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Special Topic

Economic Predictors of Plastic Surgery Expenditures: A 14-Year Analysis of Unemployment, Disposable Income, and Stock Indices

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Abstract

Macroeconomic conditions significantly affect consumer spending patterns, including aesthetic surgery expenditures. This study examines the longitudinal relationship between unemployment rates, disposable income, stock indices, and aesthetic surgery spending from 2006 to 2019. Data on aesthetic surgery expenditures were collected from the American Society of Plastic Surgeons, whereas unemployment data were obtained from the US Bureau of Labor Statistics, disposable income from the US Bureau of Economic Analysis, and stock indices from the Federal Reserve Economic Data. Time series correlational analyses and Granger causality tests were used to explore these relationships. Unemployment was inversely related to total aesthetic surgery expenditures and most individual procedures. However, Granger causality tests did not reveal a significant predictive relationship between unemployment and aesthetic procedure spending for most procedures. Disposable income was most strongly associated with expenditures on injection procedures and had nonsignificant relationships with more invasive procedures, including breast augmentation, liposuction, abdominoplasty, and blepharoplasty. The analysis demonstrated a significant positive relationship between the NASDAQ, S&P 500, and Dow Jones with all aesthetic procedures, except rhinoplasty. Granger causality tests revealed significant predictive relationships for several procedures at different lags using disposable income and stock indices as predictive variables. These findings highlight a nuanced relationship between macroeconomic conditions and consumer spending on aesthetic surgery. Overall, this paper provides new insights offering a foundation for further investigation into aesthetic plastic surgery consumption on an individual level, rather than on an aggregate.

Level of Evidence: 5 (Risk)

Macroeconomic conditions significantly influence individual spending patterns, affecting how people and families allocate resources toward nonessential goods and services. During economic downturns, such as periods of increased unemployment or recession, individuals tend to reduce discretionary spending. Even the expectation of unemployment can lead to a decline in household spending on goods.[1]

Demand for plastic surgery, including both aesthetic and reconstructive procedures, has risen significantly over the past few decades. Total expenditures on aesthetic procedures increased by 113.8% between 2005 and 2020.[2] Because a large portion of the surgeries performed by plastic surgeons are elective, it is anticipated that spending on these procedures could decrease during periods of economic hardship.[3] Given the relationship between unemployment and discretionary spending, plastic surgery is particularly vulnerable to macroeconomic forces.

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Macroeconomic principles suggest that increases in disposable income are a major driver of discretionary spending. Additionally, expectations of future income can encourage present consumer spending.[4] Because stock market performance may reflect expectations of future income, it is reasonable to expect that as disposable income and stock indices rise, there would be a corresponding increase in spending on discretionary healthcare, including aesthetic plastic surgery.

Although some research have examined the impact of economic stress on health-related choices, few studies have comprehensively explored the correlation between unemployment trends and plastic surgery demand in the United States over an extended period. This study aims to assess the relationship between unemployment rates, disposable income, and stock indices and the demand for plastic surgery from 2006 to 2019, providing valuable insights for healthcare providers, policymakers, and economists. Additionally, we examine whether this impact varies across different types of plastic surgery procedures and demographic groups. We hypothesize that there is an inverse relationship between unemployment rates and the demand for plastic surgery in the United States during this period. We also expect a positive relationship between disposable income and stock indices with plastic surgery expenditures. By analyzing macroeconomic indicators alongside plastic surgery procedure rates, this research seeks to clarify the extent to which economic fluctuations influence elective or aesthetic medical decisions.

