Le Thi Anh Tuyet (Vietnam)

APPLYING THE LASSO METHOD TO PREDICT THE IMPACT OF TARIFF REDUCTIONS ON CUSTOMS REVENUES IN VIETNAM

Abstract

The study assesses the impact of tariff reductions on fluctuations in customs revenues in Vietnam. The collection of research data was based on the official sources, namely the Government's Web Portal and the World Bank's website, and took place between 2002 and 2017.

This paper uses the LASSO (Least Absolute Shrinkage and Selection Operator) linear regression model to estimate and predict the relationship of data series, thereby drawing a regression equation to consider the impact of various factors on customs revenues. The results have proven that tariff reductions have no negative impact on customs revenues. When tariffs are reduced, import turnover increases, the level of compliance with tax laws by import-export enterprises increases, and smuggling and trade fraud decrease. Based on these conclusions, the paper proposes several policies aimed at ensuring future customs revenues in Vietnam. As follows from the findings provided below, in order to ensure customs revenues, the Vietnamese Government should introduce appropriate policies to improve the efficiency of customs management in Vietnam; envisage accurate planning and reasonable investment for the customs office in terms of facilities and human resources; establish reasonable non-tariff barriers to prevent fraud and abuse causing losses in customs revenues.

Ле Тхі Ан Тует (В'єтнам)

ЗАСТОСУВАННЯ МЕТОДУ LASSO ДЛЯ ПРОГНОЗУВАННЯ ВПЛИВУ ЗНИЖЕННЯ ТАРИФІВ НА МИТНІ ДОХОДИ У В'ЄТНАМІ

Анотація

У роботі оцінено вплив зниження тарифів на коливання митних доходів у В'єтнамі. Збір даних дослідження проводився у період з 2002 по 2017 рік на основі офіційних джерел, а саме урядового веб-порталу та веб-сайту Світового банку.

Для оцінки та прогнозування взаємозв'язку рядів даних використано модель лінійної регресії LASSO (найменший абсолютний оператор усадки та відбору), на основі чого складено рівняння регресії для врахування впливу різних факторів на митні надходження. Доведено, що зниження тарифів не має негативного впливу на митні доходи. Зниження тарифів веде до збільшення обсягу імпортних операцій, зростання рівня дотримання податкового законодавства імпортно-експортними підприємствами та зменшення випадків контрабанди та шахрайств у сфері торгівлі. З огляду на це запропоновано кілька стратегій, спрямованих на забезпечення митних надходжень у В'єтнамі в майбутньому. Як випливає з наведених нижче висновків, для забезпечення митних надходжень уряд В'єтнаму повинен запровадити відповідну політику для підвищення ефективності управління митними послугами в країні; передбачити чітке планування та розумні інвестиції для органів митної служби з точки зору засобів і людських ресурсів; встановити розумні нетарифні бар'єри для запобігання шахрайству та зловживанням, що спричиняють збитки в митних доходах.

Le Thi Anh Tuyet, Ph.D., Professor, International Economic Faculty, Banking University Ho Chi Minh City, Vietnam.

INTRODUCTION

Right after officially joining WTO in January 2007, Vietnam set to actively implement its commitments on tariff cuts with a reduction of 1.812 import tax lines at an average reduction rate of 14.5%. Free trade commitments entered the stage of more aggressive tariff reduction. Both the US-Vietnam Bilateral Trade Agreement (BTA) and the new-generation free trade agreements (FTAs), such as the EU-Vietnam Free Trade Agreement (EVFTA) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), are expected to prove efficient shortly. The expansion of international integration can help Vietnam boost exports, diversify import markets, and avoid dependence on a number of traditional raw material markets.

However, when discussing the issue of Vietnam's customs revenues in the context of international integration, there are two conflicting opinions to consider. In one respect, Vietnam's customs revenues will sharply decline due to tariff reductions, and it will be necessary to increase domestic revenue sources. The Vietnam Government should implement personal income tax regulations, which may offset the shortage of import and export taxes. At the same time, this source does not guarantee permanent compensation because the competition of low-cost imports forms domestic production and tax collection. Alternatively, reducing the import and export taxes may advance the foreign trade raise because the WTO members may also reduce their taxes and remove non-tariff barriers for Vietnamese goods. Therefore, the total state budget is still capable of growth and a positive balance sheet.

The status of customs revenues and tariff reductions in Vietnam requires a closer look. Currently, Vietnam has established diplomatic relations with more than 180 countries around the world. Over 230 world markets receive goods exported from Vietnam due to expanded trade relations. The country is an official member of ASEAN, ASEM, APEC, WTO, and CPTPP. The international economic integration tends to expand trade relations with a significant increase in the number of countries and organizations. It can provide an opportunity for Vietnam to become a developed economy, and this also forms an inevitable trend. In fact, Vietnam's integration into the world economy in recent years has promoted import and export activities, thus contributing significantly to economic growth. However, Vietnam has been facing many macroeconomic instabilities, including a growth slowdown. According to the report on the economic growth sent to the Economic Committee of the National Assembly, from 2011 through 2015, the average annual GDP growth amounted to 5.88%, which appeared the lowest growth rate since 2000, as estimated by the Ministry of Planning and Investment. The average GDP growth rate figured up to 7% in the 2006–2010 period, and between 2001 and 2005, it was 7.51% (Ministry of Planning and Investment, 2016). To prevent an economic recession, maintain a well-balanced and sustainable economic growth, the Vietnam Government is implementing additional stimulus measures with relatively substantial financial assistance sources extensively deducted from the state budget. Meanwhile, the revenue for the budget is predominantly deducted from taxes. Vietnam's customs revenues constitute about 30% of the total budget revenues.

