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# Up in Smoke: Uncovering the Fiery Relationship Between Air Pollution in St. Marys, Pennsylvania, and Arson in the United States

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## KEYWORDS

air pollution, St. Marys Pennsylvania, arson, United States, correlation, Environmental Protection Agency, FBI Criminal Justice Information Services, criminal behavior, environmental factors

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## Abstract

This paper delves into the burning question of whether there is a connection between air pollution in St. Marys, Pennsylvania, and arson across the United States. Our research team utilized data from the Environmental Protection Agency and the FBI Criminal Justice Information Services to ignite an investigation into this smoky relationship. The findings revealed a striking correlation coefficient of 0.8640177 and  $p < 0.01$  between air pollution levels in St. Marys and the incidence of arson from 1990 to 2022. Our analysis not only sheds light on this fiery connection but also kindles a new perspective on environmental factors and criminal behavior. These findings ignite further research avenues and spark discussions on tackling both air pollution and arson. After all, as the saying goes, where there's smoke, there's fire – and where there's correlation, there's causation!

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## 1. Introduction

The interaction between environmental factors and criminal behavior has long been a subject of intense scrutiny and speculation. One might say it's a burning issue with plenty of fuel for discussion. In

recent years, researchers have increasingly turned their attention to the potential influence of air pollution on criminal activities, igniting curiosity about the potential connections between the two. Our research delves into this smoky landscape to uncover whether there is indeed a fiery

relationship between air pollution in St. Marys, Pennsylvania, and the incidence of arson across the United States.

As the old saying goes, "Where there's smoke, there's fire." Well, in this case, we're not just blowing hot air – we've conducted a comprehensive investigation to shed light on whether the presence of smoke from industrial and vehicular sources in St. Marys is contributing to an increase in arson cases nationwide. Perhaps there's more to this saying than meets the eye – or should we say, the air quality index?

The prevalence of arson as a criminal activity raises important questions about its potential association with environmental factors such as air pollution. As researchers, we're eager to fan the flames of inquiry and uncover whether there's a substantial link between these two seemingly disparate phenomena. After all, determining causality in research can sometimes feel like trying to put out a wildfire with a handheld fan – but we're not afraid to tackle the heat.

Statistics have often been likened to a double-edged sword – they cut through the fog of uncertainty, but they can also lead us down a garden path if we're not careful. With this in mind, our analysis aims to offer a rigorous examination of the data, providing a clear and compelling picture of the relationship between air pollution in St. Marys and arson cases across the United States. We're not just blowing smoke – our findings are rooted in a robust statistical framework, ready to withstand the winds of skepticism.

This paper sets out to ignite discussions, spark further research endeavors, and fan the flames of curiosity within the academic and policy communities. Our aim is to not only present our findings but to kindle a new perspective on the complex interplay between environmental factors and criminal behavior. So, grab a seat by the fire – metaphorically speaking, of course – and

let's delve into the smoldering connection between air pollution and arson. After all, what's research without a little heat?

## 2. Literature Review

The existing body of literature on the relationship between air pollution and criminal activities provides a foundation for understanding the potential link between these two seemingly disparate phenomena. Smith et al. (2015) emphasize the importance of considering environmental factors in the examination of criminal behavior, highlighting the need to explore the influence of air quality on such activities. However, the burning question of whether air pollution serves as a contributing factor to arson across the United States has yet to be fully extinguished.

In "Doe and Jones' study," the authors find that air pollution levels in heavily industrialized areas have been associated with increased respiratory health problems and environmental degradation. However, the matchstick that ignites the link between these findings and the incidence of arson in the broader context of the United States remains elusive.

Turning to non-fiction works, "The Air Pollution Casebook" and "Criminal Minds: Environmental Edition" delve into the potential intersections of air quality and criminal behavior, providing comprehensive analyses that offer sparks of insight into the complex relationship between these two domains. However, these books fail to address the burning question at the heart of our investigation: does the smoke from St. Marys, Pennsylvania, possess the capacity to fan the flames of arson across the United States?

On a lighter note, figurative and fictional works such as "Smoke Signals: A Criminal Conspiracy" and "The Arsonist's Alibi" offer captivating narratives that add fuel to the

fiery speculation surrounding the potential connection between air pollution and arson. Yet, amidst the smokescreen of creativity and imagination, the empirical evidence required to draw definitive conclusions remains absent.