METHODS

Data Collection

Data from the American Society of Plastic Surgeons annual reports on plastic surgery statistics were collected from 2006 to 2019. Data were excluded beyond 2019 because of possible confounding during the COVID-19 pandemic when the United States experienced a recession that coincided with the temporary stoppage of elective surgeries. Expenditures for aesthetic procedures from 2006 to 2019 were collected. Surgical procedures included within the analysis were breast augmentation, mastopexy, abdominoplasty, liposuction, blepharoplasty, facelift, and rhinoplasty. Noninvasive procedures included were neuromodulator injections and dermal fillers. Breast reduction surgery was excluded from the final analysis as data were not collected prior to 2012. In addition to the above variables, 2 composite variables were included—total surgical procedures and total injectables. Unemployment data were obtained from the US Bureau of Labor Statistics website, disposable income from the US Bureau of Economic Analysis, and the stock indices from the Federal Reserve Economic Data.[5-7]

Statistical Analysis

Our analysis aimed to explore the relationships between economic indicators and aesthetic procedure expenditures, with a focus on determining whether changes in economic indicators could predict future expenditures. First, time series correlation analyses were conducted to examine the relationships between each economic indicator and aesthetic procedure expenditures over time. Pearson correlation coefficients were calculated to assess the linear relationships between these variables, where the coefficient ranges from −1 to 1, measuring the strength and direction of the linear relationship.

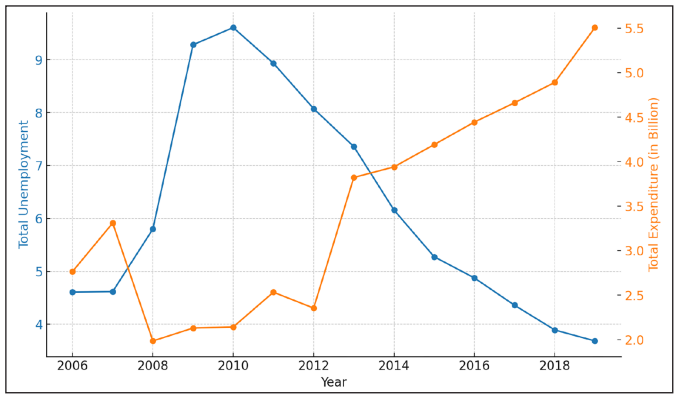

Figure 1. Time series of total unemployment and total cosmetic procedure expenditures.

P-values were also computed to evaluate the statistical significance of these correlations.

To further investigate whether past values of economic indicators could predict future changes in aesthetic procedure expenditures, Granger causality tests were conducted. These tests were performed at 1-, 2-, and 3-year lags to capture potential short- and medium-term predictive relationships. A significant Granger causality result indicates that lagged values of an economic indicator contain information that helps predict future values of aesthetic procedure expenditures. Statistical analysis was performed using Microsoft Excel (Redmond, WA) and Python. The results were reported as correlation coefficients, *P*-values, and Granger causality *P*-values. *P*-values <.05 were considered statistically significant.

RESULTS

Unemployment

Time series correlational analysis demonstrated that unemployment was inversely related to expenditures across most aesthetic procedures. The strongest correlations were with liposuction procedures ($R = -0.890$, $P < .001$) and abdominoplasties ($R = -0.884$, $P < .001$). Total expenditures had a significantly negative relationship to unemployment rate ($R = -0.659$, $P = .010$; Figure 1). Blepharoplasty ($R = -0.476$, $P = .086$), rhinoplasty ($R = -0.363$, $P = .199$), and dermal filler expenditures ($R = -0.502$, $P = .067$) did not show a significant negative correlation with unemployment rate, but they all trended toward significance (Table 1).

For most procedures, Granger causality tests did not reveal significant predictive relationships at either a 1- or 2-year lag. At a 3-year lag, the only significant predictive relationship was for liposuction expenditures ($P = .044$; Table 1).

