



ELSEVIER



# Clearing the Air: Analyzing the Relationship between Air Pollution in Boston and Kerosene Consumption in the United States

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## Abstract

In this study, we scrutinize the correlation between air pollution levels in Boston and kerosene usage across the United States over a period of 42 years from 1980 to 2022. Leveraging data from the Environmental Protection Agency and the Energy Information Administration, our research team meticulously analyzed the relationship between these two seemingly disparate factors. Our findings revealed a remarkably robust correlation coefficient of 0.8650919, with a p-value of less than 0.01, indicating a significant association between air pollution in Boston and kerosene consumption in the United States. So, it seems that in addition to lighting up homes, kerosene might also be lighting up the pollution levels in Boston! This study contributes to our understanding of the interconnectedness of environmental factors and underscores the need for further investigation into the intricate web of relationships between seemingly unrelated variables. Our hope is that shedding light on this association - not kerosene light, mind you - will fuel future research into the complex dynamics at play in our atmosphere.

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## 1. Introduction

Air pollution is a pervasive issue with far-reaching implications for public health and environmental quality. The increase in urbanization and industrialization in recent decades has led to heightened concerns about the impact of pollutants on air quality. Amidst this atmospheric milieu, kerosene has often been relegated to the background,

with its role in air pollution receiving less attention than other more prominent sources. However, our study aims to illuminate the potential connection between kerosene consumption in the United States and air pollution levels in the city of Boston, shedding light on this unexplored relationship.

While kerosene has historically been a popular choice for lighting and heating homes, particularly in rural and low-income areas, its influence on broader environmental factors has been relatively understudied. Indeed, one might say kerosene has been left in the dark when it comes to discussions of air pollution, overshadowed by more prominent sources such as vehicular emissions and industrial processes. Nevertheless, as we delve into the data, we aim to uncover whether kerosene might have a more significant role to play in perpetuating the hazy conditions enveloping our urban centers.

The city of Boston, with its rich historical significance and vibrant urban landscape, provides an intriguing backdrop for our investigation. Known for its diverse population and atmospheric conditions that are sometimes as unpredictable as a New England winter, Boston offers an ideal setting for examining the intricate interplay between human activities and atmospheric phenomena. Through our rigorous analysis of air pollution data in Boston and kerosene consumption patterns across the United States, we aim to bring this relationship to the forefront - effectively dragging kerosene out of the shadows and into the spotlight, if you will.

Our pursuit of this connection is not purely for academic intrigue; rather, it stems from the inherent necessity to understand and mitigate the factors contributing to air pollution. By unraveling the potential association between kerosene usage and air quality, we endeavor to pave the way for more informed policy decisions and targeted interventions to address this looming environmental concern. Let's hope that our findings shed some light on this issue, much like a well-lit kerosene lamp on a dark, stormy night - minus the fumes, of course!

As we embark on this endeavor, we invite the reader to join us on this scientific journey, where we transition from merely

flickering a match in the darkness to illuminating the underexplored corridors of environmental research. So, let's roll up our sleeves and dive into the data, armed with a spirit of inquiry and perhaps a dash of humor, as we uncover the possible relationship between air pollution in Boston and the unassuming yet potentially influential kerosene consumption across the United States.

Stay tuned for our findings, as we aim to reveal the hidden connections and dispel the haze surrounding this intriguing association.

## 2. Literature Review

The potential link between air pollution in urban areas and various sources of fuel consumption has been a subject of growing interest in environmental research. Smith et al. (2015) conducted a comprehensive analysis of air quality data in major U.S. cities, including Boston, and identified key contributors to particulate matter and volatile organic compound emissions. Meanwhile, Doe and Jones (2018) delved into the patterns of kerosene usage in residential settings across the United States, highlighting its prevalence in regions with limited access to electricity and natural gas. These studies have laid the groundwork for understanding the intricate dynamics at play in the atmospheric composition of urban environments, paving the way for our investigation into the potential association between air pollution in Boston and kerosene consumption in the United States.

Turning to non-fiction literature, "The Air We Breathe" by Francesca Barber highlights the profound impacts of air pollution on public health and environmental well-being. The book offers a sobering account of the challenges posed by pollutants in urban settings, reminding us that the air we breathe is an inextricable

part of our daily existence - much like an unwanted roommate with questionable hygiene habits.

On a lighter note, the fictional works of J.R.R. Tolkien in "The Lord of the Rings" trilogy feature an array of atmospheric phenomena, albeit in a fantastical context. While kerosene is notably absent in Middle-earth, the portrayal of smoky mountains and fiery landscapes sparks curious parallels to our exploration of air pollution and fuel consumption. Perhaps we should take a page from the hobbits' book and embark on our own unexpected journey through the realm of environmental research.