1. LITERATURE REVIEW

Numerous domestic and foreign authors discussed the effect produced on tariffs by international integration, namely Walsh (2003), Finger and Schuler (2000), Filmer (2003), Rege (2002), King (2003), Baunsgaard and Keen (2005), DiJohn (2010), Ghimire (2005), Gundogdu (2011), Rajkarnikar (2006), and Clarete (2004), just to name a few. Their studies partly explain the fact that many countries are still not taking the initiative towards full trade liberalization. Developing countries, in particular, always try to implement policies aimed at trade reforming, yet they put efforts into avoiding significant state budget losses. Therefore, the degree of a country's trade liberalization depends in part on the degree of change in its import and export tax revenues and on its ability to respond to tariff reductions. According to DiJohn (2010), if the reduction in a tariff revenue is easily offset by increasing domestic indirect taxes, the tariff reduction will no longer be a substantial obstacle to a country's trade liberalization path. Vietnam can be seen as a good example to analyze these challenges in a developing country's trade liberalization pathway as its budget is heavily dependent on trade tariffs.

However, the estimation results in the quantitative model of overseas empirical studies on the impact of tariff reduction on customs revenues cannot apply to Vietnam due to the differences in economic, political, managerial, and legal practices, as well as integration levels and trade elasticity. The tariff reduction effects on customs revenues in Vietnam will not resemble other countries worldwide. Most studies in Vietnam use comparative methods and analyze statistical data. A few studies apply quantitative methods or surveys. It is difficult to quantify and discern the tariff reduction impact on import and export tax revenues. Therefore, the author has written this article to build a specific quantitative study aimed at predicting the impacts of the implemented tariff reduction on customs revenues in Vietnam with the help of the LASSO regression method. By reducing and eliminating coefficients that can reduce variance without significantly increasing a bias, LASSO is regarded as a better predictor than the previous OLS regression methods.

As it follows from the theory of tariffs, import taxes tend to increase prices in the domestic market, reduce imports, and increase the country's budget revenue. This is to say that a 1% increase in tariffs can lead to fluctuations in a country's import and export tax revenues.

Economist Laffer (1940) studied tax revenues and proposed a curve model showing the relationship between the tax rate and the total tax revenue. The Laffer curve relied on the theoretical curve. Laffer showed that tax increasing in the United States would adversely affect social productivity, and at a reasonable tax rate, the total tax revenue would be maximized. A taxing country's perspective is that tariffs will yield revenue to such a taxing country. But, when it comes to the whole economy, tariffs reduce the general economic welfare because of the reduced efficiency of exploiting the resources within the world economy. Under such conditions, the trade balance changes, and a country's export and import activities become adjusted. Conversely, high tariffs can also negatively influence the goods flow in a country. High tariffs affect the competitiveness of imported goods and therefore reduce the volume of goods consumed. High tariffs also stimulate informal trade. Export duties raise the price of goods in the international market and keep it lower in the domestic market. That may reduce the number of overseas customers as they will look for alternative products. At the same time, it discourages domestic manufacturers from applying scientific, technical, and technological advances to increase productivity, quality, and lowering costs. However, if the substitutability is low, the export tax will not reduce the volume of exports and still bring significant benefits to the exporting country. Import duties play an important role in protecting the domestic market, in particular, the commencing domestic manufacturing industries. Import duties increase the price of goods, which encourages domestic producers. Import duties can also help improve the trade balance of the taxing country. There may be some large-scale economy country products whose prices do not increase to a great extent when taxed. For these goods, tariffs can put pressure on overseas producers to lower prices in order to avoid excess products in the economy. Profits will then be partly transferred to the importing country. To achieve that effect, however, the importing country must be a country with a large-scale economy capable of significantly controlling the world's demand for imported goods.

Numerous international and Vietnam's studies aim to clarify the impact of tariffs on customs revenues. Walsh (2003) confirmed that the implementation of preferential tariffs was an integral part of the trade liberalization trend, along with other regulations, such as quotas, import, and export licenses, etc. This process should change the tax revenue in each country.

Finger and Schuler (2000) analyzed the impact of a commitment on tariff preferences with a more comprehensive scope for improving transparency, objectivity, and fairness. This affects the level of compliance with import and export taxes and increases the import and export volume of enterprises, thus ensuring the country's customs revenue. Similarly, Filmer (2003) showed that the commitment to preferential tariffs in the long term would reduce trade frauds and irregularities on import and export duties of enterprises, thereby ensuring customs revenues for the said countries. In contrast, Rege (2002), after analyzing the problems arising from the commitment of tariff preferences, highlighted some difficulties for developing countries in response to tariff cuts because of reducing customs revenues.

King (2003), Ghimire (2005), Finger and Schuler (2000) argued that the high-priority problem for developing countries in implementing tariff preferential treatment commitments was identifying the origin for import and export goods.

