

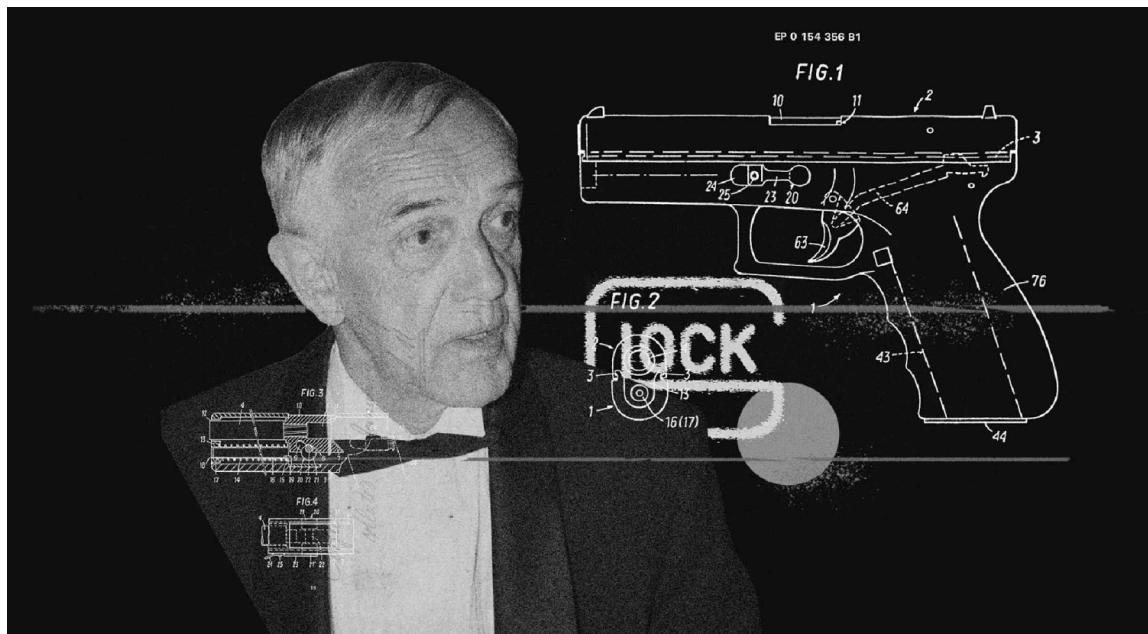
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Last Updated: 4/26/2025

Project Background and Rationale

This data was scraped responsibly with Selenium from the official Glock website (<https://eu.glock.com>) on April 24, 2025. Only public data was accessed. I chose to explore and analyse the active product range of Glock pistols for this exploratory data analysis (EDA) project as I thought it would be interesting to apply data science methods to a domain I knew little about. Exploring unfamiliar industries is always a good way to sharpen up one's ability to ask questions and stay curious. Special thanks to my friend Brandon for teaching me the basics of firearms to help kickstart this project. I hope you find my work interesting.

The Story of Glock



Gaston Glock was an Austrian engineer and businessman who founded Glock in 1963. Initially, the company specialized in manufacturing curtain rods and military equipment like knives and grenade casings. When Glock turned to firearms development in the early 1980s, he had no prior pistolsmithing experience — but his background in industrial fabrication and materials engineering became a key advantage. Instead of relying on traditional, handcrafted methods, Glock emphasized the use of modern machinery, automation, and polymer technology. This approach reduced production costs, minimized human error, and created consistent, high-quality parts with tight tolerances. His first firearm, the Glock 17, was a lightweight, durable, and highly reliable semi-automatic pistol. It quickly won the Austrian Army's contract in 1982 and soon became a global phenomenon. Today, Glock pistols are

the most widely used handpistols by law enforcement, military, and civilians around the world, valued for their rugged simplicity and unmatched reliability.

Reputation of Glock



Glock pistols have built a reputation for being rugged, reliable, and highly functional. When pistol owners think of a Glock, they often associate it with simplicity, toughness and practicality- a "no-frills" tool built to perform in any scenario. However, for many people unfamiliar with firearms, Glocks have gained a reputation as small, lightweight "plastic pistols" with limited power and range. This perception stems largely from popular media, where Glocks are often portrayed as token weapons or standard-issue pistols that lack the stopping power of larger firearms. Movies and video games like Counter-Strike have reinforced this image by positioning Glocks as token or starter weapons. In this project, we will explore and analyze the range of Glock firearms and debunk facts from fiction through statistical methods and learn a thing or two about Glock pistols.

