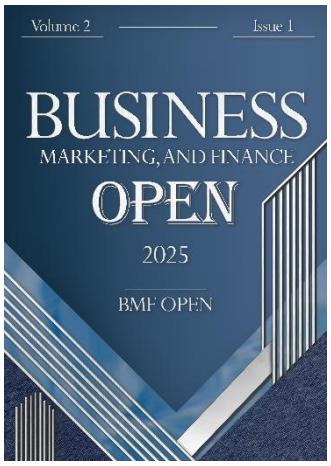
Examining the Impact of Trade Fluctuations on the Substitution Elasticity of Selected Goods During Economic Boom



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Abstract: The purpose of this study is to examine the effects of trade fluctuations on the substitution elasticity of selected goods during periods of economic boom. In this research, the Armington elasticity was calculated for 22 selected goods (considering statistical limitations) at the 2-digit, 3-digit, and 4-digit levels of the Standard International Industrial Classification (SIIC). The Armington elasticity essentially measures the sensitivity of the ratio of imported demand to domestic demand for a good in response to changes in the relative price of domestic versus imported goods. Therefore, in this study, using EViews 10 software and a multivariate regression model based on time series data, the Armington elasticity was initially calculated. The results indicate that this elasticity is positive and statistically significant for 16 selected goods. In the next step, using an ARDL regression model, the findings suggest that trade fluctuations have a significant impact on the substitution elasticity of selected goods. Additionally, trade fluctuations positively affect the substitution elasticity of selected goods during economic boom periods. Hence, all research hypotheses were confirmed at a 95% confidence level.

Keywords: Trade fluctuations, substitution elasticity, economic boom

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1. Introduction

Over time, many economists have examined the impact of trade fluctuations on the substitution elasticity of various essential goods. They consider the business cycle a type of regular and systematic fluctuation that occurs at the macroeconomic level of countries and repeats periodically. A business cycle initially consists of a boom phase, which manifests across all sectors of the economy, followed by an economic recession. This phenomenon has been of interest to economists since the early 19th century. In other words, the business cycle represents economic fluctuations within a specific period. It reflects a country's economic conditions over different time frames and is also referred to as the economic cycle or exchange cycle [1, 2].

Investment plays a pivotal role in both fostering economic growth and development and influencing business cycles and economic fluctuations, thereby making the identification of factors affecting investment critically important [3]. From a corporate perspective, company value is a function of the profitability of its investments, so managers must identify the determinants of investment levels to balance shareholder expectations with attractive investment opportunities [4]. Evaluating the nature of investment represents a rational approach to quantifying the benefits or losses associated with an investment, and appropriate models are required to accurately measure risk; selecting an

unsuitable model can lead to irreparable losses for investors and entrepreneurs [2, 5]. Among the various investment channels, stock market investment through securities exchanges is particularly noteworthy since it enables firms to become more dynamic by offering their stocks to the public, while investors acquire opportunities to contribute to economic development [6]. Historical evidence in developed countries emphasizes that investment is a key driver of economic expansion, as it ensures more effective and efficient utilization of resources; some studies have further shown that private investment exerts a stronger and more favorable effect on economic growth than public investment [7]. However, investment reacts sensitively to policy changes; its influencing factors are numerous, and their impact is not uniform across all times and locations [8]. Investment, defined as the deployment of funds to generate a future stream of returns, can involve financial assets, physical assets, or production-related activities, yet only investments in productive activities are typically deemed "capital expenditures" [7]. Public investment often proceeds without profit motivation, whereas private investment is geared toward profit and thus is particularly susceptible to macroeconomic uncertainty and policy instability; governments may respond to decreased private investment by increasing public investment [3]. Trade fluctuations can also influence substitution elasticities of goods. Tayebi et al. (2012) argue that bank financing is crucial for private investment in Iran, yet information asymmetry frequently causes banks to favor large, well-established firms over smaller businesses, impeding effective capital allocation [7]. The link between investment and a firm's balance sheet and capital structure is another vital research topic, especially regarding imperfect capital markets. If capital markets were complete, external financing would fully replace internal funds, rendering firms' financial structures irrelevant to investment decisions [4, 9]. However, in reality, capital market imperfections mean that internal and external financing are not perfect substitutes, making investment sensitive to internal cash flow, new debt issues, and financial market performance [4]. In line with this view, Bernanke et al. (1999) introduced the "financial accelerator" theory, suggesting that exogenous shocks can be amplified when firms' balance sheets are weak. As a result, financial markets, hindered by information asymmetry between lenders and borrowers, may inadvertently intensify economic volatility [10]. The World Bank's early-1990s report spurred extensive research on macroeconomic stability and its influence on various economic variables, revealing that countries with more stable economies and sound governmental policies outperform less stable counterparts [11]. In Iran's case, the economy has experienced budget deficits, high inflation, negative real interest rates, and pronounced exchange rate swings—conditions that lead to significant trade fluctuations [8]. Oil price volatility further contributes to instability in oil export revenues, emphasizing the importance of diversifying exports to reduce vulnerability and secure foreign currency for importing capital and intermediate goods [12].