Pritchett and Sethi (1994) offered an opinion that importers and exporters would tend to evade taxes when tariffs increase. Therefore, import and export tax revenues would not increase proportionally to the tariff increase rate. This means that tariff reductions may also not cause a decrease in customs revenues because tax reductions may reduce tax evasion and increase imports. In an identical view, Ebrill, Stotsky, and Gropp (1999), Khattry and Rao (2002) conducted studies to determine the optimal tax rate to maximize the national customs revenue. These studies partly showed the relationship between customs revenues and import-export tax rates.

2. AIMS

The research aims to consider the LASSO method application while predicting the impacts on customs revenues caused by tariff reduction in Vietnam.

3. METHODS

According to Gundogdu's study (2011), the customs revenue of a country depends on three principal variables: the import turnover, the average tariff, and the variable representing the indirect impact of the average tariff. Therefore, the general research equation is as follows:

$$CR = f (IMP, TRF, IndTRF), \qquad (1)$$

where *CR* – the revenues collected by the customs authorities from goods imported and exported; these include the export tax, import tax, special consumption tax, value-added tax, and the environmental protection tax for imported goods, etc. The data on Vietnam's customs revenues during 2005–2017 were collected based on quarterly reports published on the Ministry of Finance's website in the international data quarterly section on customs revenues; from 2002 to 2004, the data proceeded from the Government's Web Portal and reported the socio-economic situation quarterly.

That means that the principal customs revenues will express the sum of import duties, value-added taxes, and excise taxes on imported goods. In particular:

Import tax = Quantity · Customs value of imported goods · tax rate,

Special Consumption Tax = Quantity · (customs value of imported goods + import duty) · tax rate,

Value added tax = quantity · (customs value of imported goods + import tax + special consumption tax) · tax rate.

It can be observed that customs revenues are not a simple product of imports and an average tariff, but a combination of taxes imposed on imports. Moreover, the revenue for each tax is determined based on the taxable value of each tax. The tax calculation value of each basic tax is determined subject to the customs value of the imported goods, not the import turnover. It depends considerably on the international commitments that Vietnam made in the field of customs in each period. To be more specific, currently, Vietnam determines the customs value of imported goods based on the GATT Value Agreement of 2004.

IMP – the import turnover, namely the country's currency balance for import goods and services in a fixed period that usually lasts months, quarters, or years. The import turnover by a quarter in Vietnam is based on the data reported on the Government's Web Portal, within the socio-economic development section quarterly from 2002 to 2017.

TRF – the average tariff rate, namely the average import tax rate that includes the weight of the corresponding import value of goods. The tax rate for goods will be classified either by chapter or by section in the list of a harmonized system (HS) including description and goods codes that is presented by the World Customs Organization.

It is the preferential import tax rate, the rate applicable to goods originating from countries that have agreed upon the most favored nation treatment in trade relations. Import values are calculated with the reliance on the databases proposed by statistical offices in each country according to the items in a group, chapter, or section within the HS list. Based on this calculation, the World Bank announced the average tariff of several countries, including Vietnam, on its official website from 2002 to 2017.

IndTRF – a variable showing the indirect effects of TRF in Vietnam that is defined as the product of IMP and TRF.

Gundogdu (2011) presented an empirical analysis of Muslim countries concerning the fluctuations in customs revenues when there is a tariff adjustment:

$$LnCR^{it} = \beta + \beta\, LnIMP^{it} + \beta\, Ln(100 + TRF^{it}) + \beta\, IndTRF^{it} + \beta\, CVA^{it} + \beta\, IndCVA^{it} + e^{it}, \quad (2)$$

where i - the importer (an OIC member country), t – years, CR - customs revenues of country i, IMP^{it} - imports of country i in year t, TRF^{it} - a weighted tariff rate of country i imposed on products imported in year t, CVA - one variable as proxy for the effect exerted through implementing the WTO Customs Valuation Agreement, CVA^{it} - a dummy variable taking the value of 1 for the observations if country i implemented the WTO Customs Valuation Agreement in year t. This dummy variable captures the fluctuations in customs revenues as a result of the implemented agreement. $IndTRF^{it}$ - the indirect effect of tariffs thorough imports on customs revenues.

This paper uses the LASSO linear regression model to estimate and predict the relationship of data series, thereby drawing a regression equation to consider the impact of factors on customs revenues. Fonti and Belitser (2017) proved that LASSO (Least Absolute Shrinkage and Selection Operator) is a powerful method that performs two main tasks, including regularization and feature selection. Concerning the sum of absolute values based on the model parameters, the LASSO method requires that the sum fall less than a fixed value (the upper bound). To achieve this, the strategy introduces a shrinking (regularization) process while penalizing the regression variable coefficients, with some of them shrunk to zero. The feature selection involves the variables with a non-zero coefficient following the compression fulfillment that are selected for the inclusion in the model. This process aims to mitigate misprediction. In real-world contexts, it appears critical to adjust parameter λ, which controls the punishment strength. Actually, when λ is reasonably high, the coefficients should amount to zero, and in these circumstances, it is possible to reduce dimensionality. With an increase in parameter λ, the number of coefficients shrunk to zero increases as well. Alternatively, if $\lambda = 0$, we obtain an OLS (Ordinary Least Squares) regression. The LASSO method, when utilized, embodies numerous preferences. Above all, it can ensure an exact prediction due to the fact that shrunk and removed coefficients reduce fluctuations without a substantial increase in biases. It appears to be of particular assistance with inconsiderable observation and a large number of features. When it comes to adjusting parameter λ, it is clear that a bias increases, followed by a decrease in fluctuations when λ increases. Undoubtedly, it is necessary to determine a trade-off between biases and fluctuations.