Initial Exploration and Data Quality Assessment

If you aren't here for the technical bits, skip over this section.

```
In [1]: # Initializing dependencies
```

```
import os
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

```
current_dir = os.getcwd()
csv_path = os.path.join(current_dir, 'glock_dataset.csv')
```

In [2]: # Importing data

```
data_raw = pd.read_csv(csv_path)
data = data_raw.copy()

data.head(3)
```

Out[2]:

		name	description	url	Caliber	System	M Capa
0	G19	The G19 Gen5 is now available as an A-CUT™ COA...		https://eu.glock.com/en/products/pistols/g19-g...	9 mm Luger	Safe Action®	Stand
1	G43X	The G43X is now available as an A-CUT™ COA™ Co...		https://eu.glock.com/en/products/pistols/g43x-...	9 mm Luger	Safe Action®	Stand
2	G45	The G45 is now available as an A-CUT™ COA™ Com...		https://eu.glock.com/en/products/pistols/g45-a...	9 mm Luger	Safe Action®	Stand

3 rows × 21 columns

A quick preview of the raw data in a tabular format, let's take a look at how many firearms there are and the list of column/attribute names to see what we're working with, lets also do a bit of clean up on those names.

In [3]:

```
print('Number of handpistols in dataset:',(len(data)))
print(data.columns)
print(len(data))
```

```

Number of handpistols in dataset: 86
Index(['name', 'description', 'url', 'Caliber', 'System', 'Mag. Capacity',
       'Barrel Length', 'Trigger Pull***', 'Weight_without_magazine',
       'Weight_with_empty_magazine', 'Weight_with_loaded_magazine',
       'Dimension_LENGTH (OVERALL)*', 'Dimension_SLIDE LENGTH',
       'Dimension_WIDTH (OVERALL)', 'Dimension_SLIDE WIDTH',
       'Dimension_HEIGHT INCL. MAG.', 'Dimension_',
       'Dimension_Sight Radius POLYMER', 'Dimension_Sight Radius STEEL',
       'Dimension_Sight Radius GNS', 'Dimension_TRIGGER DISTANCE*'],
      dtype='object')

```

86

```

In [4]: # Column name clean up
data.rename(columns={

    'Mag. Capacity': 'mag_size',
    'Barrel Length': 'barrel_length',
    'Trigger Pull***': 'trigger_pull',
    'Dimension_LENGTH (OVERALL)': 'pistol_length',
    'Dimension_SLIDE LENGTH': 'slide_length',
    'Dimension_WIDTH (OVERALL)': 'pistol_width',
    'Dimension_SLIDE WIDTH': 'slide_width',
    'Dimension_HEIGHT INCL. MAG.': 'height_incl_mag',
    'Dimension_': 'height_incl_mag_2', # manually verified this attribute to be here
    'Dimension_Sight Radius POLYMER': 'sight_radius_polymer',
    'Dimension_Sight Radius STEEL': 'sight_radius_steel',
    'Dimension_Sight Radius GNS': 'sight_radius_gns',
    'Dimension_TRIGGER DISTANCE*': 'trigger_distance',
}, inplace=True)

data.columns = map(str.lower, data.columns)

(data.head(1))

```

	name	description	url	caliber	system	mag_size
0	G19	The G19 Gen5 is now available as an A-CUT™ COA...	https://eu.glock.com/en/products/pistols/g19-	9 mm Luger	Safe Action®	Standard 1

1 rows × 21 columns

Each row is a pistol and every pistol has the following attributes

name - pistol name, pistols can have the same name but have different variants based on generation or the accessories they come with.

variant - **to be added later**, pistols can have variants being sold that include different features, accessories etc. (e.g. Glock-17, Glock-17C, Glock-17-T-MOS)

description - the pistols description as per the glock product page

url - the url that the data was collected from

caliber - the ammunition which the pistol chamber is designed to accommodate

system - the safety system of the pistol

mag_size - number of bullets the magazine or clip can hold at once

barrel_length - length of the pistol barrel, longer lengths generally improve accuracy over distance and higher muzzle velocities. (more power, less wind drift,)

trigger_pull - force required to pull the trigger

weight - three values for pistol weight with no magazine, empty magazine or loaded magazine.

height_incl_mag & height_incl_mag_2 - height including magazine, some pistols can be purchased with a different magazine hence the second value

sight_radius for steel/polymer/gns - sight radius indicates distance between front and rear sights, longer is better for accuracy over distance. glock offers sights in steel, polymer and night mode.

trigger_distance - distance needed for the trigger to fire the pistol.

