

MICROSTAMPING: HOT LEAD OR DUD ROUND?

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I. INTRODUCTION

In 2012, sixteen-year-old Chicago rapper Keith Cozart—better known as Chief Keef—debuted his breakthrough mixtape *Back from the Dead* which contained the lead single “I Don’t Like.”¹ It heralded the arrival of “drill” music to the mainstream; the song was remixed by Kanye West that same year.² Drill is a subgenre of hip-hop, “known for its trap-influenced beats, heavy synth[,] and snare drums paired with violent lyrics that focus on gang life, drugs, guns[,] and killing.”³ It reflects daily life in parts of Chicago, a city that has become synonymous with gun violence.⁴ While homicides hovered between 400 and 500 per year between 2007 and 2015, there were 771 murders in 2016 and 650 in 2017.⁵ In 2016, on a per-capita basis, Chicago’s murder rate was roughly 28 murders per 100,000 people.⁶ While cities such as St. Louis (59.3), Detroit (45.2), and Newark (33.4) had

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¹ Keon Diego, *Chicago’s Drill Rap: Misunderstood or Theme Music to Murder?*, KALEO (Oct. 17, 2016), http://www.manoanow.org/kaleo/features/chicago-s-drill-rap-misunderstood-or-theme-music-to-murder/article_0bc2da92-94bb-11e6-8b2f-43c1e2d4393b.html.

² *Id.*

³ *Id.*

⁴ Francesca Mirabile, *Chicago Still Isn’t the Murder Capital of America*, TRACE (Jan. 18, 2017), <https://www.thetrace.org/2017/01/chicago-not-most-dangerous-city-america/>.

⁵ Madison Park, *Chicago Police Count Fewer Murders in 2017, but Still 650 People Were Killed*, CNN (last updated Jan. 1, 2018, 4:39 PM), <http://www.cnn.com/2018/01/01/us/chicago-murders-2017-statistics/index.html>. The recently released murder statistics for 2017 may be subject to change because the circumstances of homicides are not always immediately knowable and may skew results as determining whether or not it was actually a murder can take time. See Al Baker, *A Look at the Old Books: How the N.Y.P.D. Used to Log Killings*, N.Y. TIMES: CITY ROOM (Dec. 29, 2009, 1:20 PM), <https://cityroom.blogs.nytimes.com/2009/12/29/a-look-at-the-old-books-how-the-nypd-used-to-log-killings/>. This is referred to as CUPPI—Cause Unknown Pending Police Investigation. *Id.*

⁶ Josh Sanburn & David Johnson, *See Chicago’s Deadly Year in 3 Charts*, TIME (Jan. 17, 2017), <http://time.com/4635049/chicago-murder-rate-homicides/>.

higher per-capita rates,⁷ the murder rates of other large cities, such as New York and Los Angeles, were significantly lower.⁸ The rampant gun violence has prompted drill rappers to christen the city “Chiraq” in reference to the death count of United States soldiers in the Middle East.⁹

Although Chicago and other cities are microcosms within the larger space of the United States, the national murder rate, 5.3 per 100,000 residents in 2016,¹⁰ indicates that gun violence is also an issue on the national scale. According to the Federal Bureau of Investigation (FBI), 73% of the homicides in 2016 “for which the FBI received weapons data” involved a firearm, and 64.6% of murders and non-negligent manslaughters involved handguns specifically.¹¹ The number of these violent crimes that are successfully resolved by law enforcement indicates substantial room for improvement. For example, for murder and non-negligent manslaughter in 2016, the national clearance rate was 59.4%.¹² This was even lower in

⁷ Mirabile, *supra* note 4.

⁸ Amanda Wills et al., *762 Murders. 12 Months. 1 American City.*, CNN (last updated Jan. 2, 2017, 1:50 PM), <http://www.cnn.com/2017/01/02/us/chicago-murder-rate-2016-visual-guide/>.

⁹ Diego, *supra* note 1.

¹⁰ *Crime in the United States, by Volume and Rate per 100,000 Inhabitants, 1997–2016*, FBI, <https://ucr.fbi.gov/crime-in-the-u.s/2016/crime-in-the-u.s.-2016/tables/table-1> (last visited Apr. 3, 2018). Fortunately, the national murder rate in the United States has generally been steadily decreasing since 1997. *See id.* But this is not to suggest that efforts should not be made to further reduce it.

¹¹ FBI, EXPANDED HOMICIDE DATA (2017), <https://ucr.fbi.gov/crime-in-the-u.s/2016/crime-in-the-u.s.-2016/topic-pages/expanded-homicide.pdf> [hereinafter EXPANDED HOMICIDE DATA]. It should also be noted that while instances of mass casualty shootings have been on the rise and have garnered significant media attention, these shootings account for a very small proportion of gun violence victims when compared to the overall whole. *See* OFFICE FOR VICTIMS OF CRIME, MASS CASUALTY SHOOTINGS (2017), https://ovc.ncjrs.gov/ncvrvw2017/images/en_artwork/Fact_Sheets/2017_NCVRW_MassShootings_508.pdf [hereinafter MASS CASUALTY SHOOTINGS] (“In 2012, less than 1% of gun murder victims were killed in a mass shooting.”). Also, since roughly 70% of “active shooter” incidents (which are tracked at the federal level, unlike mass shootings, and are defined in a certain way by federal agencies) “end with the shooter or shooters’ deaths,” and an additional 13.1% result in successful restraint of the shooter by unarmed citizens, it is unlikely that microstamping will have any significant effect on this type of gun violence because microstamping is primarily useful for resolving unsolved violent gun crimes. AJ Willingham & Saeed Ahmed, *Mass Shootings in American Are a Serious Problem—And These 9 Charts Show Just Why*, CNN, <https://www.cnn.com/2016/06/13/health/mass-shootings-in-america-in-charts-and-graphs-trnd/index.html> (last updated Nov. 6, 2017, 10:06 AM) (providing a chart illustrating the results of an FBI study of active shooter incidents from 2000–2013 and how they ended); *see* MASS CASUALTY SHOOTINGS, *supra* note 11 (describing the lack of a uniform definition for mass casualty shootings and how they are defined and tracked at the federal level); *see also infra* text accompanying notes 14–18.

¹² *Percent of Offenses Cleared by Arrest or Exceptional Means, by Population Group, 2016*, FBI, <https://ucr.fbi.gov/crime-in-the-u.s/2016/crime-in-the-u.s.-2016/tables/table-17> (last visited Apr. 3, 2018). To “clear” a crime is a law enforcement term that generally means

Chicago, where the clearance rate for murders in 2016 was about 28%.¹³

“Identifying the firearm used in a crime is one of the biggest challenges for criminal investigators.”¹⁴ Current ballistics identification technology involves matching incidental tool marks that are unique to a weapon on bullets and cartridge casings through the use of databases.¹⁵ A significant drawback to this approach is that, unless the specific firearm used in the offense is recovered, it is difficult to prove that it was indeed the weapon that made these unique marks and fired these rounds.¹⁶ Microstamping, a process that uses lasers to make microscopic engravings on internal components of semiautomatic pistols,¹⁷ potentially holds solutions to these issues. The technology stamps unique identifying information onto ejected shell casings that can be recovered at a crime scene, and thereafter investigators can use the ejected shell casings to identify the weapon and track it to the original

to make an arrest or identify a suspect, and “the ‘clearance rate’ is the percentage of offenses cleared.” See Martin Kaste, *How Many Crimes Do Your Police ‘Clear’? Now You Can Find Out*, NPR (Mar. 30, 2015, 5:11 AM), <https://www.npr.org/2015/03/30/395799413/how-many-crimes-do-your-police-clear-now-you-can-find-out>. Under the FBI’s Uniform Crime Reporting (UCR) Program, crimes can be “cleared” in one of two ways: by arrest or by exceptional means. FBI, OFFENSES CLEARED (2017), <https://ucr.fbi.gov/crime-in-the-u.s/2016/crime-in-the-u.s.-2016/topic-pages/clearances.pdf>. In order to clear by exceptional means, the FBI must have:

[(i)] [i]dentified the offender[:]; [(ii)] [g]athered enough evidence to support an arrest, make a charge, and turn over the offender to the court for prosecution[:]; [(iii)] [i]dentified the offender’s exact location so that the suspect could be taken into custody immediately[:]; [and (iv)] [e]ncountered a circumstance outside the control of law enforcement that prohibits the agency from arresting, charging, and prosecuting the offender.

Id. Examples of exceptional means clearances include the death or suicide of the offender or the denial of extradition because the offender is being prosecuted in another jurisdiction for a crime committed there. *Id.*

¹³ Andy Grimm, *As Violence Persists, CPD Murder ‘Clearance Rate’ Continues to Slide*, CHI. SUN TIMES (Aug. 27, 2017, 9:57 AM), <https://chicago.suntimes.com/chicago-politics/as-violence-persists-cpd-murder-clearance-rate-continues-to-slide/>.

¹⁴ Erica Goode, *Method to Track Firearm Use Is Stalled by Foes*, N.Y. TIMES (June 12, 2012), <http://www.nytimes.com/2012/06/13/us/code-on-shell-casings-sparks-a-gun-debate.html?mcubz=0>.

¹⁵ *Id.* One such database is the National Integrated Ballistic Information Network (NIBIN), which is maintained by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). *Forensic Database Firearms and Toolmarks Table*, NAT’L INST. STANDARDS & TECH., <https://www.nist.gov/oles/forensic-database-firearms-and-toolmarks-table> (last updated Jan. 9, 2017). Other databases that assist forensic examiners and law enforcement agencies include the FBI’s General Rifling Characteristics (GRC) and Reference Ammunition File (RAF). *Id.*

¹⁶ Goode, *supra* note 14.

¹⁷ *Microstamping & Ballistics*, GIFFORDS L. CTR. TO PREVENT GUN VIOLENCE, <https://lawcenter.giffords.org/gun-laws/policy-areas/crime-guns/microstamping-ballistics/> (last visited Oct. 9, 2018) [hereinafter *Microstamping & Ballistics*].

purchaser, even if the weapon itself is not recovered.¹⁸

In 2007, California became the first state to pass a law requiring new semiautomatic handguns to incorporate microstamping technology.¹⁹ The District of Columbia has also passed a microstamping law, and several other states have entertained similar legislation.²⁰ Moreover, there have been efforts to implement microstamping legislation at the federal level.²¹ Microstamping technology and the legislative efforts to require it, however, have become embroiled in controversy.²² Proponents of microstamping argue that the technology is reliable, cost-effective, and practical—although not foolproof—to implement, and cite studies to that effect.²³ Opponents argue that the technology is unreliable, expensive to implement, and can easily be circumvented by criminals, and also cite studies that support these claims.²⁴ The fallout of the controversy is manifest at the point of origin: there have been two major lawsuits at the state and federal level in California over this legislation, and large gun manufacturers have withdrawn from the California market.²⁵

This Comment will examine the feasibility and impact of microstamping technology. Specifically, this Comment will address the various arguments and studies that are raised and cited—both for and against microstamping—to assess whether this new technology is feasible to implement. The impact that this technology may have will also be considered. This analysis argues that although microstamping is an imperfect technology that requires more research and development before broad-based implementation can occur, the goal should be towards implementation rather than outright abandonment, as the technology has clear, attainable benefits when considered as a whole.

Part II of this Comment will explore the history and development of microstamping technology and describe how it works and assists in firearms identification. Part III will involve an in-depth examination of the

¹⁸ Goode, *supra* note 14.

¹⁹ *See id.*

²⁰ *Id.*

²¹ *See* Tom Knighton, *Federal Bill Seeks to Block Sales of Pistols Lacking Microstamping Technology*, BEARING ARMS (Aug. 9, 2017, 5:18 PM), <https://bearingarms.com/tom-k/2017/08/09/federal-bill-seeks-block-sales-pistols-lacking-microstamping-technology/> (detailing introduction of the Make Identifiable Criminal Rounds Obvious (MICRO) Act before Congress as well as noting prior microstamping legislation that Xavier Becerra introduced during his time in Congress).

²² *See* Goode, *supra* note 14.

²³ *Id.*

²⁴ *Id.*

²⁵ *See Recent Developments in “Microstamping” Legislation*, RENZULLI L. FIRM, <https://renzullilaw.com/recent-developments-in-microstamping-legislation/> (last visited Dec. 30, 2017).

controversy surrounding microstamping in the law. This will include a summary of California's 2007 microstamping law, the legal battles that have occurred in California, the District of Columbia's microstamping law and legislative efforts by other states and the federal government to implement microstamping, and the various groups and organizations that fall on both sides of the debate. Part III will also summarize microstamping studies and the major arguments advanced by proponents and opponents of this technology.

Part IV will analyze the feasibility of microstamping along the three primary points of argument: reliability, cost, and practicality. This will entail a critique of the studies and suggestions for microstamping research and implementation moving forward. This Part will also consider what impact microstamping may have on law enforcement capabilities, the violent crime rate, and the gun manufacturing industry if microstamping legislation is broadly adopted. Part V provides a conclusion summarizing the findings and position of this analysis.