The least squares estimate (OLS) for pairs β_0, β is based on minimizing a square error as follows:

$$\min\left\{\sum_{i=1}^{N}(y_i - \hat{y}_i)^2\right\} = \min_{\beta_0, \beta}\left\{\sum_{i=1}^{N}\left(y_i - \beta_0 - \sum_{j=1}^{p} x_{ij}\beta_j\right)^2\right\} = \min_{\beta_0, \beta}\| y - \qquad (3)$$

$$\beta_0 1 - X\beta \|^2.$$

Like OLS, LASSO is also the estimation method for pairs β_0, β, but it includes shrinking of these parameters. Specifically, LASSO provides the solution to the min (3) with the condition that the parameter is tied:

$$\min\left\{\sum_{i=1}^{N}(y_i - \hat{y}_i)^2\right\}. \qquad (4)$$

Conditions:

$$\| \beta_j \|_2 \leq t.$$

Solving this problem is equivalent to solving the following minimization problem:

$$\min \left\{ \sum_{i=1}^{N} (y_i - \hat{y}_i)^2 + \lambda \parallel \beta_j \parallel_2 \right\}.$$

Where λ is a parameter greater than 0.

Since $\lambda \parallel \beta_j \parallel_2 > 0$, LASSO provides an estimate of the pairs β_0, β so that the predicted $\hat{y}$ values will be closer to the actual y_{ii} values than OLS. However, the estimates for pairs β_0, β will be biased against OLS.

Thus, we need to build a linear function according to the above variables as follows:

$$y = f(x_1, x_2, ..., x_p) = w_0 + \sum_{k=1}^{p} w_k x_k. \qquad (5)$$

Assume that through data collection, we obtain n sets of data: y^i, x_1^i, x_2^i... x_p^i $i=1, 2,..$; n is the data for the ith record. Normally, we find coefficients w_k, $k=0, 1, 2..., p$ so that the squared error is the smallest. As a result, the problem is solved as follows:

$$\min \left\{ \frac{1}{2n} \sum_{i=1}^{n} (w_0 + \sum_{k=1}^{p} w_k x^i - y^i)^2 \right\}. \qquad (6)$$

The convex optimization problem differentiable isn't difficult to solve with different tools. A reduction approach is often used for these purposes. The popular method applied in economic models is linear regression; however, it provides a very intuitive explanation. Guided by the magnitude of weights, we can see that a specific attribute greatly influences Vietnam's customs revenues.

Selecting the optimal lambda value introduces a crucial task in the LASSO algorithm. It is selected by such methods as cross-validation, theory-driven, and information criteria. Cross-validation helps to determine the optimal lambda value by dividing the data into K groups, referred to as folds. The theory-driven method relies on an iterative algorithm for estimating the optimal lambda value in the presence of non-Gaussian and heteroskedastic errors. The optimal lambda value can also be selected using information criteria: Akaike information criterion (AIC), Bayesian information criterion (BIC), Extended Bayesian information criterion (EBIC), and the corrected AIC (AICc).

In this research, the authors determine the optimal lambda value by cross-validation. Cross-validation is applied to assess the out-of-sample prediction performance of the estimator. The cross-validation method splits the data into K groups, referred to as folds, of approximately equal size.

Let n_k denote the number of observations in the *k-th* data partition with *k=1,...,K*. One fold is understood as the validation dataset, and the remaining *K-1* parts constitute the training dataset. The model is fit to the training data for the given lambda value. The resulting estimate is denoted as $\beta(1, \lambda)$. The mean-squared prediction error for group 1 is computed as:

$$MSPE(1, \lambda) = \frac{1}{n_1} \sum_{i=1}^{n_1} (y_i - \beta_0 - \sum_{j=1}^{p} x_{ij} \beta_j (1, \lambda))^2. \qquad (7)$$

The procedure is repeated for *k=2,... K*. Thus, MSPE (2, λ)... MSPE (K, λ) are calculated.

Then, the *K*-fold cross-validation estimate of the MSPE, which serves as a measure of prediction performance, is as follows:

$$CV(MSPE(\lambda)) = \frac{1}{K} \sum_{k=1}^{K} MSPE(k, \lambda). \qquad (8)$$

The selected optimal lambda value will have the smallest $CV(MSPE(\lambda))$.

