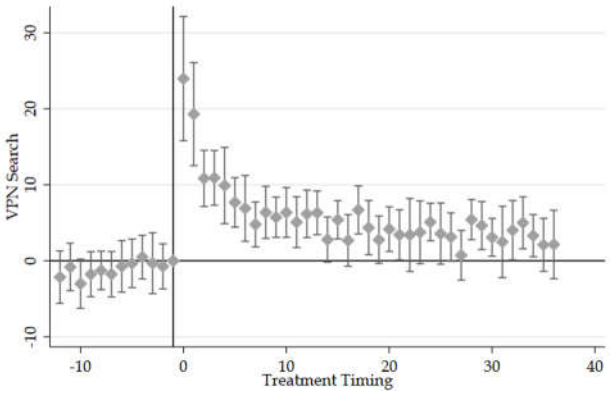
Google Trends does not provide the actual number of searches, but a normalized score from 0 to 100, where 100 represents the peak search interest for the selected query during the specified time and location. This normalization occurs at the state level.

My empirical strategy employs an event study Difference-in-Differences ("DID") framework, which is used to estimate the dynamic treatment effects of policies or interventions that are implemented at different times across different units (such as states, firms, or individuals).[17] A critical identification assumption is that treated and control units would have followed parallel trends in the absence of treatment, with pre-event coefficients serving as a falsification test of this assumption. The most useful output of the procedure is a graph showing the difference between treated and control units, where the graph shows a common first treated period for all

states even though the treatment dates may differ. The horizontal access measures time-to-treatment or time-from-treatment, with 0 indicating the treatment week. As the dependent variable includes zero, the data are kept in their level form, though percentages changes are computed.

The event study graph for the "VPN" search is presented in Figure 1, including point estimates and 95% confidence intervals, illustrating the twelve weeks pre-treatment and thirty-six weeks post-treatment. The figure reveals clean pre-treatment trends, with coefficients hovering near zero and confidence intervals including zero, providing support for the parallel trends assumption required for causal interpretation.

Figure 1. "VPN" Search

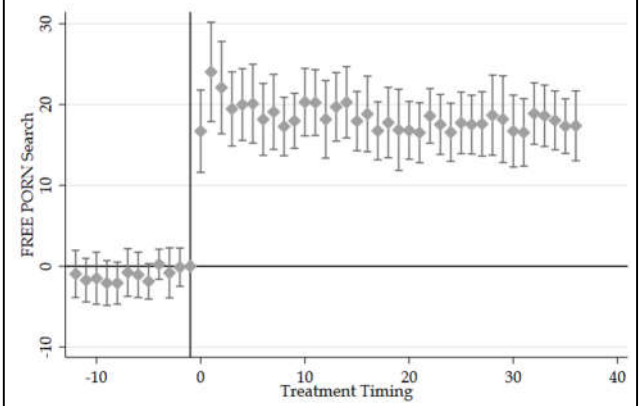



At the moment of treatment (week 0), VPN searches spike dramatically, with point estimates indicating an immediate 24-point increase (about 47%) in the week of the block. This effect is precisely estimated and highly statistically significant and represents a sizable behavioral response, not a marginal adjustment. The treatment effect remains elevated and significant for approximately twenty weeks post-treatment, with coefficients gradually declining from the initial peak. By week twenty-five, the confidence intervals frequently include zero, though some residual elevation persists. The pattern aligns with expected behavioral responses to adult sites shutting down in response to age verification laws: an immediate panic as users discover access is blocked, sustained elevated interest as users research and implement VPN solutions, then decay as early adopters find workarounds and word spreads about alternative methods or sites.

Figure 2 illustrates the event study results for the search term "free porn," as consumers of adult content look for alternatives to blocked or age-verified sites. Like the "VPN" search, there is marked increase in the search for "free porn" of about 2 points (about 30%) but unlike "VPN" search there are no signs of decay (sustained at about 25%). This stability is observed across all post-treatment periods (beyond those illustrated). The increased search for alternatives persists. These evasion efforts pose risks, as such searches may expose adults and minors to more prurient content without the content moderation standards of major platforms (*e.g.*, snuff films and scams). Again, the pre-treatment trends are near zero.

In most respects, these results are unsurprising. Efforts to evade regulation are common, and there is no reason to suspect any difference in responses to age verification regulations.