According to this definition, not every economic fluctuation can be reflected in the business cycle. These fluctuations must be systematic and follow a specific pattern. There are certain characteristics that distinguish business cycle fluctuations from other types of economic variations. One such characteristic is that business cycle fluctuations occur in major economic activities and influence all variables, including essential goods, which are the focus variables of this study [1]. Additionally, the phases of economic boom and recession occur simultaneously across economic activities. Therefore, during a recession, the economy tends to contract. The business cycle continuously repeats patterns of growth and stagnation, though the extent and intensity of fluctuations are not always equal. In this regard, the present study aims to examine trade fluctuations through substitution elasticities, particularly the Armington elasticity, for selected goods. The study investigates the transmission of essential goods' prices from the international market to the domestic market. To achieve this, the substitution elasticity between imported essential goods and domestically produced goods in Iran is calculated. The Armington elasticity represents the degree of substitution between domestically produced and foreign-produced goods. A higher elasticity suggests that buyers do not differentiate between domestic and foreign goods and perceive them as identical. Consequently, any policy aimed at influencing the prices of imported goods will also impact the pricing of domestically produced goods. To analyze the effect of trade fluctuations on the substitution elasticity of selected goods in this study, the Armington elasticity was calculated using annual data from 2016 to 2023, applying the ordinary least squares (OLS) method for 23 selected goods (key trade and domestically produced goods). Previous research findings indicate that the Armington elasticity is higher in the long run compared to the short run. This suggests that imported goods serve as substitutes for domestically produced goods, meaning buyers perceive no

distinction between them. Additionally, the prices of these goods are influenced by global prices, with international price fluctuations being more easily transmitted to the domestic market in the long run than in the short run. Given these considerations, the fundamental question of this study is: To what extent do trade fluctuations influence the substitution elasticity of essential goods during periods of economic boom?

2. Methodology

The present study is classified as an applied research type based on its objectives, as it aims to develop practical knowledge in a specific field and direct knowledge toward practical application. In other words, the goal of this research is to develop and improve methods, tools, goods, and structures.

Additionally, in terms of execution, this study is quasi-experimental and follows a descriptive-correlational research design, as it examines the relationship between trade fluctuations and the substitution elasticity of selected goods. This method is used to discover existing realities or what currently exists. Given that past data is used for variable calculation in this study, it is categorized as ex-post facto research.

The statistical population of this study consists of consumer goods within Iran. The temporal scope of this research covers the period from the beginning of 2016 to the end of 2023. The geographical scope includes all consumer goods within Iran.

To collect the necessary data for calculating the research variables and estimating the Armington elasticities for the selected goods, annual data for the period from 2016 to 2023 was used. The estimation was conducted using a single-equation approach and three different methods. Based on the Armington elasticity equation, the variables used in the estimated equations include: the domestic production quantity of good X_iD, the import quantity of good X_iM, the import price of good P_iM, and the domestic price of good P.