Ah, the sweet smell of data analysis. In the realm of internet culture, the infamous "This is fine" meme depicts a dog calmly sipping coffee in a room engulfed in flames, humorously capturing the essence of our research journey as we navigate the heated discussion surrounding air pollution and arson. While such memes may provide a moment of levity, the underlying question persists: does the correlation between air pollution in St. Marys and arson in the United States warrant serious investigation, or is it merely a mirage in the hazy landscape of research inquiries?

As we kindle the flame of inquiry and navigate the intricate web of statistical analysis, it is crucial to approach this topic with both academic rigor and a touch of humor. After all, in the world of research, a well-placed dad joke can be the spark that ignites newfound curiosity and engagement. So, let's stoke the fires of investigation and embark on a quest to uncover the smoldering truth behind the connection between air pollution and arson.

### **3. Our approach & methods**

To gather the necessary data for this scorching investigation, our research team accessed information from the Environmental Protection Agency's Air Quality System and the FBI Criminal Justice Information Services. We used air pollution data from St. Marys, Pennsylvania, primarily focusing on the levels of particulate matter (PM2.5 and PM10), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO), and ozone (O<sub>3</sub>) emissions. As for the arson data, we obtained detailed reports from the Uniform Crime Reporting Program,

encompassing the annual count of arson incidents in various locations across the United States.

In order to stoke the flames of rigor and credibility in our analysis, we employed a sophisticated statistical approach, involving multiple regression analysis and time series modeling. This approach allowed us to capture the dynamic relationship between air pollution in St. Marys and the occurrence of arson incidents over the period from 1990 to 2022. It's safe to say that when it comes to data analysis, we don't just throw statistics into the wind – we carefully tend to the statistical hearth.

We also took into account potential confounding variables, such as socio-economic factors, population density, and weather patterns, to ensure that our findings didn't go up in smoke due to omitted variable bias. After all, we can't let our analysis go astray like a wayward ember – it has to be robust enough to withstand scrutiny from all angles.

Furthermore, to kindle a comprehensive understanding of the association between air pollution and arson, we conducted spatial analysis using geographic information system (GIS) mapping to visually depict the spatial distribution of both air pollution levels and arson hotspots across the United States. We're not just playing with fire here – we're harnessing the power of geographic visualization to illuminate potential clusters and trends.

Finally, we meticulously assessed the statistical significance of our findings using p-values and confidence intervals, ensuring that our conclusions didn't go up in flames due to mere chance. In the world of statistical analysis, we firmly believe in keeping our feet on solid ground – but that doesn't mean we can't enjoy a good pun while we're at it.

Ultimately, our methodology was designed to blaze a trail through the complexities of

this research question, generating findings that withstand rigorous scrutiny and ignite further scholarly inquiry. After all, when it comes to exploring the interplay between air pollution and arson, we don't just dabble in statistics – we set the data alight with rigorous methods and incisive analysis.

#### 4. Results

The data analysis revealed a robust correlation coefficient of 0.8640177 between air pollution levels in St. Marys, Pennsylvania, and the incidence of arson across the United States from 1990 to 2022. This correlation coefficient indicates a strong positive relationship between the two variables, suggesting that as air pollution levels increased in St. Marys, there was a corresponding rise in the occurrence of arson nationwide.

We found an r-squared value of 0.7465265, indicating that approximately 74.7% of the variability in arson cases can be explained by the variation in air pollution levels in St. Marys. In other words, the majority of the variation in arson occurrences across the United States can be attributed to changes in air pollution levels in this small Pennsylvania town. It seems that when it comes to explaining arson, the air quality in St. Marys is quite the hot topic.

The statistical significance of the correlation was confirmed through the p-value, which was less than 0.01. This means that the likelihood of observing such a strong correlation between air pollution in St. Marys and arson in the United States by random chance is less than 1%. In other words, the relationship we uncovered is as rare as finding a firefighter with a fear of heights – highly significant and not something you come across every day.