Disposable Incomes

Time series correlational analysis showed that disposable income was positively correlated with expenditures on aesthetic procedures. The strongest correlations were observed for injection procedures ($R = 0.882$, $P < .001$). Total expenditures had a significantly positive relationship with disposable income ($R = 0.726$, $P = .003$; Figure 2). Disposable income had a positive but nonsignificant relationship

Table 1. Time Series Correlation and Granger Causality for Unemployment Rate and Cosmetic Procedure Expenditures

Procedure expenditure	Correlation coefficient	Correlation *P*-value	Granger *P*-value (Lag 1)	Granger *P*-value (Lag 2)	Granger *P*-value (Lag 3)
Total	−0.659	.010	.170	.131	.291
Breast augmentation	−0.760	.002	.164	.111	.797
Liposuction	−0.890	<.001	.255	.196	.044
Abdominoplasty	−0.884	<.001	.388	.278	.369
Blepharoplasty	−0.476	.086	.151	.405	.837
Mastopexy	−0.855	<.001	.324	.766	.550
Facelift	−0.690	.005	.294	.642	.864
Rhinoplasty	−0.363	.199	.236	.437	.451
Injection	−0.742	.002	.615	.080	.795
Botox (Abbvie, North Chicago, IL)	−0.781	.001	.621	.162	.797
Dermal filler	−0.502	.067	.320	.612	.783

with breast augmentation, liposuction, abdominoplasty, and blepharoplasty (Table 2).

Granger causality tests revealed significant predictive relationships for several procedures at different lags. Liposuction expenditures was consistently predicted by disposable income across all lags, with the strongest predictive relationship observed at the 2-year lag ($P < .001$). Similarly, injection expenditures showed significant predictive relationships at the 1-year ($P = .024$) and 2-year ($P = .005$) lags. Although several individual procedures demonstrated a predictive relationship, total expenditures did not demonstrate a predictive relationship at 1-year ($P = .116$), 2-year ($P = .137$), or 3-year ($P = .686$) lags (Table 2).

Stock Indices

Time series correlational analysis demonstrated a significant positive relationship between the NASDAQ, S&P 500, and Dow Jones with nearly all aesthetic procedures (Figure 3). The only procedure in which there was no significant relationship with NASDAQ ($R = 0.224$, $P = .443$), S&P 500 ($R = 0.171$, $P = .559$), and the Dow Jones ($R = 0.168$, $P = .566$) was rhinoplasty expenditures. Granger causality tests identified significant predictive relationships for most procedures for a 1-, 2-, or 3-year lag (Table 3).

DISCUSSION

The study found that macroeconomic conditions significantly influence expenditures on elective aesthetic procedures, with notable variations across different types of surgeries. There was a significant inverse relationship between unemployment rates and spending on most aesthetic procedures, indicating that expenditures on these surgeries decline as unemployment rises. However, Granger causality tests revealed limited predictive value of unemployment for future spending, suggesting that unemployment impacts immediate spending decisions.

Disposable income showed a positive correlation with expenditures on aesthetic procedures, particularly for frequently performed, less invasive treatments like injectables. Granger causality analyses further highlighted the predictive power of disposable income across various time lags for several individual procedures, demonstrating that income stability plays a critical role in elective healthcare decisions over time. Similarly, stock indices (NASDAQ, S&P 500, and Dow Jones) were positively correlated with spending on nearly all aesthetic procedures, reflecting the broader economic health's impact on elective surgery demand.

Our findings align with previous research showing that economic downturns, such as the 2008 recession, lead to decreased volumes of elective procedures across multiple specialties, including plastic surgery.[8,9] In this study, we found that rising unemployment was inversely correlated with total expenditures on aesthetic surgery, but this relationship was not uniform across all procedures. Similarly, Fujihara et al observed a comparable trend in elective hand procedures, noting that not all surgeries were equally affected by economic conditions.[10] In our analysis, blepharoplasty, rhinoplasty, and dermal fillers did not show a significant inverse correlation with unemployment rates. This may be because blepharoplasty and rhinoplasty often have medical indications, such as symptom relief, differentiating them from strictly aesthetic procedures. For dermal fillers, the weaker relationship with unemployment could be because of the demographic characteristics of the patient population that typically receives these treatments. Given that dermal fillers are rarely covered by insurance, patients opting for these procedures may have higher incomes and savings, making them less vulnerable to economic shifts like rising unemployment. These variations highlight the complex and procedure-specific impacts of macroeconomic factors on elective surgery demand.