```
In [5]: data.head(1)
```

		name	description	url	caliber	system	mag_size
0	G19	The G19 Gen5 is now available as an A-CUT™ COA...	https://eu.glock.com/en/products/pistols/g19- g...	9 mm Luger	Safe Action®	Standard	1

1 rows × 21 columns

```
In [6]: exclude = ['description', 'url']
columns = [col for col in data.columns if col not in exclude]

for col in columns:
    print(data[col].head(1))
```

```
0      G19
Name: name, dtype: object
0      9 mm Luger
Name: caliber, dtype: object
0      Safe Action®
Name: system, dtype: object
0      Standard: 15
Name: mag_size, dtype: object
0      102 mm | 4.02 inch
Name: barrel_length, dtype: object
0      26 N
Name: trigger_pull, dtype: object
0      without magazine | 600 g | 21.16 oz incl. COA
Name: weight_without_magazine, dtype: object
0      with empty magazine | 680 g | 23.99 oz incl. COA
Name: weight_with_empty_magazine, dtype: object
0      with loaded magazine** | 865 g | 30.51 oz incl...
Name: weight_with_loaded_magazine, dtype: object
0      185 mm | 7.28 inch
Name: pistol_length, dtype: object
0      174 mm | 6.85 inch
Name: slide_length, dtype: object
0      34 mm | 1.34 inch
Name: pistol_width, dtype: object
0      25,5 mm | 1.00 inch
Name: slide_width, dtype: object
0      128 mm | 5.04 inch
Name: height_incl_mag, dtype: object
0      148 mm | 5.83 inch
Name: height_incl_mag_2, dtype: object
0      NaN
Name: sight_radius_polymer, dtype: object
0      146 mm | 5.75 inch
Name: sight_radius_steel, dtype: object
0      NaN
Name: sight_radius_gns, dtype: object
0      70 mm | 2.76 inch
Name: trigger_distance, dtype: object
```

```
In [7]: columns_to_clean = {
    'barrel_length': 'barrel_length_mm',
    'trigger_pull': 'trigger_pull_N',
    'pistol_length': 'pistol_length_mm',
    'slide_length': 'slide_length_mm',
    'pistol_width': 'pistol_width_mm',
    'slide_width': 'slide_width_mm',
    'height_incl_mag': 'height_incl_mag_mm',
    'height_incl_mag_2': 'height_incl_mag_2_mm',
    'sight_radius_polymer': 'sight_radius_polymer_mm',
    'sight_radius_steel': 'sight_radius_steel_mm',
    'sight_radius_gns': 'sight_radius_gns_mm',
    'weight_without_magazine': 'weight_without_magazine_g',
    'weight_with_empty_magazine': 'weight_with_empty_magazine_g',
    'weight_with_loaded_magazine': 'weight_with_loaded_magazine_g',
    'trigger_distance': 'trigger_distance_mm'
}
```

```

# Process each column
for old_col, new_col in columns_to_clean.items():
    if old_col in data.columns:
        data[new_col] = data[old_col].str.extract(r'(\d+)').astype(float)
        data.drop(columns=[old_col], inplace=True)

# Process mag sizes
data['mag_size_standard'] = data['mag_size'].str.extract(r'Standard:\s*(\d+)').astype(float)
data['mag_size_optional'] = data['mag_size'].str.extract(r'Optional:\s*(\d+)').astype(float)
data.drop(columns=['mag_size'], inplace=True)