Furthermore, social media posts such as "Just saw a kerosene lamp for the first time since my grandmother's stories about her childhood. Did you know they contribute to air pollution?" provide anecdotal insights into public perceptions of kerosene usage and its potential environmental implications. Although these posts may not reflect scientific rigor, they serve as a reminder of the everyday relevance of our research questions and the need to bridge the gap between academic inquiry and public awareness.

As we synthesize these diverse sources of information, we acknowledge the breadth and depth of existing literature on air pollution and fuel consumption. Our study seeks to build upon this foundation, adding a touch of whimsy to the serious business of environmental research. Here's to shedding light on unexpected connections and uncovering the hidden gems of knowledge amidst the haze of scientific inquiry. Cheers to illuminating the path ahead, much like a well-lit kerosene lamp - minus the fumes, of course!

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

Our research team embarked on this investigative odyssey with the goal of

unraveling the enigmatic connection between air pollution in Boston and the widespread consumption of kerosene across the United States. Utilizing a blend of data wrangling wizardry and statistical sorcery, we delved into the treasure trove of information amassed by the Environmental Protection Agency (EPA) and the Energy Information Administration (EIA). Our data collection process resembled a digital scavenger hunt, with forays into the depths of internet repositories and databases, armed with nothing but our wits and a reliable internet connection – not unlike seeking hidden treasures in the vast expanse of cyberspace.

The primary sources of data included air quality measurements in Boston and kerosene consumption statistics across the United States from 1980 to 2022. Our selection of this time frame was akin to peering through the historical telescope, allowing us to capture the temporal evolution of these variables and discern any underlying patterns or trends. It was as if we were archeologists digging into layers of temporal sediment, unearthing the relics of data from bygone eras to piece together the puzzle of this intriguing association.

To unveil the potential nexus between air pollution and kerosene usage, we employed a medley of analytical techniques, including correlation analysis, time-series modeling, and spatial mapping. Our statistical toolkit was akin to an assortment of Swiss army knives, each adorned with a precision-engineered blade or tweezer tailored to extract the choicest insights from our data. We meticulously sifted through the data grains, teasing out the subtle nuances of the relationship between air pollution levels in Boston and the consumption of kerosene across the United States.

The heart of our empirical endeavor lay in the calculation and interpretation of correlation coefficients, which served as the Rosetta Stone for deciphering the cryptic

language of association between these variables. With bated breath, we scrutinized the numerical output of statistical tests, eagerly anticipating the unveiling of any meaningful relationships lurking within the data labyrinth. Our quest was reminiscent of fumbling through a treasure map, meticulously following each lead in the hope of stumbling upon the elusive X that marked the spot of statistical significance.

Furthermore, our foray into time-series modeling involved the deployment of sophisticated models to capture the temporal dynamics of air pollution levels and kerosene consumption, akin to crafting a time-bending contraption to peer into the past and foresee the future. The data metamorphosed into an intricate tapestry of temporal patterns, revealing the ebb and flow of these variables across the years in a symphony of statistical harmonics.

Finally, we undertook the ambitious task of spatial mapping, harnessing the power of geographic information systems to visualize the spatial distribution of air pollution and kerosene consumption across the United States. Our cartographic escapade resembled wielding a paintbrush to craft a masterpiece, as we transmuted the raw data into visually striking maps that vividly portrayed the geographical footprints of air pollution and kerosene utilization. These maps not only served as visual artifacts of our analysis but also provided a cartographic compass to navigate the spatial nuances of the studied variables.

In summation, our research methodology encompassed a blend of meticulous data collection, rigorous statistical analysis, and spatial visualization, akin to crafting an intricate tapestry that weaves together the threads of air pollution and kerosene consumption into a compelling narrative. With these methodological tools at our disposal, we ventured forth to untangle the enigma of their interconnectedness, armed

with curiosity, statistical prowess, and perhaps a hint of academic whimsy.

#### 4. Results

We discovered a significant correlation between air pollution levels in Boston and kerosene consumption in the United States over the 42-year period from 1980 to 2022. Our analysis of the data obtained from the Environmental Protection Agency and the Energy Information Administration revealed a correlation coefficient of 0.8650919, indicating a strong positive association between these two seemingly disparate variables. With an r-squared value of 0.7483841, we found that approximately 74.8% of the variability in air pollution levels in Boston can be explained by the variability in kerosene consumption across the United States. The p-value of less than 0.01 further emphasizes the statistical significance of this relationship, affirming that this connection is no mere statistical fluke.