4. RESULTS

The chart above illustrates that in the past 15 years, Vietnam's average tariff continuously decreased from 13.4% in 2002 to 6.51% in 2017. This is the inevitable result of the international economic integration process and implemented tariff reduction in Vietnam. However, the volume of customs revenues in Vietnam still maintained an upward momentum during this period. Specifically, in 2002, the Vietnam's customs revenue was only VND 31.517 bln, but in 2017 it reached VND 97.018 bln, of which the highest value was VND 173.366 bln in 2014. Although, this is the first-stage implementing of customs valuation in accordance with the principles of the GATT Value Agreement, tax evasion and fraud were quite common. Besides, it can be seen that after reaching the highest value in 2014, the customs revenues of Vietnam decreased, even though the tariff still keeps displaying the downward trend. Therefore, the authors ought to mention a link between the fluctuations in customs revenues and tariffs in Vietnam and the issue of predicting these fluctuations in the future. Vietnam will inevitably have to continue to reduce tariffs following the free-trade commitments. From this perspective, predicting the tariff reduction effects exerted on customs revenues will be of great significance for Vietnam in the near future.

This study proves two important conclusions: increasing import and export tax rates that increase customs tax revenues may be true for large countries but not always for smaller countries because, in countries with small economies, the tax rate increase will have indirect effects that reduce the revenue from the import tax through a decrease in the amount of imports greater than the direct impact due to the increase in tax rates.
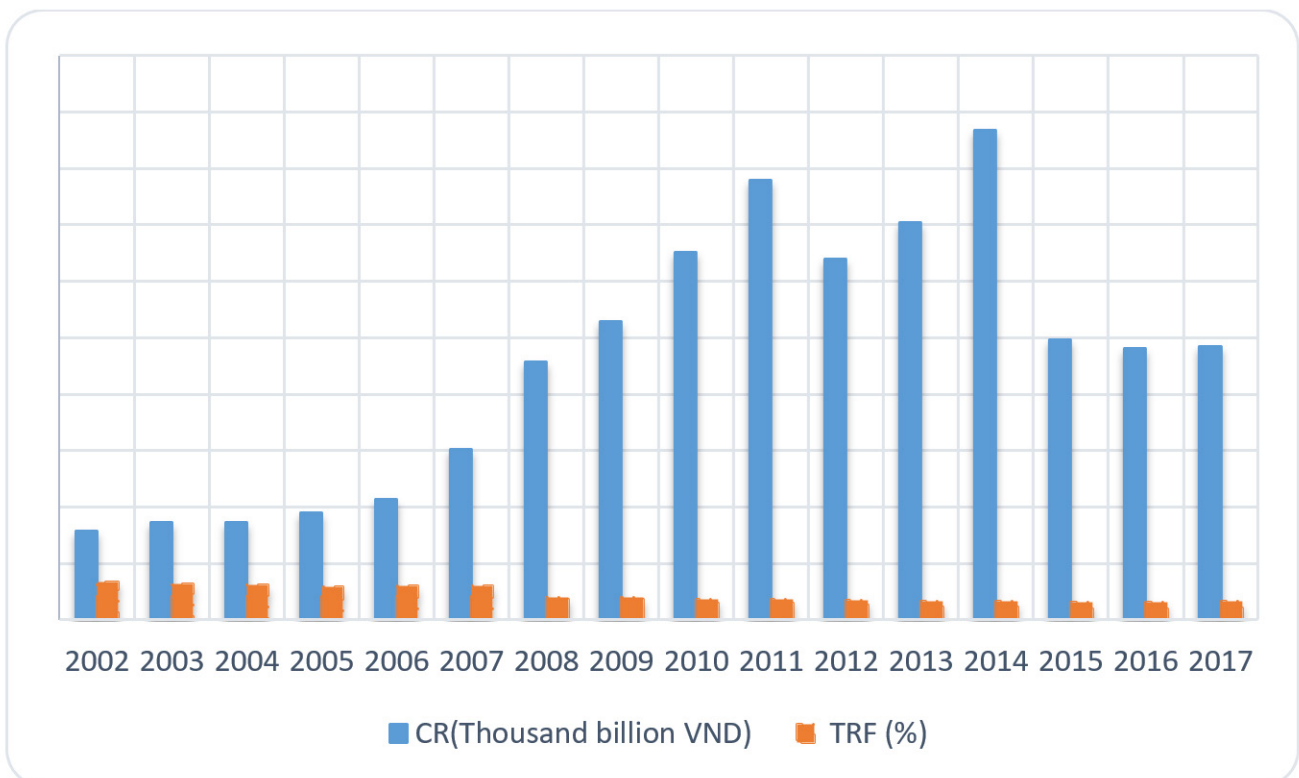
Source: CR – international publication data provided by Vietnam Ministry of Finance
(The world bank, n.d.).

Figure 1. Vietnam customs revenue and average tariffs from 2002 to 2017

Table 1. Descriptive statistics

	CR	IMP	TRF
Mean	22804.96875	23.6190625	9.02625
Standard Error	1505.883551	1.828180632	0.337286051
Median	22760	21.302	7.63
Mode	#N/A	#N/A	13.4
Standard deviation	12047.06841	14.62544505	2.698288405
Sample variance	145131857.2	213.903643	7.280760317
Kurtosis	–1.00636862	–0.74697978	–1.61824100
Skewness	0.284990914	0.517195052	0.485242979
Range	42662	53.97	7.22
Minimum	5658	3.895	6.18
Maximum	48320	57.865	13.4
Sum	1459518	1511.62	577.68
Count	64	64	64

This datasheet has provided imperial data proving that the customs revenue and import turnover have monumentally changed over time. The minimum-maximum value gap is vast. Specifically, the value of Vietnam's customs revenues by a quarter in the period 2002 to 2017 fluctuated significantly from VND 5.658 bln to VND 48.320 bln. Similarly, the value of Vietnam's quarterly import also varies in a vast range, where the lowest value is USD 3.895 mln, and the highest value is USD 57.865 mln. Additionally, the customs revenue data are presented in blns of dongs, and the import turnover is in mlns of US dollars. These figures will change substantially over time, so when applying this model, the logarithm function will be used for either of these two variables to limit the variability of the data series. When analyzed, it will return to the percent unit as the TRF variable at the same time. The neural logarithm function also allows the study to show more clearly the customs revenue elasticity according to the independent variables in the model.