# Step 1: Create the 'variant' column
data['variant'] = data['url'].str.extract(r'pistols/[^-]+-(.*)')

# Step 2: Extract 'gen' from 'variant'
data['gen'] = data['variant'].str.extract(r'(gen\d+)')

# Step 3: Remove 'gen' from 'variant' if present
# This replaces things like 'gen5-' at the beginning OR anywhere (with or without d)
data['variant'] = data['variant'].str.replace(r'gen\d-?', '', regex=True)

cols = list(data.columns)
# Ensure 'variant' is right after 'name'
cols.insert(cols.index('name') + 1, cols.pop(cols.index('variant')))
# Move 'gen' right after 'variant'
cols.insert(cols.index('variant') + 1, cols.pop(cols.index('gen')))

data = data[cols]

data.head(5)

```

Out[7]:

	name	variant	gen	description	url	caliber
0	G19	a-cut-coa-combo	gen5	The G19 Gen5 is now available as an A-CUT™ COA...	https://eu.glock.com/en/products/pistols/g19-g...	9 mm Luger
1	G43X	a-cut-coa-combo	NaN	The G43X is now available as an A-CUT™ COA™ Co...	https://eu.glock.com/en/products/pistols/g43x-...	9 mm Luger
2	G45	a-cut-coa-combo	NaN	The G45 is now available as an A-CUT™ COA™ Com...	https://eu.glock.com/en/products/pistols/g45-a...	9 mm Luger
3	G47	a-cut-coa-combo	NaN	The G47 is now available as an A-CUT™ COA™ Com...	https://eu.glock.com/en/products/pistols/g47-a...	9 mm Luger
4	G48	a-cut-coa-combo	NaN	The G48 is now available as an A-CUT™ COA™ Com...	https://eu.glock.com/en/products/pistols/g48-a...	9 mm Luger

5 rows × 24 columns

In [8]:

```
categories = ['name', 'caliber', 'system', 'variant', 'gen']

for category in categories:
    print('')
    print(category)
    print(data[category].unique())
    print('number of values: ', len(data[category].unique()))
    print('')
```

```
name
['G19' 'G43X' 'G45' 'G47' 'G48' 'G17' 'G17L' 'G18' 'G18C' 'G19X' 'G26'
 'G34' 'G43' 'G17P' 'G19P' 'G45P' 'G44' 'G22' 'G23' 'G24' 'G27' 'G35'
 'G22P' 'G23P' 'G20' 'G29' 'G21' 'G30' 'G25' 'G42' 'G17T' 'G19T' 'G45T']
number of values: 33
```

```
caliber
['9 mm Luger' '22 l.r.' '40 S&W' '10 mm Auto' '45 Auto' '380 Auto'
 'Training ammunition']
number of values: 7
```

```
system
['Safe Action®' 'Safe Action®\nSemi-/Full-automatic firing mode']
number of values: 2
```

```
variant
['a-cut-coa-combo' nan '' 'mos' 'l' 'c' 'gns' 'rail' 'mos-hunter-edition'
 'silver-slide' 'cut' 'p' 't-fx-fof' 't-mos-fx-fof' 't-mos-utm' 't-utm']
number of values: 16
```

```
gen
['gen5' nan 'gen4']
number of values: 3
```

Categories seem good sensible, change the names of the pistols to reflect the base models, differences should be in the 'variant' column which I will add as well.

Additionally, there is an empty value "" in variant, which means some Glocks don't have a variant, we'll replace these empty values with "base" indicating they're the standard version of the Glock.

```
In [9]: # Adding a column to set pistols with no variant to say base (base model)
data['variant'] = data['variant'].replace('', 'base').fillna('base')
data['variant'].unique()
```

```
# Modifying original names so they have the same base models (ie G17 and G17L both
data['name'] = data['name'].str[:3]
```

```
In [10]: # Looking into what glock models have Semi / Full auto mode
data[data['system']=='Safe Action®\nSemi-/Full-automatic firing mode']
```

Out[10]:

		name	variant	gen	description	url	caliber
12	G18	base	NaN		As a true fully automatic pistol the G18 is on...	https://eu.glock.com/en/products/pistols/g18	9 mm Luger
13	G18	c	NaN		The GLOCK G18C comes with compensator slots in...	https://eu.glock.com/en/products/pistols/g18-c	9 mm Luger

2 rows × 24 columns

So everything else but the Glock 18 is semi-automatic.

After looking into the URLs and watching some demo videos,

The Glock 18 is actually a machine pistol- a FULLY AUTOMATIC pistol. Very cool

It seems that this can only be purchased by law enforcement and militaries- reasonable.

In [11]:

```
# Lastly, let's do some quick checks to see if there are anymore null values, duplicates
data.head(1)
```

Out[11]:

		name	variant	gen	description	url	caliber	s
0	G19	a-cut-coa-combo		gen5	The G19 Gen5 is now available as an A-CUT™ COA...	https://eu.glock.com/en/products/pistols/g19-g...	9 mm Luger	Ac

1 rows × 24 columns

In [12]:

```
print('Number of duplicates:', data.duplicated().sum())
print("")
```

Number of duplicates: 0

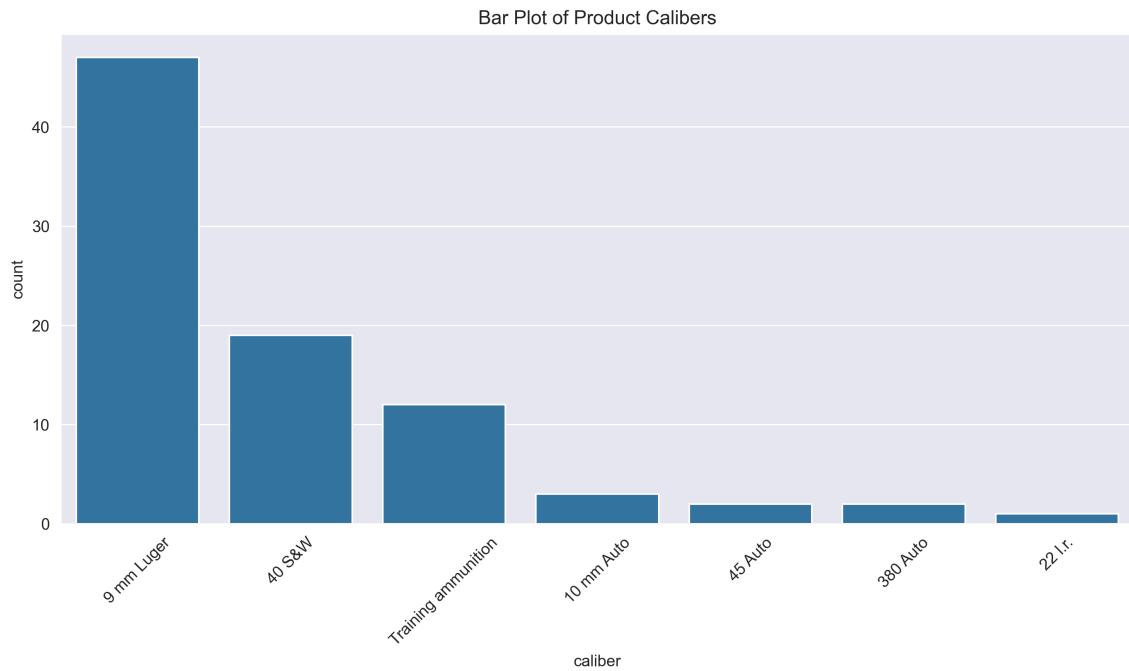
```
name                      object
variant                   object
gen                       object
description               object
url                       object
caliber                   object
system                     object
barrel_length_mm          float64
trigger_pull_N            float64
pistol_length_mm          float64
slide_length_mm           float64
pistol_width_mm           float64
slide_width_mm             float64
height_incl_mag_mm        float64
height_incl_mag_2_mm      float64
sight_radius_polymer_mm   float64
sight_radius_steel_mm     float64
sight_radius_gns_mm       float64
weight_without_magazine_g float64
weight_with_empty_magazine_g float64
weight_with_loaded_magazine_g float64
trigger_distance_mm       float64
mag_size_standard          float64
mag_size_optional          float64
dtype: object
```

No duplicates, and after going through each attribute, the data types seem to be in order, cleaning and transforming done- we will move more into exploration