Higher disposable income was associated with increased spending on aesthetic procedures, with a particularly strong relationship observed for lower cost, high-frequency treatments like injections and fillers. This reflects the direct influence of financial stability on elective procedures, consistent with a study that found a positive

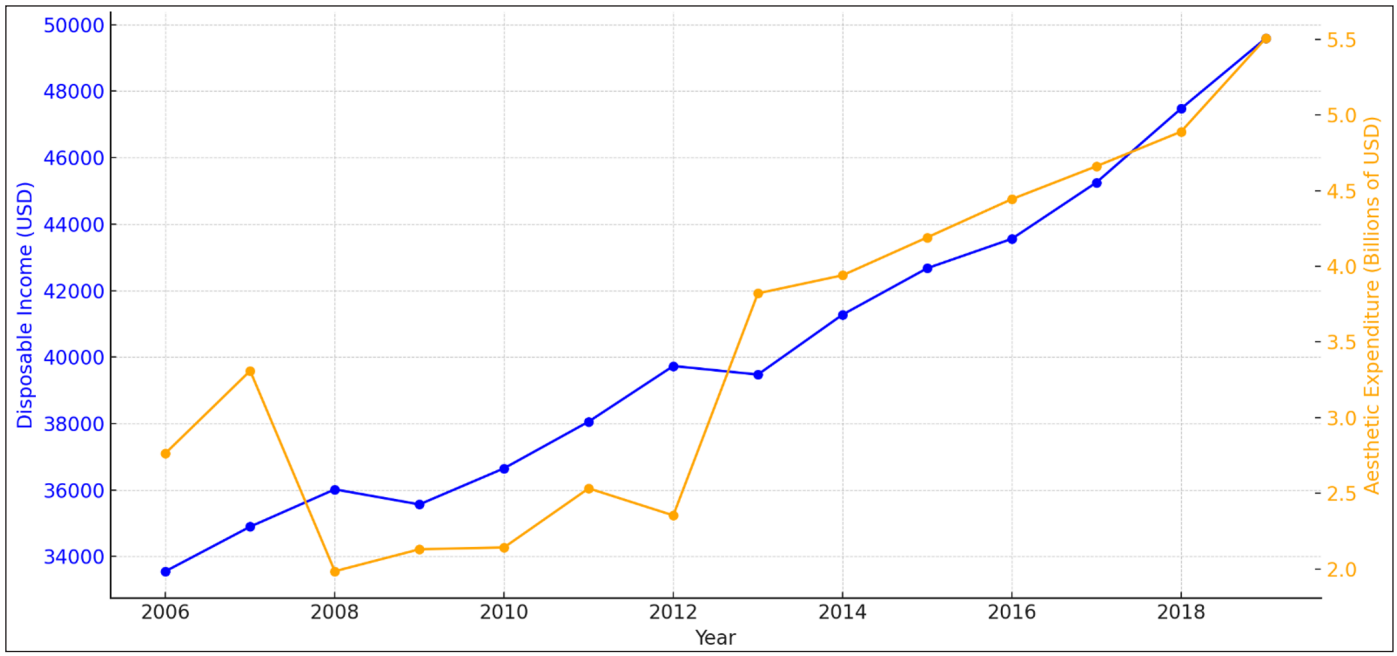

Figure 2. Time series of disposable income and total cosmetic procedure expenditures.