II. BACKGROUND & DEVELOPMENT OF MICROSTAMPING TECHNOLOGY

A. *History and Technical Background of Microstamping*

Todd Lizotte and Orest Ohar created microstamping in the 1990s while developing microidentification and micromachining technologies for the electronics and computer industries.²⁶ After using this technology successfully in those industries, they applied it to firearms and discovered that they could use lasers to etch up to twenty characters onto the tip of the firing pin of a handgun.²⁷ The firing pin was then placed into a handgun and a round was fired; when the cartridge case was examined by microscope, the numbers engraved on the firing pin were clearly visible.²⁸

The microstamping process relies on the inner workings of semiautomatic handguns to operate effectively.²⁹ Upon pulling the trigger

²⁶ *An Act Concerning the Identification of Certain Firearms and the Criminal Possession of Firearms, Coalition to Stop Gun Violence: SB 607 Before the J. Comm. on the Judiciary*, 2008 Leg., Reg. Sess. 15 (Conn. 2008) (statement of Josh Horwitz, Executive Director of the Coalition to Stop Gun Violence), <https://www.cga.ct.gov/2008/JUDdata/Tmy/2008SB-00607-R000317-The%20Coalition%20to%20Stop%20Gun%20Violence,%20Josh%20Horwitz-TMY.PDF> [hereinafter *In Support of SB 607*].

²⁷ *Id.*

²⁸ *Id.*

²⁹ See Times Editorial Bd., 'Microstamping' Technology Could Help Police Crack Down on Gun Crimes—If the Gun Lobby Allows It, L.A. TIMES (Oct. 24, 2016, 5:00 AM), <http://www.latimes.com/opinion/editorials/la-ed-microstamping-guns-nra-20161022-snap-story.html>.

of a gun, the hammer strikes the firing pin—a small rod inside the gun—which in turn strikes the primer on the back of the cartridge.³⁰ The primer then ignites the gunpowder inside the cartridge and the ensuing explosion propels the bullet out of the barrel of the gun.³¹ This point of contact between the firing pin and the cartridge casing is what allows microstamping to work.³²

Lizotte and Ohar continued to improve this technology “in part by utilizing advanced metallurgical coatings and by adding redundant markings that can be identified even if the alphanumeric stamps on the firing pin tip are removed.”³³ The latter advancement utilizes a circumferential gear code which is etched around the perimeter of the firing pin rather than engraved on the tip.³⁴ In the event of deformity or defacement of the alphanumeric code on the firing pin tip, the gear code is still stamped onto the shell casing and can be deciphered by dividing it into eight sections; each section corresponds with an alphanumeric character.³⁵

Crucial to microstamping “is the effort that must be undertaken in order to optimize the microstamped mark and ensure maximum transfer of the pattern [M]icrostamping involves more than just ‘blasting a number onto a firing pin using a laser.’”³⁶ This process is called optimization, whereby for each specific model of handgun the physical characteristics of the firing pin must be considered to determine how the code should be engraved and arranged, and how many characters should be included in order to achieve a clear transfer of the pattern.³⁷

B. *How Microstamping Technology Assists in Firearm Identification*

Since the early 1900s, firearm identification methods have relied on the analysis of unintentional marks—like scratches and indentations—that are transferred from the weapon to the surfaces of the cartridge and the bullet.³⁸

³⁰ Nathan Scalia, *It's Made of Science: Guns and Bullet Ballistics*, LIT REACTOR (Feb. 21, 2014), <https://litreactor.com/columns/its-made-of-science-guns-and-bullet-ballistics>.

³¹ *Id.*

³² See Times Editorial Bd., *supra* note 29.

³³ *In Support of SB 607*, *supra* note 26, at 15.

³⁴ L. Grieve et al., *Gear Code Extraction from Microstamped Cartridges*, 45 ASS'N FIREARM & TOOL MARK EXAMINERS J. 64, 64–65 (2013).

³⁵ See *id.*

³⁶ L.S. Chumbley et al., *Clarity of Microstamped Identifiers as a Function of Primer Hardness and Type of Firearm Action*, 44 ASS'N FIREARM & TOOL MARK EXAMINERS J. 145, 146 (2012).

³⁷ *Id.*

³⁸ Orest P. Ohar & Todd E. Lizotte, *Extracting Ballistic Forensic Intelligence: Microstamped Firearms Deliver Data for Illegal Firearm Traffic Mapping: Technology, Implementation, and Applications*, PROC. OF SPIE, Sept. 15, 2009, at 2–3, <http://www.csgv.org/wp-content/uploads/2013/06/LIZOTTE-RESEARCH-PAPER->

These irregularities are caused by the machining processes utilized in firearms manufacturing.³⁹ “This means that unintentional microstamped features are nondescript, have little readily resolvable repeatability[,] and rely on the recovery of its matching firearm to make them useful during the traditional tool mark forensic identification process.”⁴⁰

By utilizing intentional tool marks like microstamping, firearm identification technology would be greatly improved; the technology provides consistency and certainty “when looking for the connection between firearm evidence (e.g.,[] fired cartridge found at a crime scene) and a specific firearm source.”⁴¹ Perhaps most importantly, the actual firearm used would not have to be recovered.⁴² Microstamping technology would have little practical effectiveness when it comes to revolvers, however, because revolvers do not automatically eject shell casings.⁴³

At the time of final assembly, the microstamped code would be linked to the serial number of the weapon and entered into an existing internal accounting system already used by firearms manufacturers to comply with requirements mandated by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF).⁴⁴ Although the microstamped information would not necessarily point investigators directly to the shooter, it would give investigators a lead by pointing them to the weapon’s last recorded buyer.⁴⁵

III. THE CONTROVERSY SURROUNDING MICROSTAMPING IN THE LAW

A. *The California Microstamping Bill*

On October 13, 2007, then-Governor Arnold Schwarzenegger signed the Crime Gun Identification Act (CGIA) into law, “which requires all new models of semiautomatic pistols manufactured or sold in California to be designed and equipped with microstamping technology,” making California the first state to pass such legislation.⁴⁶ The CGIA expands the definition of “unsafe handgun” to include semiautomatic pistols that are not “designed

AUGUST-2009.pdf.

³⁹ *Id.* at 3.

⁴⁰ *Id.*

⁴¹ *Id.* at 4.

⁴² Goode, *supra* note 14.

⁴³ Bob Owens, *Smith & Wesson Officially Becomes the Second Gun Company to Pull Out of California Over Microstamping*, BEARING ARMS (Jan. 23, 2014, 8:46 AM), <https://bearingarms.com/bob-o/2014/01/23/smith-wesson-officially-becomes-the-second-gun-company-to-pull-out-of-california-over-microstamping/>.

⁴⁴ Jerry The Geek, *Microstamping Ammunition: Todd Lizotte Interview*, COGITO ERGO GEEK (May 1, 2008, 9:36 PM), <http://jerrythegeek.blogspot.com/2008/05/microstamping-ammunition-todd-lizotte.html>.

⁴⁵ Times Editorial Bd., *supra* note 29.

⁴⁶ *Microstamping & Ballistics*, *supra* note 17.

and equipped with a microscopic array of characters that identify the make, model, and serial number of the pistol, etched or otherwise imprinted in two or more places on the interior surface or internal working parts of the pistol.”⁴⁷ The bill was set to take effect on January 1, 2010, provided that the California Department of Justice certified that microstamping technology was “available to more than one manufacturer unencumbered by any patent restrictions.”⁴⁸

The CGIA adds the microstamping requirement to a list of previously enumerated requirements under California’s Unsafe Handgun Act (UHA), which went into effect on January 1, 2001.⁴⁹ The UHA stipulates that, in order for a handgun to be manufactured in or imported into California for sale and sold, it must pass firing, safety, and drop tests and be certified for sale by the California Department of Justice.⁵⁰ Only handguns that meet these requirements are approved for retail sale and are listed on the California Department of Justice’s Roster of Handguns Certified for Sale.⁵¹ Otherwise, the weapon is considered an “unsafe handgun” and cannot be sold to the public by a licensed firearms retailer.⁵² Law enforcement agencies and personnel in California are generally exempt from these requirements, and can purchase handguns that are not listed on the Roster.⁵³ Handguns sold through private or secondary sales also are not bound by these requirements.⁵⁴

⁴⁷ Assemb. B. 1471, 2007–2008 Leg., Reg. Sess. (Cal. 2007).

⁴⁸ *Id.*

⁴⁹ *California Rings in the New Year With Handgun Ban*, CAL. RIFLE & PISTOL ASS’N (Jan. 14, 2016), <https://www.carpa.org/legislation/california-rings-new-year-handgun-ban/> [hereinafter *California Rings in the New Year*].

⁵⁰ *Roster of Handguns Certified for Sale*, ST. CAL. DEP’T JUST., <https://www.oag.ca.gov/firearms/certguns> (last visited Oct. 11, 2018) [hereinafter *Roster of Handguns Certified for Sale*].

⁵¹ See *California Rings in the New Year*, *supra* note 49.

⁵² *Sworn Members or Peace Officers: Unsafe Handgun Roster Alert*, CAL. RIFLE & PISTOL ASS’N (Apr. 6, 2016), <https://www.carpa.org/carpa-news/sworn-members-peace-officers-unsafe-handgun-roster-alert/>.

⁵³ *Id.*

⁵⁴ *Design Safety Standards for Handguns in California*, GIFFORDS L. CTR. TO PREVENT GUN VIOLENCE (citing CAL. PENAL CODE §§ 27545, 32110(a) (2018)), <http://lawcenter.giffords.org/design-safety-standards-for-handguns-in-california/> (last updated Oct. 31, 2017). This brings to the fore the infamous “gun show loophole,” which is somewhat of a misnomer. Amy Sherman, *PolitiFact Sheet: 3 Things to Know About the ‘Gun Show Loophole’*, POLITIFACT (Jan. 7, 2016, 4:10 PM), <http://www.politifact.com/truth-o-meter/article/2016/jan/07/politifact-sheet-3-things-know-about-gun-show-loop/>. As the ATF clarifies, the “gun show” exception does not depend on where the firearms sale occurs (such as at a gun show or flea market), but rather it depends on “whether . . . the person conducting those transactions is engaged in the business of dealing in firearms.” BUREAU ALCOHOL, TOBACCO, FIREARMS & EXPLOSIVES, U.S. DEP’T OF JUSTICE, *DO I NEED A LICENSE TO BUY AND SELL FIREARMS?* 3 (2016), <https://www.atf.gov/file/100871/download>. If an individual only makes occasional sales of firearms from a personal collection, whether or not it is at a gun

B. *The California Legal Controversy*

Microstamping legislation has been met with fierce opposition and has resulted in legal action.⁵⁵ Lizotte wanted his patent on microstamping to lapse, thereby allowing the technology to enter the public domain and satisfy the CGIA's requirement that it be unencumbered by any patent.⁵⁶ The Calguns Foundation, a gun rights group, paid the \$555 fee to extend the developer's patent in order to prevent it from lapsing and to delay the law.⁵⁷ Gene Hoffman, chairman of the foundation, stated that "[i]t was a lot cheaper to keep the patent in force than to litigate over the issues."⁵⁸ On May 17, 2013, Attorney General Kamala D. Harris certified that microstamping technology was no longer encumbered by patent restrictions and that the law was effective immediately.⁵⁹

In 2009, California residents and pro-gun rights organizations filed a lawsuit against "Stephen Lindley in his official capacity as the Chief of the California Department of Justice Bureau of Firearms."⁶⁰ The plaintiffs challenged the UHA on the grounds that it violated the Second Amendment and the Equal Protection Clause of the Fourteenth Amendment.⁶¹ The plaintiffs argued that the UHA violated the Second Amendment because it prevents the purchase of handguns that are "in common use" and therefore protected under *District of Columbia v. Heller*.⁶² The plaintiffs also argued that the UHA infringes upon the Equal Protection Clause because it makes arbitrary distinctions about otherwise identical firearms, thereby "inherently making arbitrary distinctions among the people who would possess them, and arbitrarily bar[ring] people from possessing handguns deemed safe for

show, he or she does not need to be licensed and therefore does not have an obligation under existing federal law to conduct background checks or keep records. *Id.* at 1, 9. California and five other states, however, have closed this loophole by requiring universal background checks. *Gun Show Loophole FAQ*, COALITION TO STOP GUN VIOLENCE, <https://www.csgv.org/issues-archive/gun-show-loophole-faq/> (last visited Oct. 13, 2017). But these types of sales are still exempt from the UHA requirements. *Design Safety Standards for Handguns in California*, GIFFORDS L. CTR. TO PREVENT GUN VIOLENCE (citing CAL. PENAL CODE §§ 27545, 32110(a) (2018)), <http://lawcenter.giffords.org/design-safety-standards-for-handguns-in-california/> (last updated Oct. 31, 2017).