```
In [13]: sns.set_style('darkgrid')

plt.figure(figsize=(10, 6))
sns.set_style('darkgrid')
sns.countplot(x='caliber', data=data,
               order=data['caliber'].value_counts().index)
plt.xticks(rotation=45)
plt.title("Bar Plot of Product Calibers")
plt.tight_layout()
plt.savefig('images/figures/caliber_count.png', bbox_inches='tight', dpi=300)
plt.close()
```

Analysis of Most Commonly Used Ammunition



9mm Luger

Despite being portrayed as weak in pop culture, 9mm is highly effective in real-world use due to its low recoil, high magazine capacity, and strong stopping power with modern ammunition. These traits make it ideal for military, law enforcement, and self-defense, which explains why the majority of Glock pistols in the dataset are chambered in 9mm. Glock's original Glock 17 helped popularize the caliber, and with NATO standardization and advances in bullet design, most agencies now favor 9mm over heavier rounds.

.40 S&W

Originally designed for law enforcement in response to concerns about 9mm's stopping power, .40 S&W delivers more energy and penetration, but with heavier recoil and lower capacity. It became widely used in the '90s but has since declined as 9mm ammo improved over time. The chart reflects this shift—Glock produces far fewer .40-caliber models today, aligning with a broader industry move back to 9mm for its balance for performance and efficiency.

Training Ammunition

Certain glocks are training models and are designed to be used with special training ammunition. Typically including plastic, rubber, paint, low-velocity rounds.



9mm vs .40 S&W

```
In [14]: print("Heaviest Glock")
print(data.sort_values(by='weight_without_magazine_g', ascending=False)[['name', 'va
print("")  
  
print("Lightest Glock")
print(data.sort_values(by='weight_without_magazine_g', ascending=False)[['name', 'va
print("\nProduct Description: ", data.iloc[73]['description'])
```

Heaviest Glock
name variant weight_with_loaded_magazine_g caliber
56 G24 base 1090.0 .40 S&W

Lightest Glock
name variant weight_with_loaded_magazine_g caliber
73 G42 base 450.0 380 Auto