Table 2. Time Series Correlation and Granger Causality for Disposable Income and Cosmetic Procedure Expenditures

Procedure	Correlation coefficient	Correlation *P*-value	Granger *P*-value (Lag 1)	Granger *P*-value (Lag 2)	Granger *P*-value (Lag 3)
Total	0.726	.003	.116	.198	.686
Breast augmentation	0.375	.186	.106	.004	.484
Liposuction	0.460	.098	.033	<.001	.037
Abdominoplasty	0.441	.114	.250	.048	.253
Blepharoplasty	0.506	.065	.042	.116	.358
Mastopexy	0.785	<.001	.014	.003	.059
Facelift	0.665	.007	.011	.102	.429
Rhinoplasty	0.307	.280	.029	.070	.089
Injection	0.882	<.001	.024	.005	.076
Botox	0.667	.009	.137	.075	.383
Dermal filler	0.936	<.001	.031	.432	.239

relationship between disposable income and minimally invasive aesthetic procedures from 2000 to 2011.[11] The strong relationship between disposable income and minimally invasive procedures suggests that they are more susceptible to changes in consumers' financial situations. Fillers and injections typically require a smaller upfront financial commitment, making them more accessible during times of economic stability.

In contrast, there was no significant relationship between disposable income and several more invasive surgical procedures (breast augmentation, liposuction, abdominoplasty, blepharoplasty, and rhinoplasty). This weaker relationship, compared with minimally invasive procedures, may be because of several factors. These procedures involve higher upfront costs, meaning changes in disposable income may not immediately affect the decision to undergo surgery, as patients may have saved in advance to afford them. Additionally, these surgeries may be considered significant life decisions less susceptible to macroeconomic indicators. Finally, procedures such as blepharoplasty, rhinoplasty, and abdominoplasty may have medical indications and be partially covered by insurance, leading to lower individual costs. These reasons may also partially explain the lag between disposable income changes and changes in expenditures.

Previous studies have demonstrated a positive relationship between stock market indices and total aesthetic surgery volume and