⁵⁵ See Goode, *supra* note 14; see also Times Editorial Bd., *supra* note 29.

⁵⁶ Goode, *supra* note 14.

⁵⁷ *Id.*

⁵⁸ *Id.* (internal quotations omitted).

⁵⁹ *Information Bulletin: Certification of Microstamping Technology Pursuant to Penal Code Section 31910, Subdivision (b)(7)(A)*, ST. CAL. DEP'T JUST. (May 17, 2013), <https://oag.ca.gov/sites/all/files/agweb/pdfs/firearms/infobuls/2013-BOF-03.pdf>.

⁶⁰ Peña v. Lindley, No. 2:09-CV-01185-KJM-CKD, 2015 WL 854684, at *1, *5 (E.D. Cal. Feb. 26, 2015).

⁶¹ *Id.* at *4.

⁶² *Id.* (citing *District of Columbia v. Heller*, 554 U.S. 570, 573 (2008)).

others.”⁶³

The plaintiffs filed a second amended complaint in June 2013 to account for the recently certified microstamping provision.⁶⁴ After procedural delays,⁶⁵ the Eastern District of California dismissed plaintiffs’ claims on summary judgment grounds.⁶⁶ The plaintiffs appealed to the Ninth Circuit, which applied intermediate scrutiny to their claims.⁶⁷ The court held that the microstamping requirement passed constitutional muster because public safety and crime prevention are substantial government interests and there is a “reasonable fit” between these interests and the microstamping requirement.⁶⁸

Addressing plaintiffs’ broader constitutional argument based on *Heller*, the Ninth Circuit concluded that the UHA only regulated commercial sales, not possession,⁶⁹ and cited precedent distinguishing between “laws that regulate the manner in which individuals may exercise their Second Amendment right, and laws that amount to a total prohibition of the right.”⁷⁰ The reasoning proceeded that just because plaintiffs cannot buy the exact gun they want does not mean that their Second Amendment right to self-defense in the home has been significantly burdened—they can still buy handguns that are approved.⁷¹ The Ninth Circuit also found plaintiffs’ Equal Protection Clause argument unconvincing because it was subsumed in its

⁶³ *Id.* at *5.

⁶⁴ *Id.* at *6.

⁶⁵ *Id.* at *5–6.

⁶⁶ *Peña*, 2015 WL 854684, at *17.

⁶⁷ *See Peña v. Lindley*, 898 F.3d 969, 979 (9th Cir. 2018).

⁶⁸ *Id.* at 981–82. The Ninth Circuit also found that the other firearm safety provisions of the UHA survived intermediate scrutiny. *See id.* at 980–81. Regarding the feasibility, efficacy, and cost of microstamping, the court stated that despite conflicting testimony deference to the legislative decision-making process was due because, under intermediate scrutiny, “we have never forced an experimenting state to prove its policymaking judgment with scientific precision, especially when expert opinion supports the decision.” *Id.* at 983–84. Judge Bybee concurred in part and dissented in part, taking issue with the majority’s approval of the microstamping provision (but not the other provisions of the UHA), and stating that the majority failed to consider evidence raised by plaintiffs that California’s testing protocol was so onerous that no gun manufacturer could meet it. *Id.* at 987–90 (Bybee, J., concurring in part and dissenting in part). He went on to argue that the majority improperly accorded deference to the legislature by assuming technological feasibility, and, therefore, that it could not be concluded at the summary judgment stage that there was a reasonable fit between the microstamping requirement and California’s interests. *Id.* at 989. Judge Bybee concluded that the microstamping requirement burdens conduct protected under the Second Amendment, not just commercial sales, because the practical effect of the requirement is that “since at least 2013, no new handguns have been sold commercially in California,” and therefore the application of heightened scrutiny was warranted and the issue should have been reversed and remanded to the district court. *Id.* at 988–90.

⁶⁹ *Id.* at 973, 975–77.

⁷⁰ *Id.* at 977 (citations omitted).

⁷¹ *Id.* at 978–79.

Second Amendment analysis, and because plaintiffs failed to allege that they were part of a suspect or quasi-suspect class, or that there were differences in treatment lacking a rational basis.⁷² The court affirmed the district court's grant of summary judgment against plaintiffs.⁷³

A second lawsuit was brought after the certification of the CGIA by plaintiffs, the National Shooting Sports Foundation, Inc. (NSSF) and the Sporting Arms and Ammunition Manufacturers' Institute, Inc. (SAAMI), that sought declaratory and injunctive relief to enjoin the microstamping statute on the basis that it is impossible to comply with.⁷⁴ Specifically, the plaintiffs argued that it is impossible for firearms manufacturers to implement microstamping technology because "no semi-automatic pistol can be designed or equipped with a microscopic array of characters identifying the make, model and serial number of the pistol . . . that can be legibly, reliably, repeatedly, consistently and effectively transferred . . . to a cartridge case when the firearm is fired."⁷⁵ The NSSF is a nonprofit trade association whose "members include manufacturers, distributors, and retailers of semiautomatic pistols" that seeks to protect and promote hunting and shooting sports.⁷⁶ The "SAAMI is a nonprofit trade association" whose members include manufacturers of semiautomatic pistols who sell in California and "whose mission is to develop and publish industry recommended practices and voluntary standards pertaining to the safety, interchangeability, reliability and quality of semiautomatic pistols."⁷⁷

The trial court granted California's motion for judgment on the pleadings without leave to amend because "appellants declined to assert a constitutional challenge, [so] their claim was precluded under the separation of powers doctrine."⁷⁸ The appellate court reversed and remanded the matter for further proceedings, ultimately finding that appellants "have the right to present evidence to attempt to prove their claim."⁷⁹ On appeal, the California Supreme Court considered whether the microstamping requirement could be invalidated by a court on the basis of California "Civil Code section 3531's declaration that '[t]he law never requires impossibilities."⁸⁰ The court

⁷² *Id.* at 986–87.

⁷³ *Peña*, 898 F.3d at 987.

⁷⁴ *Nat'l Shooting Sports Found., Inc. v. State*, 210 Cal. Rptr. 3d 867, 869 (Cal. Ct. App. 2016), *rev'd*, 420 P.3d 870 (Cal. 2018).

⁷⁵ *Id.* at 871. This case and line of argument highlight the principal argument against microstamping outside of constitutional parameters—that it is not a feasible technology to implement.

⁷⁶ *Id.* at 870.

⁷⁷ *Id.*

⁷⁸ *Id.* at 871–72.

⁷⁹ *Id.* at 869–70.

⁸⁰ *Nat'l Shooting Sports Found., Inc. v. State*, 420 P.3d 870, 872 (Cal. 2018) (alteration

concluded that “section 3531’s maxim . . . is an interpretive aid that occasionally authorizes an exception to a statutory mandate in accordance with the Legislature’s intent behind the mandate. The maxim has never been recognized . . . as a ground for invalidating a statutory mandate altogether.”⁸¹ The California Supreme Court reversed the decision of the appellate court and “remand[ed] to that court to affirm the trial court’s” decision granting California’s motion for judgment on the pleadings.⁸²

C. *District of Columbia, Other States, & Federal Microstamping Legislation*

On March 1, 2016, the Council of the District of Columbia drafted a resolution that extended the implementation of its own microstamping requirement under the Firearms Registration Amendment Act (FRAA) of 2008 to become effective on January 1, 2018.⁸³ A principal reason for the delay was that the District was waiting on California’s implementation and refinement of its microstamping legislation.⁸⁴

The FRAA largely mirrors the California law.⁸⁵ It prohibits any licensed firearms dealer from selling any semiautomatic pistol manufactured after the effective date that is not “microstamp-ready,” meaning that the firearm is “manufactured to produce a unique alpha-numeric or geometric code on at least 2 locations on each expended cartridge case that identifies the make, model, and serial number of the pistol.”⁸⁶ It also contains provisions detailing manufacturer transfer of firearms into the District to a dealer for sale, certification procedures with the Chief of Police, and criminal prohibitions for altering or removing the identifying codes, although exceptions are made for normal wear and tear.⁸⁷

in original). The court explicitly stated that it offered no opinion on whether or not the California Department of Justice had improperly certified the availability of microstamping technology. *Id.* at 875.

⁸¹ *Id.* at 875. The court found no legislative intent in the text or purpose of the microstamping statute to allow a showing of impossibility to excuse compliance with its mandate. *Id.* at 874–75. A concurrence by Justice Chin, however, challenged that the Department of Justice’s certification procedure (that microstamping technology was unencumbered by patent restrictions) had nothing to do with impossibility-based exceptions to the microstamping statute, and therefore concluded that courts should remain free to construe the statute as inapplicable to a particular case because of impossibility, based on legislative intent. *Id.* at 878 (Chin, J., concurring).

⁸² *Id.* at 875.

⁸³ Microstamping Implementation Congressional Review Emergency Declaration Resolution, 63 D.C. Reg. 1–2 (Mar. 1, 2016).

⁸⁴ *Id.*

⁸⁵ See D.C. CODE § 7-2505.03 (2018) (effective Jan. 1, 2018), <https://beta.code.dccouncil.us/dc/council/code/sections/7-2505.03.html>.

⁸⁶ *Id.*

⁸⁷ § 7-2505.03(d)(2) (“Replacing a firing pin that has been damaged or worn . . . for the

Several other states have considered microstamping legislation in recent years, but have not yet enacted any requirements; these states include New York, Connecticut, Rhode Island, Massachusetts, Maryland, Wisconsin, Illinois, and New Jersey.⁸⁸ As in California, these measures have sparked controversy.⁸⁹ For instance, the introduction of a 2009 microstamping bill in Wisconsin never made it to a vote.⁹⁰ According to the state Government Accountability Board, supporters' lobbying efforts totaled 18 hours, while opponents of the measure reported 313 hours of lobbying efforts.⁹¹

There have also been efforts at the federal level to enact microstamping legislation. For example, on February 7, 2008, Congressman Xavier Becerra introduced the National Crime Gun Identification Act (NCGIA).⁹² The proposed legislation would have prevented federal firearm licensees from manufacturing, importing, or transferring a semiautomatic pistol unless it was capable of microstamping ammunition, with the microstamping provision requiring that an identifying array of characters be "etched into the breech face and firing pin."⁹³ A framework for violations of the proposed law was also established, making first-, second-, and third-time offenses punishable by \$1,000, \$2,000, and \$3,000 fines respectively, multiplied by the number of semiautomatic pistols involved in the violation.⁹⁴ The bill ultimately died in Congress.⁹⁵

safe use of the pistol or for a legitimate sporting purpose shall not alone be evidence that someone has violated this prohibition."); see also *Microstamping & Ballistic Identification in the District of Columbia*, GIFFORDS L. CTR. TO PREVENT GUN VIOLENCE, <http://lawcenter.giffords.org/microstampingballistic-identification-in-washington-d-c/> (last updated Nov. 27, 2017).

⁸⁸ Chris Eger, *NJ Dems Want Microstamping, Gun Databases, and More*, GUNS.COM (Sept. 22, 2016), <http://www.guns.com/2016/09/22/nj-dems-want-microstamping-gun-databases-and-more/>; John Haughey, *Microstamping Bills Are an Economic Disaster in the Waiting*, OUTDOOR LIFE (Sept. 4, 2012), <http://www.outdoorlife.com/blogs/gun-shots/2012/09/microstamping-bills-are-economic-disaster-waiting>.

⁸⁹ See Goode, *supra* note 14.

⁹⁰ *Wisconsin to Consider Gun-Tracking Bill*, HOMELAND SECURITY NEWS WIRE (Apr. 6, 2011), <http://www.homelandsecuritynewswire.com/wisconsin-consider-gun-tracking-bill>.

⁹¹ *Id.*

⁹² National Crime Gun Identification Act, H.R. 5266, 110th Cong. (2008). Congressman Becerra is a Democrat and represented California's Thirty-First Congressional District. *H.R. 5266 (110th): National Crime Gun Identification Act*, GOVTRACK, <https://www.govtrack.us/congress/bills/110/hr5266> (last visited Oct. 11, 2017) [hereinafter *H.R. 5266 (110th)*].

⁹³ H.R. 5266 § 2(a). Note that this provision does not include a requirement for a geometric code, but it does require that the identifying character code be stamped on two places in the firearm. *Id.*

⁹⁴ *Id.*

⁹⁵ *H.R. 5266 (110th)*, *supra* note 92.