Product Description: For those discerning shooters who desired the smallest GLOCK possible, the company responded with the now popular G42 in 380 AUTO with ultra-compact dimensions and easy-to-shoot characteristics. The G42 packs all the features GLOCK customers have come to appreciate - from the GLOCK Safe Action System with its multiple integrated safety features to the brand's proven reliability and durability.

The Heaviest and Lightest of Glocks



The Heaviest Glock - Glock 24

Product Description: The long slide and barrel design combined with the .40 S&W caliber cartridge make this GLOCK a great choice for a multitude of shooting activities.

In other words, this is much more performant than your average glock, chambered in a .40 S&W instead of the typical 9mm as mentioned earlier, it features a longer muzzle and an overall bigger frame, making it easier to aim over distance, introducing less bullet wobble and a more aggressive flight path when compared to more "typical" models. After doing some research, it turns out that this is a fan-favorite glock, [primarily designed for competition shooting](#). It is also regarded as one of the rarest glocks.

The Lightest Glock - Glock 42

Product Description: For shooters who desired the smallest GLOCK possible, the company responded with the now popular G42 in 380 AUTO with ultra-compact dimensions and easy-to-shoot characteristics.

Essentially the opposite of the previous model, so small that the whole pistol can essentially fit in the palm of your hand, chambered in 380 ACP which is a very small round compared to the 9mm and 40 S&W. It's a practical everyday carry for self-defense, individuals with smaller hands might also prefer this kind of pistol, not very powerful but power is not the selling point of this product.

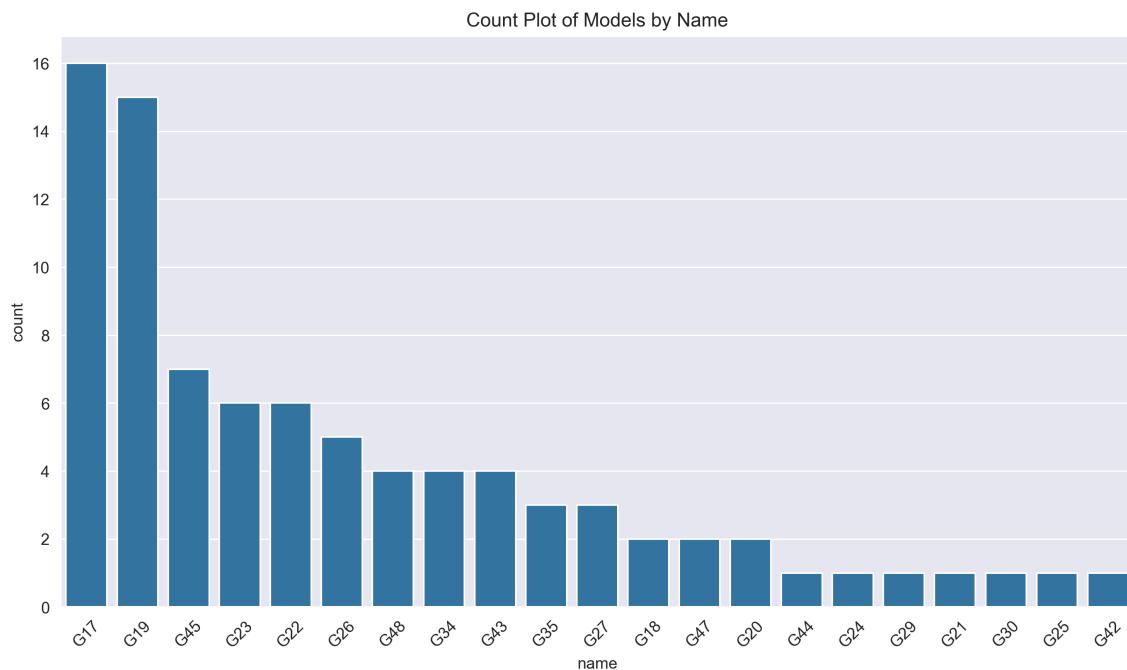
.40 S&W VS .380 ACP

The .40 S&W is a much larger and more powerful cartridge than the .380 ACP. While the .40 S&W offers greater stopping power and longer effective range, the .380 ACP provides less recoil, making it easier to control, especially in compact firearms. This difference in size and power directly influences the design and intended use of both the Glock 24 and Glock 42 models, where the Glock 24 is commonly used by competition shooters, and the Glock 42 used for concealed carry and self defense, by individuals with smaller handsizes such as women.