One of the most critical and challenging aspects of this research was collecting and organizing time-series data and categorizing goods, particularly for domestic production quantities and the relevant import price index. The domestic production quantity data was obtained from the annual industrial production reports published by the Statistical Center of Iran, which includes 2-digit, 3-digit, and 4-digit industry codes. Another required data set was the import quantity of goods, extracted from the Foreign Trade Statistical Yearbook, which is based on the classification and coding of goods according to the Harmonized System (HS).

It is important to note that the wholesale price index was used as a proxy for the domestic price index. Since the import price index is also a component of the wholesale price index, and given the availability of weighting coefficients for all goods, the import price index was removed from the wholesale price index. As a result, the wholesale price index, after excluding the import price index, was used in the calculations. Ultimately, the required elasticities for 22 product groups were estimated and analyzed. The methods employed in this study include the ordinary least squares (OLS) approach, along with R^2 and Durbin-Watson (D.W.) statistics.

Research Variables

Dependent Variable:

The elasticity of selected goods using the Armington method.

Equation (1):

$$\Delta \log\left(\frac{X_{iM}}{X_{iD}}\right) = \gamma_i^0 + \gamma_i^1 \Delta \log\left(\frac{P_{iD}}{P_{iM}}\right) + \gamma_i^2 ECM_{(-1)} + u_i$$

Before estimating the model, it is essential to confirm the long-term relationship among the research variables. The required OLS regressions represent the ratio of imported demand to domestically produced demand as X_m / X_d, and the price ratio as P_d / P_m. The necessary data for these variables were obtained from the Statistics Organization website and the Armanian website.

Independent Variable: Trade Fluctuations

Following the study by Shayegani et al. (2023), trade fluctuations were analyzed using the logarithm of gross domestic product (GDP), which was obtained from the Central Bank of Iran. To measure trade fluctuations during

economic boom periods, the median logarithm of GDP was calculated. If the logarithm of GDP in a given year exceeded the median, that year was considered an economic boom period.

Model Specification

Equation (2):

Product Elasticity(i,t) = B0 + B1 * Log(GDP)(t) + e(i,t)

where:

- Product Elasticity(i,t) represents the elasticity of product i in year t.
- Log(GDP)(t) represents trade fluctuations in year t.
- B0 is the intercept.
- B1 is the coefficient of the independent variable.
- e(i,t) is the error term.

The collected data was summarized and categorized using Excel, and the necessary computations were performed. In the findings section, the collected data was analyzed using EViews 10 software, and the research hypotheses were tested accordingly.

3. Findings

Descriptive statistics refer to a set of measures that provide a general overview of the collected data for researchers. It should be noted that descriptive statistics cannot be used to generalize results to a broader population but rather serve to offer an overall perspective on the research.

Table 1. Descriptive Statistics of Research Variables

Variable Name	Mean	Standard Deviation	Minimum	Maximum
Trade Fluctuations (Logarithm of GDP)	7.5248	0.44855	6.93	8.26
Logarithm of Imported Demand to Domestic Demand	-1.2078	1.96383	-5.73	3.06
Logarithm of Domestic Price to Imported Price	-0.7265	0.60021	-2.31	0.26
Armington Elasticity	5.9827	4.75107	1.14	23.22

As shown in Table 1, the descriptive statistics include mean, minimum, maximum, and standard deviation, which are the most well-known and frequently used descriptive statistical indices. The mean represents the average value of the data. According to Table 1, the mean of a variable indicates its average level within the studied range. For example, the mean trade fluctuation (logarithm of GDP) is 7.5248, which means that, on average, trade fluctuations (logarithm of GDP) are approximately 8. Similarly, the mean Armington elasticity is 5.98, indicating that, on average, the elasticity of the selected products is around 6.

The logarithm of imported demand to domestic demand has a standard deviation of 1.96 and a broader range, suggesting that this variable varies significantly across different products compared to the mean value.