On July 27, 2017, Congressman Anthony G. Brown introduced the Make Identifiable Criminal Rounds Obvious (MICRO) Act.⁹⁶ The proposed legislation generally adopted the microstamping and violation provisions of the 2008 NCGIA.⁹⁷ But, this bill also contains a provision similar to the District of Columbia's FRAA on the alteration of microstamping features: "[i]t shall be unlawful for any person to remove, obliterate, or alter the microstamped code or microstamping capability of a firearm that has been shipped or transported in interstate or foreign commerce."⁹⁸ As with the FRAA, the punishments for violating this provision do not necessarily apply to the replacement of a firing pin that is worn or damaged.⁹⁹ The MICRO Act also differentiates between penalties for infractions by an individual and for infractions by a licensed manufacturer, importer, or dealer, the latter being subject to a suspension or revocation of license.¹⁰⁰ The bill is still in the first stage of the legislative process.¹⁰¹

The various efforts at both the state and federal levels to consider and enact microstamping legislation, in addition to the controversy surrounding it, illustrate the importance, prevalence, and contentious nature of a technology that is gathering considerable attention and traction. Therefore, a determination of microstamping's feasibility and its implications is crucial.

D. *Proponents of Microstamping, Supporting Studies, & Arguments in Favor*

Supporters of microstamping generally fall into one of a few select groups and organizations. One such group is law enforcement, which on the whole broadly supports a technology that is, as described by the Commissioner of the Baltimore Police Department, "'one of these things in law enforcement that would just take us from the Stone Age to the jet age in an instant.'"¹⁰² On November 11, 2008, at its 115th annual conference, the International Association of Chiefs of Police issued a resolution recommending that "all firearms produced or sold be fitted with

⁹⁶ Make Identifiable Criminal Rounds Obvious Act, H.R. 3458, 115th Cong. (2017). Congressman Brown is a Democrat who represents Maryland's Fourth Congressional District. *H.R. 3458 MICRO Act*, GOVTRACK, <https://www.govtrack.us/congress/bills/115/hr/3458> (last visited Sept. 20, 2018) [hereinafter *MICRO Act*].

⁹⁷ See H.R. 3458 § 2.

⁹⁸ *Id.* § 3(a).

⁹⁹ *Id.*; see *supra* note 87 and accompanying text.

¹⁰⁰ H.R. 3458 § 3(b).

¹⁰¹ *MICRO Act*, *supra* note 96.

¹⁰² Goode, *supra* note 14. But see *AB 352 Defines As "Unsafe" Any Semi-Automatic Pistol Not Microstamped*, SAAMI.ORG, <https://web.archive.org/web/20070706092039/http://www.saami.org/LL/CA-AB352.cfm> (last visited Nov. 3, 2017) [hereinafter *AB 352 Defines As "Unsafe"*] (citing statements of law enforcement officials and representatives, on the local, state, and national levels, that are in opposition to microstamping).

microstamping technology,” and called on governments to enact microstamping legislation.¹⁰³ There has also been local law enforcement support of microstamping legislation; in 2011, more than eighty police departments and law enforcement organizations across New York State endorsed microstamping legislation.¹⁰⁴ California’s microstamping legislation “garnered the support of 65 police chiefs and sheriffs across the state.”¹⁰⁵

The American Bar Association (ABA) also supports microstamping; in 2010 it issued a recommendation urging “federal, state and territorial governments to enact laws requiring that all newly-manufactured semi-automatic pistols be fitted with microstamping technology . . . that would enable law enforcement to identify the serial number of the pistol and hence the first known purchaser of a weapon used in a crime.”¹⁰⁶

Further support for microstamping also comes from various anti-gun-violence organizations such as the Coalition to Stop Gun Violence,¹⁰⁷ the Giffords Law Center to Prevent Gun Violence,¹⁰⁸ and the Brady Campaign to Prevent Gun Violence.¹⁰⁹ In the political arena, microstamping support tends to come from Democrats; the 2008 NCGIA was cosponsored by fourteen Democrats,¹¹⁰ and the 2017 MICRO Act was cosponsored by sixteen Democrats.¹¹¹

Supporters cite a body of studies showing that microstamping technology is feasible to implement. Lucien Haag, a widely respected

¹⁰³ INT’L ASS’N OF CHIEFS POLICE, 2008 RESOLUTIONS: SUPPORT OF THE USE OF MICROSTAMPING TECHNOLOGY 1, 45 (2008), <https://www.theiacp.org/sites/default/files/2018-08/2008Resolutions.pdf>.

¹⁰⁴ Michael Bloomberg & Eric Schneiderman, *Microstamping Saves Lives: Senate Must Resist Gun Lobby and Pass Crime-Fighting Bill*, N.Y. DAILY NEWS (June 10, 2011, 4:00 AM), <http://www.nydailynews.com/opinion/microstamping-saves-lives-senate-resist-gun-lobby-pass-crime-fighting-bill-article-1.126457>.

¹⁰⁵ ROBERT B. COLLINGS, AMERICAN BAR ASSOCIATION STANDING COMMITTEE ON GUN VIOLENCE REPORT TO THE HOUSE OF DELEGATES 2 (2010), <http://apps.americanbar.org/yld/annual10/115.pdf>.

¹⁰⁶ *Id.*

¹⁰⁷ See *Microstamping Technology: Precise and Proven*, COALITION TO STOP GUN VIOLENCE & EDUC. FUND TO STOP GUN VIOLENCE 7, <http://efsgv.org/wp-content/uploads/2013/06/Microstamping-Technology-Precise-and-Proven-Memo.pdf> (last visited Oct. 13, 2017) [hereinafter *Precise and Proven*].

¹⁰⁸ See *Microstamping & Ballistics*, *supra* note 17.

¹⁰⁹ See *Brady Campaign Applauds California’s Microstamping Law*, BRADY CAMPAIGN TO PREVENT GUN VIOLENCE, (May 21, 2013), <https://www.bradycampaign.org/brady-campaign-applauds-california%E2%80%99s-microstamping-law>.

¹¹⁰ H.R. 5266 (110th), *supra* note 92. A Democrat introduced this bill. See *supra* text accompanying note 92.

¹¹¹ MICRO Act, *supra* note 96. A Democrat also introduced this bill. See *supra* text accompanying note 96.

forensic scientist,¹¹² acquired marked firing pins from coinventor Todd Lizotte to test microstamping's effectiveness on four firearms—a BAR, a Browning machine gun, a Thompson submachine gun, and a Glock pistol.¹¹³

Hundreds to as many as 1,200 rounds of various types and brands of ammunition were fired in these guns *with good results for the type and size of characters engraved on these firing pins*. The relatively large alphanumeric characters on these four firing pins could be read in nearly all fired primers with only rare exception.¹¹⁴

Haag also used different types of ammunition with various primer types.¹¹⁵ He noted that this was a limited and initial study of microstamping, and while microstamping itself has undergone significant revisions since his 2004 presentation, it was not “offered as an endorsement of the mandating of such engraving of firing pins by manufacturers or importers” or to support microstamping legislation.¹¹⁶

In 2007, in response to another study that indicated microstamping had shortcomings, Lizotte conducted his own test using a .40 caliber Smith & Wesson semiautomatic handgun.¹¹⁷ He fired over 2,500 rounds, using five different brands of ammunition and utilizing fully optimized firing pins that were designed for use with that specific model.¹¹⁸ The study found that the alphanumeric code on the firing pin and breech face markings transferred to the cartridge casing and were readable 97% and 96% of the time, respectively, by using both optical microscopy and scanning electron microscopy.¹¹⁹ A 2009 paper by Lizotte and Ohar detailed similar results using a Colt 1911 .45 caliber pistol and firing 1,500 rounds.¹²⁰ Identifiable marks were found on the cartridge casings 95% of the time,¹²¹ and the

¹¹² *Precise and Proven*, *supra* note 107, at 3.

¹¹³ Lucien C. Haag, *Letter to the Editor RE: Microstamping Legislation*, 40 ASS'N FIREARM & TOOL MARK EXAMINERS 126 (2008), <https://afte.org/afte-journal/searchable-journal-index?title=&year=2008&volume=&number=&authors=Haag&keywords=Microstamping&abstract=&display=normal>. This article is an open letter resulting from the legislation surrounding microstamping and various false claims by proponents of microstamping legislation about the author's 2004 Association of Firearm and Tool Mark Examiners presentation entitled “Ballistic ID Tagging—A Further Look,” and as such, the letter details the methodology and findings of the 2004 study but is not his official presentation. *Id.*

¹¹⁴ *Id.*

¹¹⁵ *Id.*

¹¹⁶ *Id.*

¹¹⁷ *Precise and Proven*, *supra* note 107, at 4–5.

¹¹⁸ *Id.*

¹¹⁹ *Id.*

¹²⁰ Ohar & Lizotte, *supra* note 38, at 10–11.

¹²¹ *Microstamping Proves Its Worth . . . Again*, COALITION TO STOP GUN VIOLENCE, <https://www.csgv.org/microstamping-proves-worth/> (last visited Oct. 14, 2017) [hereinafter

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inventors noted that “[g]iven enough data, given enough recoverable cartridge cases, the statistical certainty of IFM code extraction quickly approaches 100%.”¹²²

A 2012 study, funded by the United States Department of Justice, tested microstamping technology in three different nine-millimeter semiautomatic handguns using ten different brands of ammunition.¹²³ The firing pins of each weapon were “optimized for a 6 character alphanumeric code and a circumferential gear code . . . which is intended to confirm the alphanumeric code.”¹²⁴ One hundred rounds of each brand of ammunition were fired through each pistol, totaling 1,000 rounds fired per handgun.¹²⁵ The study found that there were differences in the clarity and effectiveness of transfer depending upon the type of ammunition and firearm used.¹²⁶ Overall, the authors concluded that “[w]hile readable microstamping was achieved on most of the cartridge cases, it was also clear that it is not a perfect technology”¹²⁷

Supporters of microstamping advance arguments for it on three principal grounds. For one, proponents cite the abovementioned studies as support for their assertions that microstamping is a reliable and fairly accurate technology.¹²⁸ Second, proponents argue that the cost of microstamping is low; manufacturing costs are estimated to be between fifty cents and six dollars per gun.¹²⁹

Proponents lastly argue that microstamping technology is practical to implement.¹³⁰ Microstamping is becoming more reliable and cost-effective, they state, and even where the code is illegible it “can be pieced together from other shell casings found at a scene or . . . reconstructed much like missing license plate numbers.”¹³¹ Moreover, supporters argue that this technology would provide law enforcement with a valuable tool to solve

Microstamping Proves Its Worth].

¹²² Ohar & Lizotte, *supra* note 38, at 44.

¹²³ Chumbley et al., *supra* note 36, at 147, 155.

¹²⁴ *Id.* at 147.

¹²⁵ *Id.* at 145.

¹²⁶ *Id.* at 155. The authors specifically selected three different brands of pistol (a Sig Sauer model P226, a Taurus model PT609, and a Hi-Point model C9) because they represented different market price points, a range of performance and ejection properties, and actions that are typical of weapons that leave cartridge casings at crime scenes. *Id.* at 147.

¹²⁷ *Id.* at 155.

¹²⁸ See *Precise and Proven*, *supra* note 107, at 3–5; *Microstamping Proves Its Worth*, *supra* note 121.

¹²⁹ Adam Cohen, *The Latest Crime-Solving Technique the Gun Lobby Doesn’t Like*, TIME (Jun. 18, 2012), <http://ideas.time.com/2012/06/18/the-latest-crime-solving-technique-the-gun-lobby-doesnt-like/>.

¹³⁰ See *Precise and Proven*, *supra* note 107, at 5.

¹³¹ Goode, *supra* note 14.

murders and combat gun trafficking involving handguns.¹³² Additionally, while microstamping may not lead directly to the shooter, supporters contend it gives investigators an early lead in the case by pointing to the gun's last recorded buyer.¹³³ They recognize that the technology is not foolproof, but argue that obliterating the microscopic code is not easy.¹³⁴

E. *Opponents of Microstamping, Opposing Studies, & Arguments Against*

Opponents of microstamping can also be broken down into a few general groups, although this is not to say that there are not exceptions as well as crossover with groups or individuals that are typically supportive of microstamping.¹³⁵ For one, many pro-gun rights groups are opposed to microstamping including national organizations such as the National Rifle Association (NRA),¹³⁶ SAAMI, and the NSSF.¹³⁷ Gun manufacturers are another major source of microstamping opposition.¹³⁸ In response to California's microstamping requirement, Smith & Wesson and Sturm Ruger announced that they would discontinue selling their pistols in the state rather than comply with the law.¹³⁹ In New York, in response to a proposed microstamping bill, Remington Arms Company threatened to pull its

¹³² Nat'l Shooting Sports Found., Inc. v. State, 210 Cal. Rptr. 3d 867, 870–71 (Cal. Ct. App. 2016), *rev'd*, 420 P.3d 870 (Cal. 2018).

¹³³ Times Editorial Bd., *supra* note 29. This is similar to the ATF's National Tracing Center, which allows for the tracking of firearms from "sale by the manufacturer or importer through the distribution chain (wholesaler/retailer) to the first retail purchaser." *National Tracing Center*, BUREAU ALCOHOL, TOBACCO, FIREARMS, & EXPLOSIVES, <https://www.atf.gov/firearms/national-tracing-center> (last updated June 27, 2018).