```
In [15]: order = data['name'].value_counts().sort_values(ascending=False).index

sns.set_style('darkgrid')

plt.figure(figsize=(10, 6))
sns.set_style('darkgrid')
sns.countplot(x='name', data=data, order=order)
plt.xticks(rotation=45)
plt.title("Count Plot of Models by Name")
plt.tight_layout()
plt.savefig('images/figures/model_distribution', bbox_inches='tight', dpi=300)
plt.close()
```



```
In [16]: # Return Glock 17 base models for analysis
g17 = data[
    (data['name'] == 'G17') & (data['variant'] == 'base')
][[
    'name',
    'variant',
    'gen',
    'caliber',
    'system',
    'weight_without_magazine_g',
    'weight_with_loaded_magazine_g',
    'mag_size_standard'
]]

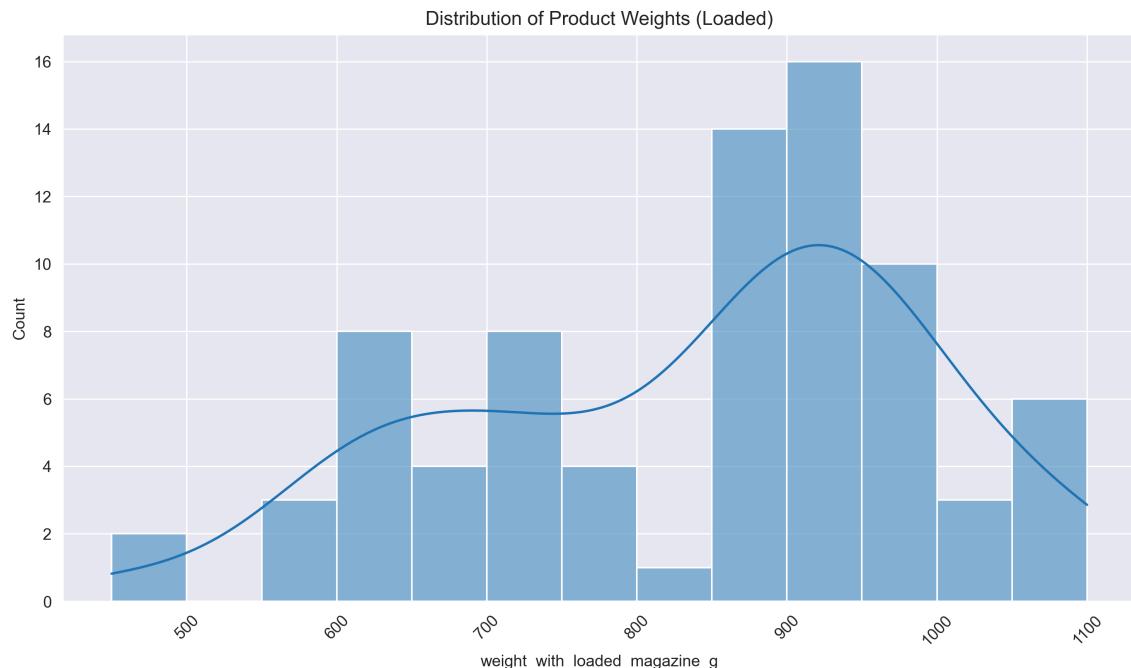
g17
```

Out[16]:

	name	variant	gen	caliber	system	weight_without_magazine_g	weight_with_loade
5	G17	base	NaN	9 mm Luger	Safe Action®		625.0
6	G17	base	gen4	9 mm Luger	Safe Action®		625.0
8	G17	base	gen5	9 mm Luger	Safe Action®		630.0
41	G17	base	gen5	9 mm Luger	Safe Action®		630.0

In [17]:

```
plt.figure(figsize=(10, 6))
sns.histplot(data['weight_with_loaded_magazine_g'], bins=13, kde=True)
plt.xticks(rotation=45)
plt.title("Distribution of Product Weights (Loaded)")
plt.tight_layout()
plt.savefig('images/figures/distribution_gun_weight', bbox_inches='tight', dpi=300)
plt.close()
```



We can see that across the Glock product range, a majority of their models sit around the 900g mark when paired with a stock-issued loaded magazine, on the low end we see the G42, weighing in at just under half a kilogram, and on the high end we see models like the G24 which weigh just over a kilogram. This is generally considered on the low to medium end for pistol weights, visually highlights Glock's philosophy of capitalizing on polymer-frames to reduce product weight, making them more ideal to carry around when compared to competitors products which are traditionally heavier and more troublesome to carry concealed.

Glock 17 (Gen 5) vs Beretta 92FS

Glock 17 (Gen 5)



Beretta 92FS (M9)



Feature	Glock 17 Gen 5	Beretta 92FS
Unloaded Weight	630 grams	945 grams
Chambering	9mm	9mm
Magazine Capacity	17 rounds	15 rounds
Frame Material	Polymer-based	Aluminum

The Glock 17 and Beretta 92FS are both full-size 9mm service pistols that serve as flagship models in their respective lineups. Despite both being chambered in 9mm with similar magazine capacities, they differ notably in design and market positioning.

The Glock 17 like many other glocks, features a polymer frame, contributing to its lighter weight of approximately 630 grams when unloaded. In contrast, the Beretta 92FS, with its aluminum alloy frame, weighs about 945 grams unloaded . Nearly a 50% difference in product weight, which highlights the benefits of Glock products for extended carry, appealing to both law enforcement and civilian users seeking a balance between portability and performance.

Both pistols hold significant positions in their manufacturers' offerings. The Glock 17, originally introduced in the 1980s, set the standard for Glock's line of reliable, easy-to-maintain firearms. The Beretta 92FS, adopted by the U.S. military as the M9 in 1985, has been a symbol of durability and precision in Beretta's lineup.

In terms of market share, Glock has achieved substantial coverage, particularly in U.S. law enforcement. A research survey sent across the US law enforcement agencies in 2018 showcases that Glock pistols were the preferred choice for 65% of U.S. law enforcement agencies. This widespread adoption underscores Glock's emphasis on lightweight design, reliability, and cost-effectiveness, distinguishing it from competitors like Beretta.

In summary, while both the Glock 17 and Beretta 92FS are esteemed service pistols, the Glock 17, like many of the other product offerings, utilizes its lighter weight and smaller size

to appeal strongly to its customerbase, especially among law enforcement agencies seeking efficiency and ease of use.