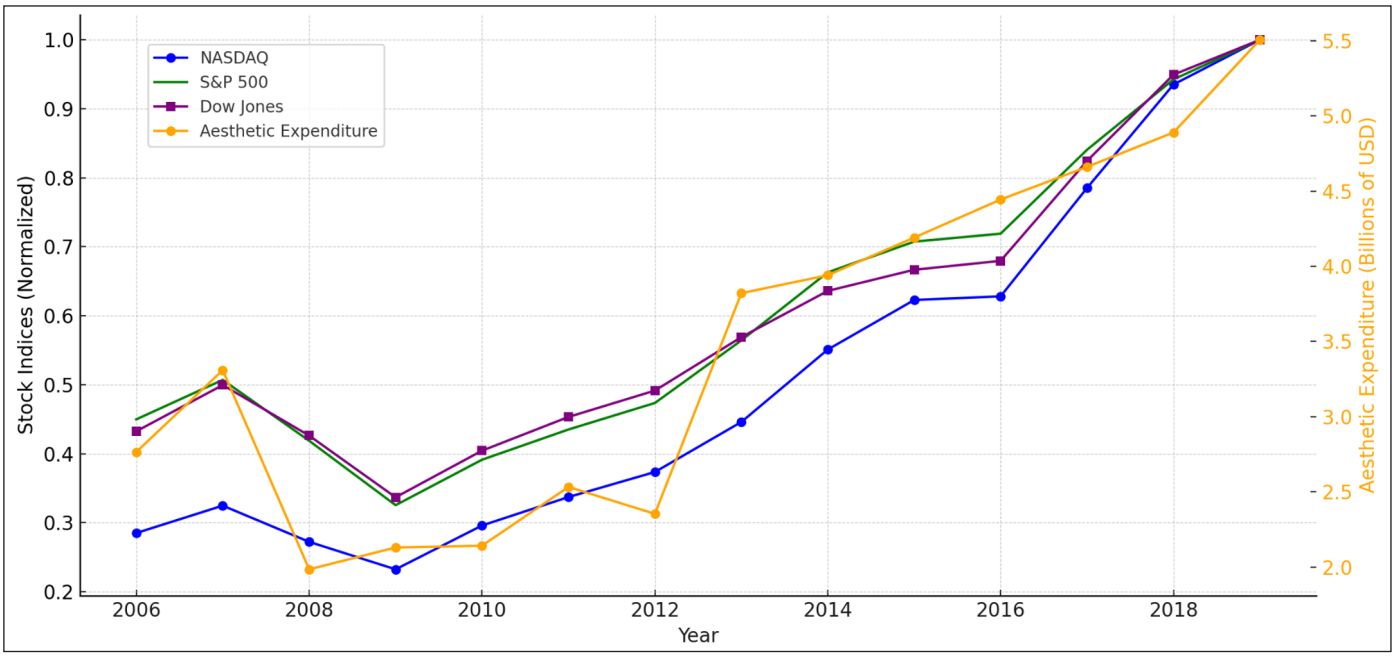

Figure 3. Time series of stock indices and total cosmetic procedure expenditures.

expenditures, which aligns with our findings.[2,9,12,13] Bay et al demonstrated a strong correlation between stock indices and plastic surgery demand, but our study expands upon that research in 2 significant ways. First, it conducts a procedure-specific analysis to understand how stock fluctuations uniquely impact spending on individual aesthetic procedures. Second, our analysis applies Granger causality tests to uncover predictive relationships over time, providing insight into how stock performance may forecast future aesthetic expenditures.

This procedure-specific analysis revealed a similar pattern to that which was observed with unemployment and disposable income: a weaker relationship between stock indices and surgeries, such as rhinoplasty and blepharoplasty, and exceptionally strong correlations with minimally invasive treatments, such as fillers, injections, and Botox (Abbvie, North Chicago, IL). This suggests that although overall economic confidence, as reflected in stock market performance, generally boosts spending on aesthetic procedures, its impact varies by procedure type, with less invasive, lower cost options being more directly and immediately influenced by economic conditions.

The Granger causality tests revealed that although there was no lag between total expenditures and economic indicators, lag was present for individual procedure types. For some more invasive and costly procedures, such as breast augmentation and abdominoplasty, there appears to be a greater lag time for certain stock indices and disposable income. The lag time between stock market increases and larger aesthetic surgery expenditures may reflect how consumers view and manage their wealth in response to rising stock values. Because stocks are not inherently liquid assets, patients may not be immediately inclined to sell them to fund elective procedures. Furthermore, when stock values rise, consumers often anticipate further gains, making them hesitant to sell. Additionally, liquidating stocks incurs capital gains taxes, prompting consumers to be more strategic when considering investment-derived wealth for nonessential expenses, such as aesthetic surgery. Minimally invasive procedures, such as Botox and dermal fillers, tended to have shorter or no lag times, as patients may be more willing to spend immediately because of the lower cost barrier.

Conversely, lag time is largely absent with unemployment rates, suggesting a more immediate impact on expenditures. Rising unemployment directly affects financial security, leading to an immediate reduction in discretionary spending. Furthermore, it has been shown that even the prospect of unemployment can reduce individual spending.[1] Urgent financial constraints caused by unemployment may cause an immediate decrease in spending, whereas the lag associated with stock indices and disposable income may reflect a more cautious approach by consumers.

Although there have been studies demonstrating relationships between unemployment, disposable income, and stock indices, this paper offers several strengths that provide a unique contribution to the literature.[2,8-10,12] This analysis included a wide variety of procedures, allowing for comparisons across procedures to understand how consumer behavior may be affected by macroeconomic forces. By utilizing both time series correlation and Granger causality testing, this study not only identified associations but also explored possible predictive relationships between economic indicators and plastic surgery expenditures.