5. DISCUSSION

LASSO estimation. Once the CR, IMP, TRF, and IndTRF data were imported into the Stata 15 software and processed for the software requirements after installing LASSO, the authors determined the optimal value. The results are presented in the following Table 2.

Table 2. Optimal lambda definition

	Lambda	MSPE	St. dev.
	----------+--		
1	69.292653	.38002009	.02811016
2	63.136885	.33428824	.02622961
3	57.527978	.29197566	.02307576
4	52.417351	.25685642	.02039247
5	47.760738	.22770839	.01810667
6	43.517806	.203517	.01616034
7	39.651804	.18344001	.01450746
8	36.129247	.16677823	.01311137
9	32.919624	.15295123	.01194246
10	29.995135	.14147721	.01097614
11	27.33045	.13195618	.01019109
12	24.902488	.12407264	.00956098

Table 2 (cont.). Optimal lambda definition

	Lambda	MSPE	St. dev.
13	22.69022	.11764632	.00903271
14	20.674483	.11234991	.00863618
15	18.837819	.10799586	.00834447
16	17.164319	.10445036	.00813476
17	15.639488	.10155057	.00800489
18	14.250119	.09918	.00793936
19	12.984178	.0972453	.00792418
20	11.830699	.09566951	.00794731
21	10.779693	.094389	.00799871
22	9.8220545	.09335115	.00807021^
23	8.9494903	.09251254	.0081553
24	8.1544422	.09183728	.00824892
25	7.4300241	.09129579	.00834715
26	6.7699612	.09085781	.00844442
27	6.1685365	.09049131	.00853346
28	5.6205407	.09018921	.0086165
29	5.1212274	.08994216	.00869423
30	4.6662717	.08974615	.00876951
31	4.2517329	.08959171	.0088417
32	3.8740207	.08947105	.00891039
33	3.5298634	.08937777	.00897535
34	3.21628	.08930659	.00903647
35	2.9305546	.08925322	.00909373
36	2.6702122	.08921412	.00914718
37	2.4329979	.0891864	.00919693
38	2.2168571	.08916771	.00924311
39	2.0199176	.08915614	.0092859
40	1.8404737	.08910793	.00931486
41	1.6769711	.08961174	.00944938
42	1.5279936	.09005966	.0095476
43	1.3922509	.08971524	.00958396
44	1.2685671	.08813358	.00975777
45	1.1558711	.08678059	.00995313
46	1.0531867	.08567994	.01015607
47	.95962451	.08478677	.01036217
48	.87437411	.08406403	.01056798
49	.79669713	.08348112	.0107708
50	.72592075	.08301276	.01096856
51	.66143195	.08263814	.01115972
52	.60267216	.08234007	.01134315
53	.54913243	.0821044	.01151809
54	.50034901	.08191949	.01168405
55	.45589939	.08177577	.01184078
56	.41539854	.08166537	.01198822
57	.37849568	.08158185	.01212643
58	.34487117	.08151992	.01225561
59	.31423376	.08147525	.01237603
60	.2863181	.08144432	.01248802
61	.26088239	.08142425	.01259196

Table 2 (cont.). Optimal lambda definition

	Lambda	MSPE	St. dev.
62	.23770632	.08141269	.01268824
63	.21658914	.08140774	.01277728*
64	.19734796	.08140787	.01285951
65	.17981611	.08141185	.01293535
66	.16384174	.08141867	.01300522
67	.1492865	.08142754	.01306951
68	.13602429	.08143782	.01312862
69	.12394027	.08144902	.01318292
70	.11292976	.08146075	.01323276
71	.10289739	.08147269	.01327847
72	.09375627	.08148462	.01332038
73	.08542722	.08149636	.01335877
74	.0778381	.08150778	.01339393
75	.07092318	.08151879	.01342611
76	.06462256	.08152931	.01345556
77	.05888167	.08153931	.01348248
78	.05365078	.08154877	.0135071
79	.0488846	.08155767	.0135296
80	.04454182	.08156602	.01355016
81	.04058485	.08157382	.01356894
82	.0369794	.08158109	.01358609
83	.03369426	.08158785	.01360175
84	.03070095	.08159412	.01361605
85	.02797356	.08159993	.0136291
86	.02548847	.0816053	.01364101
87	.02322414	.08161026	.01365188
88	.02116098	.08161483	.01366179
89	.01928109	.08161904	.01367084
90	.01756821	.08162291	.01367909
91	.0160075	.08162647	.01368661
92	.01458544	.08162973	.01369347
93	.01328971	.08163273	.01369973
94	.01210909	.08163548	.01370544
95	.01103335	.081638	.01371064
96	.01005318	.08164031	.01371538
97	.00916008	.08164242	.01371971
98	.00834632	.08164435	.01372365
99	.00760486	.08164612	.01372725
100	.00692927	.08164774	.01373052