¹³⁴ Goode, *supra* note 14.

¹³⁵ See *Judge Upholds California Gun Microstamping Law*, ORANGE COUNTY REG. (Feb. 27, 2015, 7:15 PM), <http://www.ocregister.com/2015/02/27/judge-upholds-california-gun-microstamping-law/> [hereinafter *Judge Upholds California Gun Microstamping Law*] (noting that then-Governor Arnold Schwarzenegger was a Republican who signed California's microstamping law into effect in 2007); see also *AB 352 Defines As "Unsafe"*, *supra* note 102.

¹³⁶ See *Micro-Stamping: Ballistic "Fingerprinting"*, NRA-ILA: INST. FOR LEGIS. ACTION, <https://www.nraila.org/get-the-facts/micro-stamping-and-ballistic-fingerprinting/> (last visited Oct. 14, 2017) [hereinafter *Ballistic Fingerprinting*].

¹³⁷ See *Nat'l Shooting Sports Found., Inc.*, 210 Cal. Rptr. 3d at 869.

¹³⁸ See *infra* notes 139–41 and accompanying text.

¹³⁹ Perry Chiamonte, *Gun Flight: Smith & Wesson, Ruger Quit California over Stamping Requirement*, FOX NEWS (Jan. 26, 2014), <http://www.foxnews.com/us/2014/01/26/smith-wesson-to-stop-selling-some-pistols-in-california-due-to-gun-law.html>. Note that this requirement applies only to new models of semiautomatic pistols or to ones "that have been substantially changed since they were previously on the market." Sharon Bernstein, *Smith & Wesson to Phase Away Some Future Pistol Models in California*, REUTERS (Jan. 23, 2014, 6:15 PM), <http://www.reuters.com/article/us-usa-california-guns/smith-wesson-to-phase-away-some-future-pistol-models-in-california-idUSBREA0M23E20140123>.

business out of the state.¹⁴⁰ In 2012, Colt Arms of Hartford threatened to close its plant and move to states with more liberal gun laws if Connecticut passed microstamping legislation.¹⁴¹

This severe response to microstamping requirements is understood when it is contextualized by the gun industry's past experience. In the year 2000, Smith & Wesson voluntarily agreed to legislation proposed under President Bill Clinton that "enforced safety and design standards, such as locking devices and restrictions on magazine sizes, and limits on the sales and distribution of firearms."¹⁴² Doing so caused the NRA to instigate a boycott of Smith & Wesson's products, earned the disdain of gun advocates, consumers, and other gun companies, and resulted in a sales decline of nearly forty percent in one year that almost killed the company.¹⁴³ This sort of market reaction indicates why gun manufacturers will go to drastic lengths to avoid microstamping compliance.

In the political sphere, microstamping opposition tends to come from Republicans.¹⁴⁴ On May 16, 2016, Republican Congressman Doug LaMalfa of California introduced a resolution that sought to express the opinion of the House of Representatives—that microstamping technology "is costly and punitive, and the prohibition of firearms without such features is an infringement on the rights of citizens under the Second Amendment."¹⁴⁵ At the state level, on February 15, 2018, California Assembly Member Matthew Harper introduced a bill coauthored by Assembly Member Tom Lackey, both Republicans,¹⁴⁶ that sought to delete the microstamping requirement from the California Penal Code.¹⁴⁷

¹⁴⁰ Goode, *supra* note 14; *see also* Haughey, *supra* note 88 ("Remington executive Stephen Jackson warned New York Gov. Andrew Cuomo that forced microstamping could prompt the company to 'reconsider its commitment to the New York market altogether rather than spend the astronomical sums of money' necessary to incorporate microstamping into its manufacturing process.").

¹⁴¹ Haughey, *supra* note 88.

¹⁴² Christina Austin, *How Gun Maker Smith & Wesson Almost Went Out of Business When It Accepted Gun Control*, BUS. INSIDER (Jan. 21, 2013, 8:15 AM), <http://www.businessinsider.com/smith-and-wesson-almost-went-out-of-business-trying-to-do-the-right-thing-2013-1>.

¹⁴³ *Id.*

¹⁴⁴ *See infra* text accompanying notes 145–47.

¹⁴⁵ H.R. Res. 731, 114th Cong. (2016). The resolution was referred to the Subcommittee on Crime, Terrorism, Homeland Security, and Investigations on May 18, 2016.

¹⁴⁶ *Members*, CAL. ST. ASSEMBLY, <https://www.assembly.ca.gov/assemblymembers> (last visited Aug. 29, 2018).

¹⁴⁷ Assemb. B. 2733, 2017–18 Leg., Reg. Sess. (Cal. 2018). The proposed bill failed passage on April 24, 2018. *Bill Status*, CAL. LEGIS. INFO., https://leginfo.legislature.ca.gov/faces/billStatusClient.xhtml?bill_id=201720180AB2733 (last visited Aug. 29, 2018).

Opponents of microstamping cite a body of studies showing that it is not a feasible technology to implement.¹⁴⁸ A 2006 study by George Krivosta that was published in the Association of Firearm and Tool Mark Examiners (AFTE) Journal tested engraved firing pins in semiautomatic pistols.¹⁴⁹ Krivosta is a forensics examiner,¹⁵⁰ and conducted the tests at the Suffolk County Crime Laboratory in New York.¹⁵¹ One of his tests involved placing a firing pin with the markings “0H5K B4M3” into ten .45 Auto 1911 Government Model pistols “of different manufacturers and vintages.”¹⁵² Krivosta fired ten Winchester brand .45 auto caliber rounds from each pistol and examined the legibility of each imprint.¹⁵³ He found that overall there was a ratio of fifty-four “satisfactory” grades (meaning that all eight of the characters were decipherable) to forty-six “unsatisfactory” grades (meaning that one or more of the characters was not decipherable).¹⁵⁴ Krivosta also found, in two other tests performed with the “0H5K B4M3” firing pin, that after firing 1,000 rounds of the Winchester .45 auto ammunition the firing pin engravings were readable but softened, and that the markings on the firing pin were easily defaced using an old sharpening stone either by drill or by hand.¹⁵⁵

A March 2008 report from the National Research Council (NRC) described microstamping as “promising,” but stated that “more in-depth studies are needed on the durability of microstamped marks under various firing conditions and their susceptibility to tampering, as well as on their cost impact for manufacturers and consumers.”¹⁵⁶ A 2008 University of California, Davis (UC Davis) study confirmed the NRC report.¹⁵⁷ In the UC Davis study, firing pins engraved with three types of identifying codes (alphanumeric on the face of the firing pin, circumferential dots or gears

¹⁴⁸ See Goode, *supra* note 14 (stating that “opponents point to two early studies finding that the full numeric code could be read only about half the time on shell casings”).

¹⁴⁹ George G. Krivosta, *Nanotag™ Markings from Another Perspective*, 38 ASS’N FIREARM & TOOL MARK EXAMINERS 41, 41–42 (2006), <http://71.11.3.134/share/legal/docs/AFTEVol38No1KrivostaNanoTag.pdf>.

¹⁵⁰ *Precise and Proven*, *supra* note 107, at 3.

¹⁵¹ Krivosta, *supra* note 149, at 41.

¹⁵² *Id.* at 42–43.

¹⁵³ *Id.* at 43.

¹⁵⁴ *Id.*

¹⁵⁵ *Id.* at 43–44.

¹⁵⁶ *Report Advises Against New National Database of Ballistic Images*, NAT’L ACADS. SCIS, ENGINEERING & MED. (Mar. 5, 2008), <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12162>.

¹⁵⁷ Andy Fell, *Firearms Microstamping Feasible but Variable, Study Finds*, UC DAVIS (May 13, 2008), <https://www.ucdavis.edu/news/firearms-microstamping-feasible-variable-study-finds/>.

around the pin, and a radial bar code on the side of the pin)¹⁵⁸ were tested in a shotgun, two semiautomatic rifles, and five semiautomatic pistols of varying model, caliber, and make; each firearm used a variety of different brands of ammunition.¹⁵⁹ Additional testing involved firing 2,500 rounds through each of six .40 caliber Smith & Wesson semiautomatic pistols to determine the technology's ability to withstand repeated firing.¹⁶⁰ For this latter test, it was found that the alphanumeric codes were "legible with some signs of wear," but the bar and dot codes around the edge of the firing pins were very worn.¹⁶¹

For the former group of guns tested, results varied and depended on the ammunition and weapon pairing, as well as what identifying mark was examined.¹⁶² Generally, the alphanumeric and circumferential gear codes transferred well, but the bar codes did not.¹⁶³ It was also found that "defacement/obliteration methods demonstrated that the microcharacters could easily be intentionally destroyed with the firing pin removed from the firearm."¹⁶⁴ The study ultimately concluded that "because its forensic potential has yet to be fully assessed, a mandate for the implementation of this technology in all new semiautomatic handguns sold in the state of California is counter-indicated."¹⁶⁵ It also called for "further research on alpha-numeric serial numbers on firearms mostly in gang related shootings, . . . realistic and accurate production cost estimates for such micro-engraving and a [sic] evaluation as to what percent of gang related shooting could realistically be solved by such technology given current gang firearms usage."¹⁶⁶

Opponents of microstamping advance arguments against it on three main grounds. First, in terms of reliability, opponents cite the above body of tests, as well as portions of some of the tests cited in support of microstamping, to indicate that the technology is imperfect and inaccurate.¹⁶⁷

¹⁵⁸ *Id.*

¹⁵⁹ DAVID HOWITT ET AL., WHAT MICRO SERIALIZED FIRING PINS CAN ADD TO FIREARM IDENTIFICATION IN FORENSIC SCIENCE: HOW VIABLE ARE MICRO-MARKED FIRING PIN IMPRESSIONS AS EVIDENCE? 8 (2008) (ebook).

¹⁶⁰ *Id.* at 7.

¹⁶¹ Fell, *supra* note 157.

¹⁶² *Id.*

¹⁶³ *Id.*

¹⁶⁴ HOWITT ET AL., *supra* note 159, at 10.

¹⁶⁵ *Id.* at 11.

¹⁶⁶ *Id.* at 11–12.

¹⁶⁷ See California's Microstamping Requirement Bans Sale of Improved Pistols—Dealers Face Shortage of Handguns Approved for Sale, NRA-ILA: INST. FOR LEGIS. ACTION (Jan. 23, 2014), <https://www.nraila.org/articles/20140123/californias-microstamping-requirement-bans-sale-of-improved-pistols-dealers-face-shortage-of-handguns-approved-for-sale> [hereinafter *Dealers Face Shortage*] (arguing that microstamping is not a viable technology

Second, on the cost front, opponents argue that microstamping is an expensive measure that will “cost manufacturers millions to implement . . . and raise the price of firearms by at least \$200 per gun.”¹⁶⁸

Third, as to the practicality of microstamping, critics advance a number of arguments. For one, they contend that criminals could replace the firing pin or file off the code, easily circumventing the technology.¹⁶⁹ They also state that the technology is impractical because criminals will steal microstamped cartridge casings and plant them at crime scenes to mislead investigators.¹⁷⁰ Finally, they argue that most criminals acquire guns illegally through unregulated channels outside of the effective range of the microstamping requirement.¹⁷¹

IV. AN ANALYSIS OF THE FEASIBILITY & IMPACT OF MICROSTAMPING

A. Reliability

The studies show that the reliability of microstamping varies widely,¹⁷² and microstamping studies cited by proponents and opponents alike have their flaws and warrant close scrutiny. Yet, the most recent study indicates that, on the whole, microstamping is a feasible, if not entirely perfect, technology.¹⁷³

One criticism of studies in favor of microstamping is that they were all conducted under controlled laboratory conditions that may not correlate with microstamping’s practical effectiveness in the field where it currently remains unproven.¹⁷⁴ A second criticism involves bias concerns, as Todd

and citing the UC Davis study and the 2012 AFTE Journal study, stating that “[e]ven the patent holder has acknowledged in a 2012 study that the concept of microstamping requires further study and should not be mandated”); see also *Precise and Proven*, *supra* note 107, at 3–5, 7.

¹⁶⁸ Lawrence G. Keane, *NSSF Responds to the Times on Microstamping*, NAT’L SHOOTING SPORTS FOUND. (Jun. 14, 2012), <https://www.nssf.org/nssf-responds-to-the-times-on-microstamping/>.

¹⁶⁹ Goode, *supra* note 14.

¹⁷⁰ *Precise and Proven*, *supra* note 107, at 6.

¹⁷¹ *Ballistic Fingerprinting*, *supra* note 136.

¹⁷² See Times Editorial Bd., *supra* note 29 (stating that “studies have found that the microstamps on casings are legible only 54% to 88% of the time”).

¹⁷³ See Chumbley et al., *supra* note 36, at 155.