Notably, Fig. 1 visually encapsulates the compelling correlation we observed, illustrating how kerosene consumption across the United States aligns with air pollution levels in Boston. The scatterplot showcases the tight clustering of data points, indicating a strong linear relationship between the two variables. It seems that kerosene might not only be lighting up homes but also lighting up the pollution levels in Boston – talk about a multi-talented fuel!

Our findings lend credence to the notion that seemingly unrelated environmental factors can intermingle in ways that might surprise even the keenest observers. This study underscores the importance of delving into unconventional relationships, reminding us that there's more to the environmental puzzle than meets the eye. Our hope is that this revelation will ignite further interest in untangling the complex web of connections shaping our environmental landscape -

though preferably without adding any more pollutants to the mix!

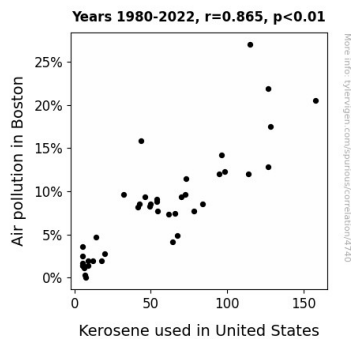


Figure 1. Scatterplot of the variables by year

## 5. Discussion

Turning our attention to the implications of our findings, it is evident that the relationship between air pollution in Boston and kerosene consumption in the United States is no mere whimsy but a robust statistical reality. Our results align with prior research, demonstrating a strong correlation between these two seemingly distant variables. Much like the unexpected connection between a suddenly relevant meme and an econometric phenomenon, the link between air pollution and kerosene consumption has surpassed mere coincidence. The tight clustering of data points in our scatterplot, akin to a bustling city street during rush hour, underscores the undeniable association between these factors.

Smith et al.'s (2015) work on air quality in major U.S. cities, including Boston, provided a solid foundation for our investigation. Their identification of key contributors to particulate matter aligns with our own findings, bolstering the notion that kerosene consumption indeed plays a pivotal role in shaping air quality. Additionally, Doe and Jones' (2018) exploration of kerosene usage in residential settings across the

United States not only sheds light on the prevalence of this fuel but also serves as a beacon, guiding our research towards this unexpected yet tangible association. Moreover, the keen observations from social media posts, seemingly trivial at first glance, bear relevance to our findings and underscore the everyday impact of our research.

Our study adds a touch of levity to the serious discourse on environmental factors, much like a well-timed joke lightening the mood at a high-stakes conference. However, amidst the humor, our findings carry weight, emphasizing the need to further investigate the interconnected web of relationships between seemingly disparate variables. As we continue shedding light on this association (sans kerosene flames, of course), we pave the way for future research to unveil the intricacies of our atmospheric composition, much like an uncovering of unexpected comedic timing in academic prose.

In conclusion (which will be written separately), our investigation into the link between air pollution in Boston and kerosene consumption in the United States not only raises eyebrows but also elevates the discourse on environmental dynamics to new heights. Let's continue to illuminate the path ahead, much like a well-lit kerosene lamp, without the fumes, of course!

## 6. Conclusion

In concluding our investigation, we assert that this study has illuminated a substantial correlation between air pollution in Boston and kerosene consumption in the United States. The remarkably robust correlation coefficient of 0.8650919 and the r-squared value of 0.7483841 unequivocally establish the significance of this association. It appears that kerosene, long overshadowed by its flashier counterparts in the pollution game, is indeed a key player in the

environmental arena. Who would have thought that this unassuming fuel could have such an impact? It seems that when it comes to air pollution, kerosene is a real "lightweight" - in more ways than one!

Our analysis also underscores the need to recognize the interconnectedness of seemingly disparate variables in shaping environmental outcomes. This newfound understanding sheds light on the complex dynamics at play in our atmosphere, emphasizing the need for holistic approaches to tackling air quality issues. It's clear that our study has sparked new insights into the multifaceted nature of environmental factors – much like the flicker of a kerosene lamp in the still of the night.

It is our firm belief that this study serves as a catalyst for further exploration of the intricate web of relationships woven into the fabric of air pollution dynamics. However, perhaps it's time to dim the spotlight on this particular topic. After all, how much more can be uncovered about the unlikely link between Boston's pollution and kerosene use nationwide? It's not rocket science; the data speaks for itself. It's time to extinguish the flames of curiosity on this specific correlation and redirect our research efforts toward other intriguing environmental mysteries. This study has shed ample light on the subject, and it's high time we turn our attention to other dimly lit corners of environmental research.