Despite its strengths, this study has several limitations that should be considered when interpreting the findings and their broader implications. The study excluded data beyond 2019 because of the potential confounding effects of the COVID-19 pandemic, which may limit the generalizability of the findings to current market conditions. Although this study analyzed several economic indicators, it does not account for all potential variables that could influence aesthetic surgery demand, such as healthcare policy changes and shifts in social attitudes toward aesthetic surgery. Additionally, the reliance on aggregate data may obscure individual-level economic decisions

Table 3. Time Series Correlation and Granger Causality for Stock Indices and Cosmetic Procedure Expenditures

Procedure	Indicator	Correlation coefficient	Correlation *P*-value	Granger *P*-value (Lag 1)	Granger *P*-value (Lag 2)	Granger *P*-value (Lag 3)
Total	NASDAQ	0.784	<.001	.045	.124	.254
	S&P 500	0.788	<.001	.121	.301	.364
	Dow Jones	0.802	<.001	.056	.136	.166
Breast augmentation	NASDAQ	0.533	.045	.051	.002	.891
	S&P 500	0.591	.026	.070	.009	.786
	Dow Jones	0.595	.025	.062	.003	.862
Liposuction	NASDAQ	0.627	.016	.015	.002	.021
	S&P 500	0.679	.008	.020	.005	.072
	Dow Jones	0.676	.008	.028	.006	.070
Abdominoplasty	NASDAQ	0.611	.020	.205	.084	.070
	S&P 500	0.674	.008	.169	.050	.055
	Dow Jones	0.646	.013	.281	.094	.042
Blepharoplasty	NASDAQ	0.554	.040	.020	.097	.155
	S&P 500	0.553	.040	.036	.154	.326
	Dow Jones	0.574	.032	.021	.098	.106
Injection	NASDAQ	0.939	<.001	.039	.125	.447
	S&P 500	0.963	<.001	.070	.244	.484
	Dow Jones	0.946	<.001	.092	.283	.464
Mastopexy	NASDAQ	0.889	<.001	.004	.011	.023
	S&P 500	0.907	<.001	.009	.047	.034
	Dow Jones	0.904	<.001	.018	.056	.039
Facelift	NASDAQ	0.813	.001	.017	.135	.319
	S&P 500	0.819	<.001	.058	.293	.678
	Dow Jones	0.803	.001	.022	.155	.369
Rhinoplasty	NASDAQ	0.224	.443	.011	.057	.023
	S&P 500	0.171	.559	.019	.087	.132
	Dow Jones	0.168	.566	.011	.060	.116
Botox	NASDAQ	0.769	.001	.263	.351	.787
	S&P 500	0.829	<.001	.277	.323	.942
	Dow Jones	0.792	.001	.367	.460	.856
Dermal filler	NASDAQ	0.920	<.001	.011	.267	.022
	S&P 500	0.892	<.001	.123	.174	.024
	Dow Jones	0.905	<.001	.028	.098	.007

when considering aesthetic surgery. Finally, although Granger causality tests explore predictive relationships, these methods cannot establish true causation, and the observed relationships may be influenced by unmeasured variables.

Building on the current study's findings, future research could further deepen our understanding of how economic factors influence demand for plastic surgery and other elective medical services. Research could investigate how different demographic groups change their spending habits in response to macroeconomic changes. Additionally, as more data are collected post-COVID-19, it can be analyzed to determine whether the relationships between macroeconomic indicators and plastic surgery expenditures remain consistent. Finally, utilizing individual patient-level data, rather than aggregate data, would allow for a more detailed exploration of elective healthcare decision making.

CONCLUSIONS

The main objective of this study was to assess the relationship between macroeconomic indicators and expenditures on plastic surgery. Unemployment rates, disposable income, and stock indices have very strong relationships with total expenditures on aesthetic procedures, but the strength and potential causality differs among different procedure types. These findings highlight a nuanced relationship between economic well-being and consumer spending on aesthetic surgery. Overall, this paper provides new insights offering a foundation for further investigation into aesthetic plastic surgery consumption on an individual level, rather than on aggregate.

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