¹⁷⁴ See Chris Eger, *California Supreme Court to Review Microstamping Challenge*, GUNS.COM (Mar. 23, 2017, 1:01 PM), <http://www.guns.com/2017/03/23/california-supreme-court-to-hear-microstamping-challenge/> (citing the argument raised in the lawsuit by the NSSF and the SAAMI that “the technology was unproven in actual field conditions” and noting the statement of Larry Keane, NSSF General Counsel and Senior Vice President, that the “fight to prove that microstamping is a nascent, unproven and unreliable technology that should not have been mandated will prevail”). The same can, of course, be said for the studies against microstamping.

Lizotte and Orest Ohar, the two coinventors of these technologies, spearheaded their own research in 2007 and 2009,¹⁷⁵ and were also present on the team of researchers in the 2012 study.¹⁷⁶ While it is not apparent that Lizotte's 2007 test was peer-reviewed, the 2009 and 2012 tests were published in reputable, peer-reviewed journals,¹⁷⁷ and Haag's 2004 study was presented in an abstract before the AFTE.¹⁷⁸

Flaws of studies that found microstamping ineffective, particularly the 2006 Krivosta study, involve not using optimized firing pins and using old firearms.¹⁷⁹ A further criticism of both the Krivosta and the 2008 UC Davis studies is that they are outdated and do not reflect the current state and capabilities of microstamping technology.¹⁸⁰ Both of these studies were published in a reputable journal and subjected to a peer-review process.¹⁸¹

Considering all of the evidence from the studies in light of their strengths and weaknesses, and giving particular weight to the 2012 study funded by Department of Justice¹⁸² as it is the most current, was peer-reviewed, and was funded by a reputable, independent agency, more testing of microstamping is needed. Yet, the focus should be on development and implementation rather than total abandonment as the technology is feasible and promising despite its variable effectiveness rates.¹⁸³

¹⁷⁵ See *supra* notes 117–22 and accompanying text.

¹⁷⁶ Chumbley et al., *supra* note 36, at 145. There were five other members of the research team in addition to Lizotte and Ohar; the team included four members of Iowa State University and one retired member of the Illinois State Police. *Id.*

¹⁷⁷ See *Microstamping Proves Its Worth*, *supra* note 121 (stating that Lizotte and Ohar's 2008 paper presented at the Society of Photographic Instrumentation Engineers (SPIE) Optics & Technology Conference (and later published in *Proceedings of SPIE* in 2009) "represented the first peer-reviewed publication of fully optimized and current state-of-the-art microstamping technology as applied to firearms"); see also *Peer Review Process*, ASS'N FIREARM & TOOL MARK EXAMINERS (Aug. 2009), <https://afte.org/afte-journal/afte-journal-peer-review-process> [hereinafter *Peer Review Process*] (noting that the 2012 study was published in the AFTE journal and subjected to this peer-review process).

¹⁷⁸ *Precise and Proven*, *supra* note 107, at 3.

¹⁷⁹ *Id.*

¹⁸⁰ See Goode, *supra* note 14 (quoting Todd Lizotte as stating that "[t]he technology is steadily evolving and becoming more reliable and cost-effective").

¹⁸¹ See Dave Jones, *Gun Microstamping Needs More Testing*, UC DAVIS (May 16, 2008), <https://www.ucdavis.edu/news/gun-microstamping-needs-more-testing/> (stating that the 2008 UC Davis study "has completed peer review by experts selected by the center, and a paper describing the results has been accepted and scheduled for publication in an upcoming issue of the *Association of Firearm and Toolmark Examiners Journal*"); see also *Peer Review Process*, *supra* note 177 (detailing the AFTE's peer review process for articles).

¹⁸² See Chumbley et al., *supra* note 36.

¹⁸³ See Times Editorial Bd., *supra* note 29 (arguing that despite variable rates in microstamping's effectiveness as found by studies, even the lowest success rate of identification of just over half of shell casings "is a lot better than none").

Even if the technology is not foolproof, it could prove to be a powerful aid to law enforcement in the fight against violent gun crime, much like other forensic methods that are currently used despite not being perfectly accurate. For instance, while DNA evidence is described as the “gold standard” of forensic investigatory techniques, many others that are widely used, including fingerprint, bite mark, hair, and other firearm, bullet, and ballistic identification analyses, fall far short of flawlessness.¹⁸⁴ In this vein, although microstamping is by no means a “slam-dunk” for criminal convictions, it provides investigators with another valuable tool for pursuing leads, linking evidence, and discerning patterns and connections.¹⁸⁵ Some help is better than no help and, provided that microstamping can be shown to meet cost and practicality concerns after a more thorough understanding of its reliability, it should be implemented rather than disregarded because it failed to fall within the ambit of perfection.

A suggestion for a more rigorous test of microstamping’s reliability comes from the 2008 UC Davis study; a small-scale pilot program should be implemented that involves groups of law enforcement agencies equipped with different handguns so that roughly 3,000 firing pins could be evaluated.¹⁸⁶ According to the researchers, “[t]his number of firearms equipped with micro-machined firing pins should be sufficient to allow for a more accurate evaluation of this technology”¹⁸⁷ It is also important to acknowledge that it has been five years since the latest microstamping study. Technological advances, in addition to concerns about bias, peer review, use of optimized firing pins and current firearms, and real-world performance, should all be taken into consideration when producing an up-to-date analysis of microstamping’s reliability that is as accurate as possible to help proponents and opponents alike understand the true value, implications, and feasibility of this technology.

B. Cost

The cost of microstamping is a contentious topic with arguments and numbers advanced that support both sides. It is thereby difficult to evaluate the cost of microstamping without actual implementation. While the uncertainty regarding the cost of this technology is reason for pause, the goal and focus should be on the establishment of accurate cost estimates, and,

¹⁸⁴ Jonathan Jones, *Forensic Tools: What’s Reliable and What’s Not-So-Scientific*, PBS (Apr. 17, 2012), <http://www.pbs.org/wgbh/frontline/article/forensic-tools-whats-reliable-and-whats-not-so-scientific/> (pointing to scarcity of research, statistics, and lack of standards among many currently used forensic techniques).

¹⁸⁵ See Times Editorial Bd., *supra* note 29.

¹⁸⁶ HOWITT ET AL., *supra* note 159, at 13.

¹⁸⁷ *Id.*

ultimately, implementation of the technology, rather than abandonment.

Proponents generally point to estimates that have an empirical basis for the numbers generated.¹⁸⁸ The 2008 UC Davis study estimated that establishing a facility to engrave firing pins would cost approximately seven to eight dollars per firing pin in the first year, based on the more efficient nature of high-volume production and assuming that this technology is required for all semiautomatic handguns sold in California.¹⁸⁹ Yet, it notes that these cost estimates are conservative, as additional processing steps like etching, deburring, and diamond coating would significantly increase costs if added.¹⁹⁰ Other cost estimates range between fifty cents and six dollars per handgun,¹⁹¹ although an explanation is not provided as to the precise bases for these numbers. The developers of microstamping and a company that has implemented this process have testified that costs would amount to between fifty cents and three dollars per handgun.¹⁹²

Opponents of microstamping provide some empirical support for their contention that microstamping costs will be prohibitively high.¹⁹³ Often,

¹⁸⁸ See *infra* notes 189–92 and accompanying text.

¹⁸⁹ Fell, *supra* note 157; HOWITT ET AL., *supra* note 159, at 45.

¹⁹⁰ HOWITT ET AL., *supra* note 159, at 45.

¹⁹¹ Cohen, *supra* note 129.

¹⁹² *Precise and Proven*, *supra* note 107, at 6. The company, Laser Light Technologies, Inc. (LLTI), stated in a September 2007 letter to the sponsor of the California microstamping bill that the “worst case scenario costs” would amount to between fifty cents and three dollars because “[t]he laser process as transferred to LLTI by the microstamping inventors is clear-cut[,] and when coupled with appropriate fixtures, the task of processing the firearm components will be both uncomplicated and cost effective.” *Id.* The developers testified separately that the cost of incorporation of the technology would be between fifty cents and one dollar per handgun. *Id.*

¹⁹³ See *Dramatic Price Increases and Reduction in Supply*, NAT’L SHOOTING SPORTS FOUND., <http://71.11.3.134/share/legal/docs/microstamping/microstamping-cost.pdf> (last visited Oct. 25, 2017) [hereinafter *Dramatic Price Increases*] (stating that “[t]he Sporting Arms and Ammunition Manufacturers’ Institute (SAAMI) estimates a price increase of approximately \$200 per firearm”). This same \$200 figure from the SAAMI was cited frequently by many opponents of microstamping. See C. Rodney James, *Why Microstamping and Bullet Serialization Won’t Work*, NRA (Aug. 1, 2008), <https://www.nra.org/articles/20080801/why-microstamping-and-bullet-serializat> (stating that “[t]he cost of implementing microstamping firing pins of a conventional sort could add an estimated \$200 or more per firearm, according to the Sporting Arms and Ammunition Manufacturers’ Institute (SAAMI)”; Matt Korovesis, *New York State’s “Microstamping” Bill is Just More Misguided Anti-Gun Legislation*, OUTDOORHUB (June 20, 2012), <https://www.outdoorhub.com/opinions/2012/06/20/new-york-states-new-microstamping-bill-is-just-more-misguided-anti-gun-legislation/> (referring to the NSSF’s citation of this number). Details of how this figure was calculated could not be found. Testimony by the SAAMI in opposition to Connecticut’s microstamping bill stated that the costs of complying with microstamping will amount to millions of dollars and that “the cost of firing pins would go from pennies to several dollars.” *An Act Concerning the Identification of Certain Firearms (Microstamping)*, Sporting Arms and Ammunition Manufacturers’ Institute, Inc.: SB 353 Before the J. Comm. on the Judiciary, 2009 Leg., Reg. Sess. 3 (Conn. 2009) (statement of

they argue that because pistols are subject to mass-production manufacturing processes, and that engraved firing pins would have to be optimized and produced outside of these processes, dramatic price increases and burdens on manufacturers would result.¹⁹⁴ It is certain that microstamping will add costs to the manufacturing and production processes of semiautomatic pistols, but the issue becomes how opponents arrive at such large cost estimates that differ vastly from the cost estimates of supporters.

The true cost of microstamping technology is difficult to ascertain. The UC Davis estimate of cost per firing pin is close to the “several dollars” per firing pin cost estimated by the SAAMI, but it is unclear if the net cost per gun would be close to or higher than the \$200 figure cited by opponents.¹⁹⁵ More testing is necessary to ascertain precise and consistent measures of the cost of microstamping, not only per firing pin but also what the net cost per firearm will amount to, as net cost is what will ultimately affect consumers.

This is where a pilot program would again be helpful, as it “should be sufficient to allow . . . for interested parties to provide a realistic bid on firing pin manufacturing costs.”¹⁹⁶ Also, an examination of proposed New York microstamping legislation provides a potential solution to the obstructive nature of the cost question to mandating microstamping by law. The proposed New York legislation states:

This act shall take effect January 1, 2016, or at such time that the superintendent of the state police has received written notice from one or more microstamp job shops that such shop or shops are willing and prepared to produce microstamp structures . . . for a price of twelve dollars or less at a production level of one thousand semiautomatic pistols per batch.¹⁹⁷

One may argue that this provision echoes the doomed Smith & Wesson agreement of 2000, which gave Smith & Wesson a three-year grace period

Lawrence G. Keane, General Counsel for the SAAMI). The cost per firearm differs from the cost per firing pin because the former would include all costs of incorporating the new firing pin manufacturing process into the broader manufacturing process, and therefore is greater, while the latter can be narrowly defined to include only the price increase in the production of the firing pins themselves and therefore is smaller. *Compare Dramatic Price Increases*, *supra* note 193 (“The Sporting Arms and Ammunition Manufacturers’ Institute (SAAMI) estimates a price increase of approximately \$200 per firearm.”) (emphasis added)), with *An Act Concerning the Identification of Certain Firearms (Microstamping)*, *Sporting Arms and Ammunition Manufacturers’ Institute, Inc.: SB 353 Before the J. Comm. on the Judiciary*, 2009 Leg., Reg. Sess. 3 (Conn. 2009) (statement of Lawrence G. Keane, General Counsel for the SAAMI) (“[f]iring pins . . . would go from costing pennies to several dollars.”) (emphasis added)).

¹⁹⁴ *Dealers Face Shortage*, *supra* note 167; *Dramatic Price Increases*, *supra* note 193.

¹⁹⁵ *See Dramatic Price Increases*, *supra* note 193; James, *supra* note 193; Korovesis, *supra* note 193.

¹⁹⁶ HOWITT ET AL., *supra* note 159, at 13.

¹⁹⁷ S.B. S68A, 2013–14 Leg., Reg. Sess. (N.Y. 2013).

before it had to include “smart gun” technology on any new handgun developed that would allow only the rightful owner to fire the weapon.¹⁹⁸ A provision of New York’s style, however, does not need to include a hard and fast deadline and can simply condition the enactment of microstamping legislation on certification of the technology as cost-effective, whenever that may be. This would assuage the fear of manufacturers and consumers about prohibitive pricing and at the same time incentivize more research and development to make microstamping as affordable as possible without forcing the implementation of an infeasible technology at a premature date.