Note: * lopt = a lambda that minimizes MSPE. Run model: cvlasso, lopt; lse = the largest lambda for which MSPE is within one standard error of the minimal MSPE. Run model: cvlasso, lse. K-fold cross-validation with 10 folds. Elastic net with alpha=1. Fold 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

The optimal lamda was selected based on the Mean Squared Percentage Error (MSPE) criteria. The optimal lamda is determined corresponding to the smallest MSPE. The results showed that the lambda value in line 63 reached the optimal value by .21658914. Use this lambda value to get the LASSO regression quantity.

Table 3. Regression coefficients by the LASSO method

Selected	Lasso	Post-est OLS
LnIMP	0.9625053	1.1099573
TRF	-0.0780206	-0.0610751
IndTRF	-0.0052129	-0.0060721
Partialled-out*		
_cons	8.6864674	8.2553748

As we discussed above, the LASSO regression model does not eliminate the effect of independent variables by using P-Value as in the OLS regression. The LASSO regression models will automatically remove those less effective variables and retain the most relevant variables only. This approach is suitable for models with little input and a few explanatory variables within this model. The above LASSO regression table shows that all IMP, TRF, and IndTRF variables are retained in the model. This indicates that all three variables have implications for changing customs revenues in Vietnam. Therefore, predicting future customs revenue modifications can be assessed through the regression coefficient analysis of independent variables within the model.

The results exhibit the variables of the import turnover, average tariffs, and indirect effects of average tariffs that all affect Vietnam's customs revenues. In particular, the import turnover has the most positive impact: when it increases by 1%, the customs revenue increases by 0.96%. In contrast, the regression coefficients of tariff variables and the indirect effects of tariffs are negative. This suggests that tariff reductions will exert both direct and indirect impact, thus increasing customs revenues in Vietnam. However, that impact level is not extensive. If a tariff is reduced by 1%, it will increase Vietnam's customs revenue by 0.08.

CONCLUSION

This paper aims to consider the tariff reduction impact on customs revenues in Vietnam by utilizing the LASSO linear regression method for data samples from the first quarter of 2002 to the fourth quarter of 2017. The study has shown that tariff reductions have both direct and indirect effects on the fluctuations in our customs revenues. In particular, the coefficient shows that the direct and indirect impact exerted on customs revenues with tariffs is negative. Such a result proves that tariff reductions have a direct and indirect impact that increases the customs revenue of Vietnam. This is expressed by the fact that when tariffs are reduced, the competition between domestic and imported goods increases, with an advantage to quality and brand. The demand for imported goods tends to increase, causing an impact on increasing import turnover.

Moreover, according to the Behavioral theory, the cost of tax conformity affects compliance through income effects; the increased compliance costs will hinder the decision to comply with taxes and vice versa. Therefore, the tariff reduction will reduce the tax compliance cost, which ultimately supports reducing tax evasion. To sum up, the immediate impact of tariff reductions is to increase imports, minimize trade frauds on import and export taxes, and increase customs revenues in Vietnam. The Laffer curve theory also proves the same: Vietnam's tariffs were extra-high in the past in order to protect domestic production.

As is evident from the foregoing, tariffs are no longer the principal cause of fluctuations in Vietnam customs revenues. In particular, according to the LASSO regression results, the regression coefficients show the direct impact of average tariffs (–0.0780206) and the indirect impact of average tariffs (–0.0052129). Against this background, it may be concluded that tariff reductions will not cause significant fluctuations in customs revenues and will have a slight impact on the same. It also bears mentioning that although Vietnam's tariffs have been continuously reduced in line with a roadmap of Vietnam's tariff reduction commitments related to international agreements, the state budget revenues of Vietnam's customs remain increased over time. This fact shows that the level of tariff reduction impact on customs revenues has not been elevated to a great extent. The management efficiency of the customs office presents a decisive factor in securing Vietnam's customs revenues. Vietnam's customs office has continuously promoted modernization, standardization, and harmonization following the international standards in order to improve the state management capacity on customs in general and the compliance of tax law in particular. Thereby, significantly reducing the threat of commercial fraud through tax calculation values, transfer pricing, etc., the country managed to ensure state budget revenues.

Hence it appears that the authorities should not be too concerned about the international integration effects exerted on tariffs on customs revenues in Vietnam. Pursuant to the research results, Vietnam's customs revenues are no longer sensitive to the increase or decrease in tariffs. The current customs revenues of Vietnam will largely depend on the management effectiveness, the level of transparency, modernization, and facilitating the customs clearance of import and export goods, as well as the ability to prevent trade frauds relating to import and export taxes. Notably, customs revenues will depend predominantly on the effectiveness in the determination of tax calculated values, the origin of goods and HS codes of Vietnam's customs. To succeed in these activities, the State and the Ministry of Finance of Vietnam need to put into effect accurate planning and reasonable investment for the customs office in terms of facilities and human resources. In order to be transparent, fair, and effective, it is necessary to deploy the application of information technology extensively within the whole state customs service and recruit officials with high professional qualifications, proficiency in informatics and foreign languages.