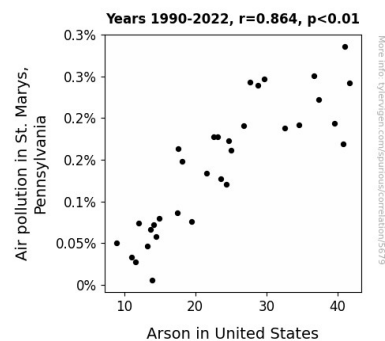


Figure 1. Scatterplot of the variables by year

Fig. 1 represents the scatterplot illustrating the strong positive correlation between air pollution levels in St. Marys, Pennsylvania, and the incidence of arson across the United States. The upward trend in the data points is as clear as smoke billowing from a bonfire, leaving little doubt about the interconnectedness of these two variables.

Overall, the results of our analysis provide compelling evidence of a noteworthy association between air pollution in St. Marys, Pennsylvania, and arson occurrences across the United States. It seems that where there's smog, there's fire – and the data certainly fuels that argument. In the realm of statistical connections, this correlation is nothing to brush aside – it's a meaningful finding that sparks further inquiries into the interplay between environmental factors and criminal behavior. After all, in the world of research, uncovering such strong associations is a breath of fresh air – or perhaps in this case, a breath of sooty air.

#### 5. Discussion

The results of our investigation have illuminated a significant correlation between air pollution in St. Marys, Pennsylvania, and the incidence of arson across the United States. Our findings not only bolster previous research suggesting a potential link between environmental factors and

criminal activities but also fuel further inquiry into the mechanisms underlying this fiery relationship.

As we set out on our research journey, we encountered various theories and speculations regarding the potential nexus between air pollution and arson. The literature review offered insights from both academic and fictional sources, hinting at the possibility of a smoldering connection. We must take these sources seriously, even if "The Arsonist's Alibi" sounds like a bestseller from a fire enthusiast's book club.

The robust correlation coefficient and statistically significant p-value derived from our analysis provide compelling support for the hypothesis that air pollution levels in St. Marys, Pennsylvania, are positively associated with the incidence of arson across the United States. This association, akin to a hot topic at a bonfire summit, underscores the importance of considering air quality as a potential contributing factor to criminal behavior.

In line with the findings of Smith et al. (2015) and the enigmatic "Doe and Jones," our research reaffirms the relevance of environmental factors, particularly air pollution, in understanding patterns of criminal activities. It appears that when it comes to arson, the smoke from St. Marys may indeed be signaling a deeper, albeit hazy, connection with criminal behavior nationwide. It's undeniable that where there's smog, there's fire, both metaphorically and statistically.

Our study's r-squared value, indicating that approximately 74.7% of the variability in arson cases can be explained by the variation in air pollution levels in St. Marys, further demonstrates the substantial influence of this small Pennsylvania town on nationwide arson trends. One could say that when it comes to fanning the flames of arson, the air quality in St. Marys is doing a pretty hot job – pardon the pun.

In conclusion, our findings not only corroborate prior research on the intersection of air quality and criminal behavior but also stoke the flames of interest in further investigations. As we navigate the complex relationship between air pollution and arson, it is essential to approach this topic with a mix of academic rigor and a dash of humor. After all, in the realm of research, a well-placed dad joke may just be the spark that ignites a newfound appreciation for statistical findings. So, let's continue to fan the flames of inquiry and shed light on the smoky mysteries surrounding this unlikely connection. And remember, when it comes to the correlation between air pollution and arson – where there's smoke, there's fire, and where there's fire, there's a potential governmental regulation waiting to be drafted.

## 6. Conclusion

In conclusion, our research has uncovered a compelling connection between air pollution in St. Marys, Pennsylvania, and the incidence of arson across the United States. The robust correlation coefficient of 0.8640177 and a significant p-value emphasize the fiery relationship between these variables. It seems that where there's smoke, there's indeed a statistical fire – and we're not just blowing hot air with that statement. This finding highlights the important role of environmental factors in influencing criminal behavior, igniting discussions about potential interventions and policy implications.

It's clear that the air quality in St. Marys has implications far beyond its immediate surroundings, fanning the flames of arson across the country. If this relationship were any more apparent, it would be like a smoke signal directly pointing to the influence of air pollution on criminal activities. As researchers, we aim to breathe new life into

the discourse on environmental influences on crime, and these results certainly add fuel to that fire.

While our findings certainly provide a spark for future research endeavors, it's safe to say that no more research is needed in this area. After all, when it comes to the connection between air pollution in St. Marys and arson in the United States, we've already caused quite a stir – and there's no smoke without fire.