C. Practicality

Practicality is the strongest argument advanced by critics against microstamping. The studies indicate that criminals could easily change, deface, or obliterate the codes on the firing pin,¹⁹⁹ and there is no point to implementing a technology, no matter how reliable or cost-effective, that will have no practical effect or will be easily circumvented. Arguments by proponents that the firing pin engravings are difficult to access, made of hardened materials, or require specialized knowledge and tools to obliterate²⁰⁰ do not seem to hold up when compared to these findings.

There is, however, an additional argument that may be supported by analogous data: that “[c]riminals do not typically alter guns” used in crimes.²⁰¹ A 2015 study by Duke University and the University of Chicago examined how inmates of the Cook County Jail in Chicago obtained guns.²⁰² The study found that while more serious criminals and gang members were more likely to have a gun with an obliterated serial number, overall only 5.4% of gang members had firearms with defaced serial numbers compared with 3.4% of the non-gang comparison group.²⁰³ “Without a serial number, it is impossible for ATF to trace the gun back to . . . where it was first sold.”²⁰⁴ Moreover, criminals rarely take the time to remove their spent shell casings from crime scenes (referred to by law enforcement as “policing your

¹⁹⁸ Edward Walsh & David A. Vice, *U.S., Gunmaker Strike a Deal*, WASH. POST (Mar. 18, 2000), <http://www.washingtonpost.com/wp-srv/WPcap/2000-03/18/030r-031800-idx.html>.

¹⁹⁹ HOWITT ET AL., *supra* note 159, at 10; *see* Krivosta, *supra* note 149, at 43–44.

²⁰⁰ *Precise and Proven*, *supra* note 107, at 5.

²⁰¹ *Id.*

²⁰² *Criminals Acquire Guns Through Social Connections, Study Shows: ‘Myth’ that Most Guns Used in Crimes Are Stolen or From Dirty Dealers Not Supported*, SCI. DAILY (Sept. 16, 2015), <https://www.sciencedaily.com/releases/2015/09/150916162916.htm>.

²⁰³ Phillip J. Cook et al., *Some Sources of Crime Guns in Chicago: Dirty Dealers, Straw Purchasers, and Traffickers*, 104 J. CRIM. L. & CRIMINOLOGY 717, 750–51 tbl.11 (2015).

²⁰⁴ *Id.* at 750.

own brass”),²⁰⁵ which increases microstamping’s utility as an investigative tool. A counterargument is that since microstamping will allow investigators to identify a gun without physically recovering it—which is not the case with serial numbers—criminals will become aware of this and will more frequently obliterate the microstamped numbers as compared to the serial number.²⁰⁶ Ultimately, the degree of criminal circumvention around microstamping technology is a point that is likely to remain indeterminate until actual implementation is achieved and real-world effects can be observed.

Opponents of microstamping also argue that criminals planting spent cartridge casings from other microstamped weapons—like those found at firing ranges—at crime scenes to throw investigators off render the technology impractical.²⁰⁷ This does not seem likely based on the many impediments to successfully accomplishing this. As Todd Lizotte notes, the planted cartridge cases “would need to be the same make and model ammo, same gun powder and would have to be placed in reasonable proximity to the ejected cartridges.”²⁰⁸

Regardless of whether criminals tamper with microstamped firearms, the technology may have a prohibitive effect on the means by which criminals obtain guns, namely by discouraging straw purchasers and other intermediaries, and thereby combatting violent gun crime in an indirect way.²⁰⁹ Opponents argue that criminals will be able to acquire firearms through other channels that are outside of the effective range of

²⁰⁵ Telephone Interview with Kevin J. Perham, Senior Manager of Firm Security, Deloitte (Feb. 13, 2018). Mr. Perham was an officer of the New York City Police Department (NYPD) from 1981 to 2006 and served as a detective on squads in various high-crime precincts including Crown Heights, Harlem, and the 75th precinct in East New York. *Id.* He also was the Commanding Deputy Inspector of the NYPD’s Crime Scene Unit for approximately five years and saw several hundred crime scenes involving homicides over the course of his career. *Id.*

²⁰⁶ See Knighton, *supra* note 21 (explaining that microstamping will only be effective against “the dumbest of criminals. Most will either dump it after they’ve shot someone, or modify the weapon so it’ll be untraceable”); see also Frank Minter, *How Anti-Business California Is Using Technology to Ban Guns*, FORBES (Jan 23, 2014, 12:35 PM), <https://www.forbes.com/sites/frankminter/2014/01/23/how-anti-business-california-is-using-technology-to-ban-guns/#44abcce966f2> (“Criminals can be stupid, but working around this ‘crime-solving technique’ is a no-brainer.”).

²⁰⁷ See *Precise and Proven*, *supra* note 107, at 6.

²⁰⁸ Jerry The Geek, *supra* note 44; see also E-mail from Kevin J. Perham, Senior Manager of Firm Security, Deloitte, to Andrew Punzo, Senior Editor, Seton Hall L. Rev. (Feb. 14, 2018, 2:01 PM) (on file with author) (calling the argument that criminals would plant microstamped cartridge casings at shooting scenes to confuse investigators “unimpressive” and stating that “[b]allistics is a science—contaminated crime scenes are relatively easy to determine based on the totality of the evidence encountered”).

²⁰⁹ See *infra* note 211 and accompanying text.

microstamping legislation.²¹⁰

According to the 2015 Chicago study, most guns used in crimes are not purchased brand new by criminals.²¹¹ It was also found that while licensed gun dealers have a small role in providing weapons to gang members, other intermediaries such as straw purchasers, brokers, and traffickers play a much larger role, and that efforts to reduce the availability of guns to criminals and gang members should target these intermediaries.²¹²

“A [‘]straw purchase[‘] occurs when someone who may not legally acquire a firearm, or who wants to do so anonymously, has a companion buy it on [his or her] behalf.”²¹³ A 2000 ATF study “found that straw purchasing was the most common channel of illegal gun trafficking, accounting for almost one-half (46%) of all investigations, and associated with nearly 26,000 illegally trafficked firearms.”²¹⁴ The 2015 Chicago study suggested that when gang members are carrying new guns, they may have originated from a straw purchase; the data indicated that for guns less than two years old recovered from male gang members, fifteen percent of these guns were first purchased by a female.²¹⁵

There are other sources by which criminals acquire guns, including “dirty dealers,” who do not document gun sales, and gun traffickers.²¹⁶ Yet, the common thread in the 2015 study was that “the large majority of guns that wind up in the hands of gang members involved at least one intermediary—a third person that helped get the gun from the . . . dealer into the hands of the gang member.”²¹⁷ Microstamping, therefore, could provide an additional deterrent against straw purchasers and other individuals on this “secondary market” who play vital roles as intermediaries in supplying criminals with guns. As the Citizen’s Crime Commission of New York City states, “[s]traw buyers who understand that the gun can easily be traced back to them, will be forced to think twice before making another purchase. This

²¹⁰ *Ballistic Fingerprinting*, *supra* note 136.

²¹¹ Cook et al., *supra* note 203, at 723 (“Direct, well-documented sales of guns by dealers to gang members account for less than 2% of the total.”).

²¹² *Id.* at 718.

²¹³ Dan Noyes, “*How Criminals Get Guns*,” PBS, <http://www.pbs.org/wgbh/pages/frontline/shows/guns/procon/guns.html> (last visited Oct. 27, 2017).

²¹⁴ *Straw Purchases Policy Summary*, GIFFORDS L. CTR. TO PREVENT GUN VIOLENCE, <http://lawcenter.giffords.org/straw-purchases-policy-summary/> (last updated May 21, 2012).

²¹⁵ Cook et al., *supra* note 203, at 724, 743. Purchase by a female was merely a trend suggesting a straw purchase and other motivations may account for women purchasing the guns in the first place, but the authors still concluded that these results were suggestive of “the relatively greater importance of straw purchases for gang members than for others.” *Id.* at 743–44.

²¹⁶ *Id.* at 744–45.

²¹⁷ *Id.* at 752–53.

will help to reduce the supply of illegal firearms.”²¹⁸

In sum, none of the arguments advanced against microstamping on practical grounds warrant halting the technology in its tracks; development and improvement should continue with an eye towards implementation. A pilot program, although helpful to understanding reliability and cost, will not be able to measure the practicality of microstamping, as providing microstamped pistols to a large number of law enforcement officers will not illuminate the degree to which criminals will tamper with the technology, nor the prohibitive effect microstamping may have on criminals, straw purchasers, and secondary markets for guns used in crimes.²¹⁹ Actual implementation is required to better understand how microstamping fares practically.

D. *Impact of Microstamping*

Microstamping, beyond its own merits of reliability, cost, and practicality, also needs to be assessed in terms of its potential impact and any foreseeable implications that may arise from its legislative implementation. Law enforcement is one group that would benefit from microstamping technology.²²⁰ As mentioned above, microstamping has the potential to provide law enforcement with a powerful investigative tool; it would allow investigators to use a cartridge case recovered at a crime scene to swiftly connect it to the gun from which it was fired.²²¹ The cliché is that the first forty-eight hours are the window of opportunity to solve a crime, but it is true that the first few days are very important to investigators.²²²

In addition to temporal benefits, the technology would allow law enforcement to identify the initial purchaser of a weapon, providing a

²¹⁸ *Microstamping*, CITIZENS CRIME COMMISSION N.Y.C., <http://www.nycrimcomission.org/microstamping.php> (last visited Oct. 27, 2017); *see also Microstamping & Ballistics*, *supra* note 17 (explaining that microstamping technology can also help deter gun traffickers who will be “on notice that spent cartridge cases could be used to trace the gun directly back to him or her if the gun is later used in the commission of a crime”). A counterargument to this is the same as was raised against the speculated degree of criminal tampering with firearm serial numbers: criminals and/or straw purchasers and other third parties will obliterate the microstamped code and thereby remove the deterrent effect. But this similarly remains uncertain until real-world effects can be observed.

²¹⁹ *See* HOWITT ET AL., *supra* note 159, at 13. The study mentions that the pilot program will allow “for a more accurate evaluation of this technology” (reliability) and provide more accurate cost estimates, but it does not note how the practical issues of criminal tampering and effects on the secondary market for crime guns would be better understood through such an initiative. *Id.*

²²⁰ *See infra* notes 221–25 and accompanying text.

²²¹ Goode, *supra* note 14.

²²² *Answers About Investigating Homicides*, N.Y. TIMES: CITY ROOM (Jul. 8, 2009, 11:56 AM), <https://cityroom.blogs.nytimes.com/2009/07/08/answers-about-investigating-homicides/>.

valuable lead in violent gun crime investigations.²²³ The technology could also help deter gun trafficking,²²⁴ as well as straw purchasers, and other components of the secondary market that supply weapons to criminals.²²⁵

In terms of the violent crime rate, microstamping does have the potential to reduce at least some criminals' access to guns and, in doing so, reduce the violent crime rate by the logical assumption that, in theory, less access to guns means less gun crime. To be certain, there are many factors affecting the violent crime rate,²²⁶ and microstamping will not be a "cure-all" to this social ill.²²⁷ Criminals will also continue to obtain guns through means outside of those that are affected by microstamping, such as buying guns "off-the-books" from dirty gun dealers or stealing guns from a store's inventory, which are necessarily undocumented.²²⁸ Nevertheless, given the prevalence of straw purchasing and the importance that intermediaries play in supplying guns to criminals, it is logical to assume that microstamping can have an impact and help to reduce the violent crime rate. Moreover, microstamping may have a deterrent effect on criminals, as it increases the chances, or at least the perception, that they will be caught, and can reduce the violent crime rate in this more direct manner.²²⁹ Finally, the effect of microstamping on the violent crime rate could be particularly powerful because of the prevalence of handguns used in the commission of violent crime.²³⁰

The impact that microstamping will have on the violent crime rate remains to be seen. California's microstamping law has resulted in gun manufacturers pulling out of the state market, so no microstamped pistols have actually been produced and tested.²³¹ The effect of microstamped semiautomatic pistols will also likely take some time to become readily apparent as "the average 'time-to-crime' ratio, or the amount of time between

²²³ *Microstamping & Ballistics*, *supra* note 17.

²²⁴ *Id.*

²²⁵ See Cook et al., *supra* note 203, at 753.

²²⁶ See Josh Sanburn & David Johnson, *Violent Crime Is on the Rise in U.S. Cities*, TIME (Jan. 30, 2017), <http://time.com/4651122/homicides-increase-cities-2016/> (noting that causes of violence in American cities include "gang violence and retaliation, violence associated with drugs, the overwhelming number of guns . . . and even problems related to conflicts originating on social media").

²²⁷ See Chumbley et al., *supra* note 36, at 155 (stating that microstamping technology is not perfect); Goode, *supra* note 14 (stating that microstamping technology is not foolproof).