Figure 2. "Free Porn" Search




Importantly, Google Trends does not identify whether searchers are adults or minors. However, existing research on VPN usage by age provides important context. Studies indicate that adolescents aged 13-18 are highly tech-savvy and already routinely use VPNs to bypass school

filters and parental controls.[18] This demographic pattern suggests a perverse outcome: age verification laws may be least effective at blocking motivated teenagers who are the primary policy concern. Meanwhile, age verification laws impose costs on adults who either face friction using VPNs or simply abandon attempts to access legal content. Age verification laws thus impose differential costs based on technical sophistication and willingness to navigate circumvention tools. Less tech-savvy adults—who have full constitutional rights to access adult content—bear the highest burden. This stands in tension with First Amendment principles that disfavor content regulations creating unequal access based on economic resources or technical knowledge.

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The widespread adoption of VPNs triggered by age verification laws also generates negative spillovers far beyond the adult content industry. VPNs fundamentally disrupt the targeted advertising model that finances much of the free internet. Advertising effectiveness declines when users mask their true locations and identities. When a substantial share of internet users adopt VPNs—a 40% increase in searches suggests millions of new users—advertisers face degraded targeting capabilities across the entire internet ecosystem. In addition, VPN use makes content licensing more complicated as streaming services struggle to enforce geographic restrictions, and fraud detection is more difficult when legitimate users mask their locations.

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Perhaps most concerning, the surge in VPN adoption driven by age verification laws increases cybersecurity risks across the internet. VPNs and firewalls accounted for 58% of ransomware incidents in 2024, with VPN vulnerabilities representing the top entry point for ransomware attacks. Over 5 million internet-exposed remote management solutions have been detected, and more than 65% of businesses applying for cyber insurance have at least one exposed web login panel.

Free VPNs pose risks. Studies show that free Android VPNs are projected to have malware impact 39% of services, IP leaks in 84.5%, and third-party tracking in 76.5% by 2025.[19] In May 2024, U.S. authorities dismantled a large botnet built from networks of computers infected via at least 18 bogus free VPN apps.[20] Analysis by Comparitech found that several free VPNs were communicating with Chinese and Russian domains.[21] Many users driven to VPNs by age verification laws will opt for free services, inadvertently exposing themselves to malware, data theft, and identity fraud.

**Conclusion**

While it is too early to tell for sure, the evidence on age-verification laws for adult content suggests a regulatory failure with costs exceeding benefits. The effectiveness of these laws at protecting minors is questionable as motivated teenagers—who already use VPNs to bypass school filters—can easily circumvent age restrictions. There are good reasons to believe that age verification laws will not achieve their narrow objective of reducing minors' access to adult content, though these laws seem certain to impinge on the First Amendment rights of adults by "burden[ing] substantially more speech than necessary."[22] Adding to the costs of the regulations is a degradation of the commercial infrastructure of the internet, heightened cybersecurity vulnerabilities, and exposure to more problematic content.

Accordingly, policymakers should consider less restrictive alternatives that impose fewer costs on adults and the broader internet ecosystem. Device-level parental controls place responsibility on parents without requiring sensitive data collection or driving widespread VPN adoption. At minimum, states considering age verification laws should conduct thorough cost-benefit analyses accounting for impacts on free speech, internet commercial infrastructure, and cybersecurity.

## NOTES:

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3 *Free Speech Coalition v. Paxton,* 606 U.S. 461 (2025).

4 As the Court explained, *c*ontent-based laws—those that target speech based on its communicative content—are presumptively unconstitutional and may be justified only if they satisfy strict scrutiny. *Paxton, id.* at 471. Strict scrutiny requires the government to prove that a law serves a "compelling governmental interest" and is "narrowly tailored" to achieve that interest using the least restrictive means possible. *Id.* at 469. Content-neutral laws, on the other hand, "are subject to an intermediate level of scrutiny because in most cases they pose a less substantial risk of excising certain ideas or viewpoints from the public dialogue." Under intermediate scrutiny, a law will survive review "if it advances important governmental interests unrelated to the suppression of free speech and does not burden substantially more speech than necessary to further those interests." *Id.* at 471.

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8 *Paxton, supra* n. 3, 606 U.S. at 480-81.

9 *See supra* n. 4.

10 *Reno v. ACLU*, 521 U.S. 844, 875 (1997) (citations omitted).

11 *Id.* at 875-876.

## NOTES CONTINUED:

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[13] Data available at: https://www.census.gov/library/visualizations/interactive/exploring-age-groups-in-the-2020-census.html; *Youth (0 to 17) population Profile Detailed By Age, Sex, And Race/Ethnicity*, Office of Juvenile Justice and Delinquency Program (last visited November 4, 2025) (available at: https://ojjdp.ojp.gov/statistical-briefing-book/population/faqs/qa01104).

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[18] J. Baker, *Briefing: VPNs and the Online Safety Act*, Open Rights Group (September 2025) (available at: https://www.openrightsgroup.org/app/uploads/2025/09/VPN_Briefing.pdf).

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[22] *Paxton*, *supra* n. 3.