Table 2. Elasticity Estimation Using the Ordinary Least Squares (OLS) Method

Row	Product	Statistic	Significance Level	Durbin-Watson	R-squared
1	Computer, Electronic, and Optical Products	1.14	0.03	1.08	0.31
2	Bricks	8.75	0.03	2.78	0.59
3	Clothing (for families)	7.13	0.09	1.23	0.31
4	Printing and Publishing	5.09	0.06	0.89	0.67
5	Leather	4.00	0.09	2.06	0.40
6	Wood and Wood Products	1.80	0.23	0.82	0.23
7	Livestock and Poultry Feed	12.46	0.01	1.73	0.67
8	Pharmaceuticals and Pharmaceutical Products	7.76	0.06	1.61	0.41
9	Tobacco	1.26	0.36	1.47	0.33
10	Glass	2.60	0.17	0.89	0.51
11	Dairy Products	6.63	0.04	0.48	0.73
12	Basic Metals	3.91	0.10	1.02	0.39
13	Sugar	3.51	0.11	1.28	0.37

14	Paper and Paper Products	1.78	0.23	0.69	0.23
15	Shoes (for families)	8.78	0.03	0.39	0.59
16	Meat and Meat Products	4.85	0.07	0.72	0.66
17	Furniture (Wooden and Metal)	23.22	0.00	1.56	0.79
18	Plastic Products	6.94	0.04	0.83	0.74
19	Textiles	4.04	0.09	1.77	0.62
20	Chemicals and Chemical Products	2.67	0.16	1.25	0.52
21	Fruits and Vegetables	4.53	0.05	0.81	0.64
22	Land Vehicles	8.77	0.02	1.07	0.78

The results in this table indicate that all estimated elasticities, except for wood and wood products, tobacco, glass, sugar, paper and paper products, and chemicals, are statistically significant at a 90% confidence level. The findings suggest that the range of estimated Armington elasticities using the OLS method varies between 1.26 and 23.22.

Based on the table, it can be concluded that products such as furniture, livestock and poultry feed, shoes, land vehicles, bricks, pharmaceuticals, and clothing exhibit very high substitution elasticities. This means that these products have a strong potential for substitution with similar imported goods, making an import substitution policy feasible for these products.

A high substitution elasticity also implies that a 1% change in the domestic-to-import price ratio leads to a much larger change (more than 1%) in the import-to-domestic production ratio. In other words, if tariffs and protections decrease (e.g., due to joining the WTO), and import prices fall relative to domestic prices, the increase in imports relative to domestic production will be significantly higher. This may lead domestic producers to lose motivation and the ability to compete, causing them to halt production, lay off workers, and exacerbate unemployment problems. The high import volume of low-cost Chinese and Turkish shoes and clothing supports this finding.

Products such as plastic products, dairy products, printing and publishing, meat and meat products, fruits and vegetables, textiles, leather, and basic metals have lower substitution elasticities than the first group. While they also have considerable substitutability with imported counterparts, their substitution power is relatively lower. Thus, an import substitution policy is likely to be moderately successful for these products. If domestic prices increase relative to import prices (e.g., due to reduced subsidies and tariffs), the import-to-domestic production ratio will rise, though not as sharply as in the previous group. Consequently, the resulting unemployment increase will also be less severe.

Products such as computer, electronic, and optical products have substitution elasticities close to one, meaning they are not considered strong substitutes for similar imported goods. Therefore, an import substitution policy—at least in the short term—will not be feasible for these products. However, if domestic prices increase relative to import prices (e.g., due to tariff and subsidy reductions), the increase in imports relative to domestic production will be less than 1%. In other words, domestic consumers will not immediately switch to imported alternatives in response to rising domestic prices.

Based on the Levin, Lin, and Chu unit root test, if the test statistic significance level is less than 0.05, the null hypothesis is rejected, confirming the stationarity of the research variables over the study period.