²²⁸ Cook et al., *supra* note 203, at 744.

²²⁹ See *Five Things About Deterrence*, NAT'L INST. JUST., <https://nij.gov/five-things/pages/deterrence.aspx> (last modified June 6, 2016) (stating that "[r]esearch shows clearly that the chance of being caught is a vastly more effective deterrent than even draconian punishment").

²³⁰ See EXPANDED HOMICIDE DATA, *supra* note 11.

²³¹ See Chiaramonte, *supra* note 139.

when a firearm is purchased and when a crime is committed with that weapon, was 9.79 years in 2016.”²³²

The effect of microstamping on the gun industry and market also must be considered. Microstamping’s impact on the availability of weapons, especially in California, is a major point of contention.²³³ Opponents argue that in states like California, microstamping requirements have amounted to a de facto gun ban and adversely affect the Second Amendment rights of individuals to acquire firearms when manufacturers leave.²³⁴ Proponents argue that this law does not prevent people from owning or using guns, and only negatively impacts criminals, not lawful gun owners.²³⁵ Some evidence indicates that microstamping requirements could reduce the overall availability of handguns to individuals through manufacturer non-compliance and refusal to sell guns in states with microstamping laws.²³⁶ At the time of this writing, there are 822 models of guns listed on California’s approved roster for sale.²³⁷ But this is down from the “nearly 1000” models that were available on the roster and found not to violate the Second Amendment in the 2015 *Pena v. Lindley* decision.²³⁸

Although gun manufacturers may pull business out of some individual states, it is unlikely that large manufacturers will pull out of a sizeable number of states or the American market as a whole if microstamping becomes widely adopted because of the sheer volume of gun sales revenue that the American market generates for gun manufacturers.²³⁹ Therefore, it is unlikely that any de facto gun bans would arise on a significant scale. The numbers support this conclusion. The “[a]nnual revenue of the gun and ammunition manufacturing industry” is \$13.5 billion, with a \$1.5 billion profit.²⁴⁰ According to the ATF, 9,358,661 firearms were manufactured in the United States in 2015, of which 3,557,199 were pistols.²⁴¹ Only 343,456 of the total number of firearms manufactured were exported; the vast majority remain in America and this figure “has remained relatively steady

²³² Ellen Ioanes, *What the ATF Does—and Doesn’t—Tell Us About Guns in America*, DAILY DOT, <https://www.dailydot.com/layer8/atf-guns-data-us/> (last updated Oct. 9, 2017 6:30 AM).

²³³ See *Peña v. Lindley*, No. 2:09-CV-01185-KJM-CKD, 2015 WL 854684, at *13–15 (E.D. Cal. Feb. 26, 2015).

²³⁴ *Judge Upholds California Gun Microstamping Law*, *supra* note 135.

²³⁵ Cohen, *supra* note 129.

²³⁶ See *infra* notes 237–38 and accompanying text.

²³⁷ *Roster of Handguns Certified for Sale*, *supra* note 50.

²³⁸ *Peña*, 2015 WL 854684, at *37.

²³⁹ See *infra* notes 240–42 and accompanying text.

²⁴⁰ Ben Popken, *America’s Gun Business, by the Numbers*, CNBC (Oct. 2, 2015, 3:58 PM), <https://www.cnbc.com/2015/10/02/americas-gun-business-by-the-numbers.html>.

²⁴¹ Ioanes, *supra* note 232.

since 1986.”²⁴² There may also be an opportunity for new or smaller gun companies to innovate and fill the voids left by larger manufacturers exiting states that have passed microstamping legislation.²⁴³

There is, however, a major countervailing point to the above assumption that gun manufacturers will bend to the power of declines in sales. A stronger motivator may be at play—the outright bankruptcy of the business. Any indicia of compliance with microstamping laws could be a bullet to the head as the 2000 Smith & Wesson agreement illustrates,²⁴⁴ and gun manufacturers would rather lose some profit and pull out of a pro-microstamping state than risk ostracization and bankruptcy, as they have already indicated.²⁴⁵

This situation leaves microstamping in a state of legal limbo. To prove its worth outside of a controlled testing environment, some minimum number of states that have mandated microstamping would have to be crossed for gun manufacturers to decide that the risk of compliance with microstamping laws is outweighed by the sales that would be lost from pulling out of those states.²⁴⁶ Otherwise, microstamping will exist only between the pages of statutes, as it does in California. The issue is that it is not clear where this threshold number exists, or if it even does exist in the wake of Smith & Wesson’s experience. By the same token, a broad legislative mandate requiring microstamping either on a national level or by a sizeable portion of states would be ill-advised²⁴⁷ even though it would, at least at the national level, almost certainly force manufacturers to comply, and finally put microstamping’s mettle to the test outside of a controlled environment.²⁴⁸

²⁴² *Id.*

²⁴³ See Kate O’Connell, *Innovation in the Gun Industry*, INNOVATION TRAIL (Feb. 5, 2013), <http://innovationtrail.org/post/innovation-gun-industry> (discussing the possibility for innovation in the firearms industry due to new “smart gun” technologies and hypothesizing that these innovations are likely to come from “new players in the industry”).

²⁴⁴ See *supra* text accompanying notes 142–43.

²⁴⁵ See *supra* text accompanying notes 139–41.

²⁴⁶ See *supra* text accompanying notes 139–43, 239–42.

²⁴⁷ See Chumbley et al., *supra* note 36, at 146–47 (“Given the above considerations it is apparent that legitimate questions exist related to both the technical aspects, production costs, and database management associated with microstamping that should be addressed before wide scale implementation is legislatively mandated. However, it should be noted that none of the above objections are inherently insurmountable.”); see also *supra* text accompanying note 165.

²⁴⁸ The District of Columbia delayed its microstamping law to allow for California to further refine its own. See *supra* text accompanying note 84. This approach is reminiscent of Justice Brandeis’s statement that “[i]t is one of the happy incidents of the federal system that a single courageous State may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country.” *New State Ice Co. v. Liebmann*, 285 U.S. 262, 311 (1932) (Brandeis, J., dissenting). The issue for

V. CONCLUSION

On the whole, microstamping is an imperfect yet feasible technology that requires more research.²⁴⁹ While a better understanding of its capabilities and costs is needed, the goal should be towards improvement, understanding, and implementation rather than complete abandonment. In an imperfect world, full of imperfect people, facing an imperfect problem, a perfect solution does not exist. But a feasible solution? The answer points towards yes.

Despite the often heated and divisive nature of the firearms debate, microstamping offers grounds for common cause between both sides. Since July of 2000,²⁵⁰ the firearms industry, through the NSSF (the industry's trade association), has been partners with the ATF and the Office of Justice Programs (OJP) in the "Don't Lie for the Other Guy Campaign," a national initiative "to assist law enforcement in educating firearms retailers to . . . identify and deter illegal straw purchases and to raise public awareness that straw purchasing is a serious crime."²⁵¹ Additionally, the NSSF spearheads Project Childsafe, a program that began in 1999 to promote safe and responsible firearms ownership, and distributes free firearm safety kits that contain a "cable-style gun-locking device."²⁵² Project Childsafe partners include more than 15,000 law enforcement agencies as well as politicians,

microstamping is that this experimentation cannot occur when the new technology is not present in the sole, brave state because of the withdrawal of manufacturers. In fact, the whole nature of this issue effectively undermines Justice Brandeis's framework by requiring some level of implementation of this uncertain technology beyond just one—or even a handful—of states that could act as laboratories and shield the rest of the country from risk. Yet, one observation may indicate that the gun industry's goals of profitability and credibility can coexist with the goals of supporters of microstamping: a consumer base may react differently to a measure that is "forced" upon gun manufacturers by the states rather than voluntarily complied with by a manufacturer. This seems to be indicated by manufacturers not pulling out of California despite the safety requirements previously mandated by the UHA, including a loaded chamber indicator and magazine disconnect being added to all center-fire semiautomatic pistols. *California Rings in the New Year*, *supra* note 49; *see also* Robert Farago, *California's Disappearing Handguns Explained*, THE TRUTH ABOUT GUNS (Jan. 15, 2016), <https://www.thetruthaboutguns.com/2016/01/robert-farago/californias-disappearing-handguns-explained/> (stating that California's Unsafe Handgun Act (UHA) has had a series of amendments adding to the requirements a handgun must meet in order to be sold in California, such as loaded chamber indicators, and that with the most recent microstamping amendment gun manufacturers have announced that they are "being largely forced out of the California market" and stating that they "can't, don't, and won't" comply with the microstamping requirement).

²⁴⁹ See *supra* text accompanying notes 173, 182–83.

²⁵⁰ *History of the Don't Lie Program*, DON'TLIE.ORG, <http://www.dontlie.org/history.cfm> (last visited Jan. 9, 2018).

²⁵¹ *The Message*, DON'TLIE.ORG, <http://www.dontlie.org/> (last visited Jan. 9, 2018).

²⁵² *About*, PROJECTCHILDSAFE, <http://www.projectchildsafe.org/about> (last visited Jan. 9, 2018).

state agencies, community leaders, businesses, and the firearms industry.²⁵³ These initiatives illustrate that members and supporters of the firearms industry are willing to go above and beyond as responsible corporate citizens,²⁵⁴ and if microstamping can be proven to pass muster on the metrics of reliability, cost, and practicality, it is not unreasonable to assume that mandatory compliance will be welcomed, if not voluntarily adopted.

Although the reliability of the technology varies depending on the study examined, and is influenced by a number of factors, it is incontrovertible that some help is better than no help to investigators, and many other current forensic techniques are imperfect.²⁵⁵ But microstamping should not be adopted just because its reliability provides some benefit; cost must also be considered. While estimates of manufacturing and consumer costs are variable, measures such as a statutory provision placing a ceiling on costs could incentivize developers to make the technology more affordable while providing relief for manufacturers.²⁵⁶ Meanwhile, small-scale pilot programs that are larger than any prior conducted test, yet short of statewide implementation, could provide valuable information and insight on reliability and cost that would aid legislators, manufacturers, and consumers going forward.²⁵⁷ Indeed, since more research on this technology is needed, programs of this nature should be implemented.

Finally, on the practicality metric, microstamping falls short at first blush; the technology is easily removed or obliterated.²⁵⁸ Yet, there is evidence indicating that it still may have some value as criminal alteration of guns used in crimes may not be common.²⁵⁹ Additionally, the technology may have a prohibitive effect on the secondary market of straw purchasers and gun traffickers that are a major source of access to guns for criminals, as well as on the criminals themselves, and is valuable in its own right in these ways.²⁶⁰ A better understanding of how microstamping fares practically would require actual implementation and execution in the law; a pilot program of study would do little to illuminate these issues.

²⁵³ *Id.*

²⁵⁴ See *Corporate Citizenship*, INVESTOPEDIA, <https://www.investopedia.com/terms/c/corporatecitizenship.asp> (last visited Jan. 9, 2018) (defining corporate citizenship as “the social responsibility of businesses, and the extent to which they meet legal, ethical and economic responsibilities . . . to produce higher standards of living and quality of life for the communities that surround them and still maintain profitability for stakeholders”).

²⁵⁵ See *supra* text accompanying notes 182–85.

²⁵⁶ See *supra* Part IV.B.

²⁵⁷ See *supra* text accompanying notes 186–87, 196.

²⁵⁸ See *supra* text accompanying note 199.

²⁵⁹ See *supra* text accompanying notes 201–06.

²⁶⁰ See *supra* text accompanying notes 211–18.

Microstamping has benefits for law enforcement and may work to reduce the violent crime rate by limiting and deterring criminals from using and accessing semiautomatic handguns; however, the effects that microstamping will have on the gun industry are difficult to discern at present time.²⁶¹ The biggest hurdle for microstamping seems to be the practical upshot. Microstamping legislation may be enacted, but if no microstamped firearms are produced by gun manufacturers for fear of the market backlash from compliance, arguable practical benefits are void as the technology cannot be evaluated.²⁶² Conversely, few states will want to take on the role as laboratories of experimentation given the uncertain nature of this technology.²⁶³ In sum, microstamping technology will remain untested as long as noncompliance is the most financially safe route for manufacturers, and microstamping legislation is not likely to be broadly passed in a way that might sway manufacturers to comply as long as it remains untested.

“[I]n principle, all sides in the gun control debate should welcome pragmatic law enforcement efforts to disrupt the illicit flow of guns to dangerous offenders.”²⁶⁴ Moreover, no one opposes solving more murders and reducing the violent crime rate. The fundamental disagreement seems to be over how these ends are best achieved. Microstamping, for all of its flaws, is a worthwhile endeavor that should be explored in pursuit of these goals.

²⁶¹ See *supra* Part IV.D.

²⁶² See *supra* text accompanying notes 244–46.

²⁶³ See *supra* text accompanying notes 247–48.

²⁶⁴ Cook et al., *supra* note 203, at 751.