AUTHORS CONTRIBUTIONS

Conceptualization: Le Thi Anh Tuyet.
Data curation: Le Thi Anh Tuyet.
Formal Analysis: Le Thi Anh Tuyet.
Funding acquisition: Le Thi Anh Tuyet.
Investigation: Le Thi Anh Tuyet.
Methodology: Le Thi Anh Tuyet.
Project administration: Le Thi Anh Tuyet.
Resources: Le Thi Anh Tuyet.
Software: Le Thi Anh Tuyet.
Supervision: Le Thi Anh Tuyet.
Validation: Le Thi Anh Tuyet.
Visualization: Le Thi Anh Tuyet.
Writing – original draft: Le Thi Anh Tuyet.
Writing – review & editing: Le Thi Anh Tuyet.

REFERENCES

1. Baunsgaard, T., & Keen, M. (2005). *Tax Revenue and (or?) Trade Liberalization* (IMF Working Paper WP/05/112). Retrieved from https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Tax-Revenue-and-or-Trade-Liberalization-18252
2. Clarete, R. (2004). *Customs Valuation Reform in the Philippines* (Background paper prepared for the World Development Report 2005). Retrieved from https://openknowledge.worldbank.org/handle/10986/9076
3. DiJohn, J. (2010). *The Political Economy of Taxation and State Resilience in Zambia since 1990* (Working Paper No. 78). Retrieved from https://www.lse.ac.uk/international-development/Assets/Documents/PDFs/csrc-working-papers-phase-two/wp78.2-political-economy-of-taxation-in-zambia.pdf

4. Ebrill, L., Stotsky, J., & Gropp, R. (1999). *Revenue implications of trade liberalization* (IMF Occasional Paper, 180). Retrieved from https://www.imf.org/external/pubs/nft/op/180/index.htm

5. Filmer, R. (2003). *South Asia FDI Roundtable/Customs administration: Impediments to Trade and Investment* (Discussion draft).

6. Finger, J., & Schuler, P. (1999). *Implementation of Uruguay Round commitment the development challenge* (World Bank Policy Research Working Papers No. 2215). Retrieved from http://documents1.worldbank.org/curated/en/457771468752978781/103503322_20041117155006/additional/multi-page.pdf

7. Fonti, V., & Belitser, E. (2017). *Feature selection using LASSO* (Research Paper in Business Analytics) (26 p.). Retrieved from https://beta.vu.nl/nl/Images/werkstuk-fonti_tcm235-836234.pdf

8. Ghimire, D. (2005). *The Legislative review study on customs policies of HMG.* Nepal: Centre for Public Policy Dialogue.

9. Greene, W. (2000). *Econometric analysis.* New Jersey: Prentice-Hall.

10. Gundogdu, A. (2011). Determinants of OIC countries' customs revenue Vis-à-Vis Implementation of WTO customs valuation agreement. *Journal of Economic Cooperation and Development, 32*(3), 39-64. Retrieved from https://www.econbiz.de/Record/determinants-of-oic-countries-customs-revenue-vis-%C3%A0-vis-implementation-of-wto-customs-valuation-agreement-g%C3%BCndo%C4%9Fdu-ahmet-%C5%9Fuayb/10009544457

11. Khattry, B., & Rao, J. (2002). Fiscal Faux Pas? An analysis of the Revenue Implication of trade liberalization. *World Development, 30*(8), 1431-1444. Retrieved from https://econpapers.repec.org/article/eeewdevel/v_3a30_3ay_3a2002_3ai_3a8_3ap_3a1431-1444.htm

12. King, J. (2003). *Next steps in tax reform* (IMF Preliminary report). Nepal.

13. Ministry of Planning and Investment (2016). *Report on the quality of economic growth sent to the Economic Committee of the National Assembly.* Hanoi.

14. Pritchett, L., & Sethi, G. (1994). *Tariff rates, tariff revenue, and tariff reform: some new facts* (World Bank Policy Research Working Paper, 1143). Retrieved from https://www.jstor.org/stable/3989884?seq=1

15. Rajkarnikar, P. (2006). *Implementation of the WTO customs valuation agreement in Nepal: An ex ante impact assessment* (Asia – Pacific Research and Training Network on Trade. Working Paper No. 18). Retrieved from https://www.unescap.org/sites/default/files/AWP%20No.%2018.pdf

16. Rege, V. (2002). *Customs valuation and customs reform, Development, trade and the WTO* (pp. 128- 138). Washington: World Bank.

17. The world bank (n.d.). *Tariff rate, applied, weighted mean, all products (%).* http://data.worldbank.org/indicator/TM.TAX.MRCH.WM.AR.ZS?page=2

18. Tibshirani, R. (1996). Regression Shrinkage and Selection via the LASSO. *Journal of the Royal Statistical Society. Series B (Methodological), 58*(1), 267-288. Retrieved from https://www.jstor.org/stable/2346178?seq=1

19. Walsh, T. (2003). Trade policy and customs Administration. In M. Keen (Ed.), *Changing Customs. Challenges and Strategies for the Reform of Customs Administration* (pp. 83-94). Washington: IMF. Retrieved from https://www.imf.org/external/pubs/nft/2003/customs