Table 3. Stationarity Test Results for Research Variables

Variable	Differentiation Level	Test Type	Statistic	Significance Level
Trade Fluctuations (Logarithm of GDP)	First Level	Intercept	-14.3190	0.0000
Logarithm of Imported Demand to Domestic Demand	First Level	Intercept	-95.1789	0.0000
Logarithm of Domestic Price to Imported Price	---	Intercept	-17.1965	0.0000
Armington Elasticity	---	Intercept	-3.9717	0.0000

As shown in Table 3, since the significance level is below 0.05, all research variables are stationary.

Before testing the research hypotheses, it is necessary to examine the long-term relationship between trade fluctuations and product elasticity. This was done using the Johansen–Kao cointegration test, with results presented below.

Table 4. Johansen Cointegration Test Results

Variable	Statistic	Significance Level	Result
Trade Fluctuations (GDP)	3.3207	0.0042	Rejected

The results indicate that the null hypothesis of no long-term relationship is rejected. Thus, the presence of a long-term relationship and cointegration between trade fluctuations and product elasticity is confirmed.

Table 5. Data Analysis Results for Testing the First Hypothesis

Variables	Coefficients	Standard Error	T-Statistic	Significance Level
Trade Fluctuations (Short-Term)	0.009612	0.002277	4.220869	0.0000
Intercept (Long-Term)	0.426391	0.062660	6.804789	0.0000
Trade Fluctuations (Long-Term)	0.011097	0.002681	4.139076	0.0000

According to Table 5, the coefficient of the trade fluctuations variable in the short term is 0.009612, which is positive. The t-statistic significance level for the trade fluctuations variable is 0.0000, which is less than the 0.05 error threshold. Additionally, the coefficient of the trade fluctuations variable in the long term is 0.011097, which is also positive, and the t-statistic significance level for this variable is 0.0000. Since the significance level is below 0.05 in both cases, trade fluctuations have a significant impact on the substitution elasticity of selected goods. Therefore, this hypothesis is confirmed at a 95% confidence level.

Table 6. Data Analysis Results for Testing the Second Hypothesis

Variables	Coefficients	Standard Error	T-Statistic	Significance Level
Trade Fluctuations During Economic Boom (Short-Term)	0.046751	0.005923	7.892720	0.0000
Intercept (Long-Term)	0.134295	0.037581	3.573441	0.0005
Trade Fluctuations During Economic Boom (Long-Term)	0.011426	0.002720	4.200687	0.0000

As shown in Table 6, the coefficient of the trade fluctuations variable during economic boom periods in the short term is 0.046751, which is positive. The t-statistic significance level for the trade fluctuations variable during economic boom periods in the short term is 0.0000, which is less than the 0.05 error threshold. Additionally, the coefficient of the trade fluctuations variable during economic boom periods in the long term is 0.011426, which is also positive, and the t-statistic significance level for this variable is 0.0000. Since the significance level is below 0.05 in both cases, trade fluctuations during economic boom periods have a significantly positive impact on the substitution elasticity of selected goods. Therefore, this hypothesis is confirmed at a 95% confidence level.

4. Discussion and Conclusion

All estimated elasticities, except for the categories of wood and wood products, tobacco, glass, sugar, paper and paper products, and chemicals, were statistically significant at a 90% confidence level. The results indicate that the range of Armington elasticities estimated using the ordinary least squares (OLS) method varies between 1.26% and 23.22%. Based on the presented table, it can be concluded that products such as furniture, livestock and poultry feed, shoes, land vehicles, bricks, pharmaceuticals and pharmaceutical products, and clothing exhibit very high substitution elasticities. This means that these products have a strong potential for substitution with similar imported goods, making an import substitution policy feasible for these products.

Products such as plastic products, dairy products, printing and publishing, meat and meat products, fruits and vegetables, textiles, leather, and basic metals have lower substitution elasticities than the first group. While they also have considerable substitutability with imported counterparts, their substitution power is relatively lower. Thus, an import substitution policy is likely to be moderately successful for these products, although not as significantly as in the previous group.

Products such as computer, electronic, and optical products have substitution elasticities close to one, meaning they are not considered strong substitutes for similar imported goods. Therefore, an import substitution policy—at least in the short term—will not be feasible for these products. However, if domestic prices increase relative to

import prices (e.g., due to tariff and subsidy reductions), the increase in imports relative to domestic production will be less than 1%. In other words, domestic consumers will not immediately switch to imported alternatives in response to rising domestic prices.

The findings of this study indicate that trade fluctuations have a significant impact on the substitution elasticity of selected goods. Fisher (1993) defines economic stability as low and predictable inflation rates, appropriate interest rates for investment, a suitable budget deficit-to-GDP ratio, and an exchange rate close to the equilibrium level. Analyzing the main indicators of economic stability in the country reveals that Iran's economy has experienced budget deficits, high inflation rates, negative real interest rates, and severe exchange rate fluctuations, all of which contribute to trade fluctuations. Oil price volatility has led to instability in oil export revenues. Under such conditions, expanding non-oil exports to enhance economic flexibility, mitigate the impact of oil price volatility, and secure foreign currency for importing capital and intermediate goods to support economic growth are among the key objectives of the country's economic development strategy.

Considering the above discussions, when referring to substitution between goods, the common perception is often the replacement of two different but substitutable products. However, it is crucial to recognize that in many cases, a particular good may be produced domestically while a similar product is also imported and consumed. Based on this principle, if the price of a domestic good increases (or decreases) relative to its imported counterpart, the volume of imports relative to domestic production will change accordingly. Therefore, estimating the substitution elasticity of imports relative to domestic production—known as the Armington elasticity—is essential, which has been achieved in this study.

More specifically, when two goods are perfect substitutes, their price ratio remains constant, and by definition, the substitution elasticity between them is infinite. However, in the real world, this outcome does not apply to two similar goods produced in different countries; they are not perfect substitutes. For example, consider a country that imposes various tariffs (for any reason) to restrict the free trade of goods and services. If, for any reason, these tariffs are reduced and trade is liberalized, the relative price of imported goods will decrease compared to domestic goods, leading to import substitution relative to domestic production.

Additionally, products manufactured in different countries vary due to differences in labor, capital, technology, and resources, as well as disparities in production capacity (availability or scarcity of goods). As a result, product quality differs across countries, and production costs are often not identical.

A product manufactured in different locations, while generally similar, may have significant differences from the perspective of buyers. These differences may arise from factors such as the historical quality of a brand, the use of high-quality raw materials, a strong reputation, or economic cycles such as recessions and booms. Consequently, even though similar goods are produced in different countries, they are not perfect substitutes and are perceived as distinct by consumers.

Thus, each country demands not only the goods it produces but also similar products from other countries due to perceived differences in quality and origin. In other words, a country supplying a particular product in global markets is not only differentiated from other producers due to its unique production characteristics but can also be identified based on demand patterns. Therefore, the demand for products can be theoretically distinguished both by product type and by the location of production.

The results indicate that trade fluctuations have a significant positive impact on the substitution elasticity of selected goods during economic boom periods. A boom refers to a period of increased economic activity within an economy, market, or industry. During an economic boom, key economic indicators such as gross domestic product (GDP) rise, sales of goods and services increase, businesses thrive, and household incomes grow. Economic booms drive stock market growth and increase trading activity. However, it is important to note that economic booms carry the risk of high inflation. When demand surpasses supply, producers raise prices.

The primary causes of economic booms vary across time periods. For instance, the economic boom in the United States during the 1920s was driven by technological advancements that led to mass production, the electrification of the country, new mass marketing techniques, the availability of affordable financing, and increased employment. Generally, economic growth is defined as an increase in the production of goods and services over a specific period compared to

other periods. If the production of goods or services in an economic system increases, economic growth is said to have occurred. Based on this concept, GDP is often considered a key measure of economic growth.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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