

Import Reliance and Government Revenue: Testing Tariff–Tax Relationships Across Developed Countries

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Abstract

This paper investigates the relationship between domestic consumption taxes and tariffs in developed countries, with a focus on how this relationship is influenced by a country’s import-to-GDP ratio. As countries reduce tariffs, in the context of trade liberalization, governments must explore alternative revenue sources, such as increasing domestic consumption taxes. We hypothesize that countries with high import-to-GDP ratios will substitute domestic taxes for lost tariff revenue more strongly than countries with low import dependency. Using data from 11 developed countries (Australia, Belgium, Canada, France, Ireland, Israel, Korea, New Zealand, Norway, Switzerland, and the United States). We find weak and inconsistent correlations between tariff levels and domestic tax revenue. Our results suggest that trade dependence alone does not determine fiscal substitution behavior, and other factors may influence how governments adjust their tax systems in response to changes in tariff revenue.

1 Introduction

Governments use both domestic consumption taxes and tariffs to increase revenue. As developed countries lower tariffs, an important question is how they replace the lost revenue from decreased tariffs. This can either happen within countries over time, as governments change their tax structure in response to declining tariffs, or across countries. Understanding this shift matters for trade policy and for how countries tax systems may be affected by declining tariff revenues.

This paper focuses on the relationship between domestic consumption taxes on goods and services and tariff revenue in developed developed countries. The goal is to examine how domestic consumption taxes relate to tariffs in developed countries and how this relationship depends on a country’s import-to-GDP ratio.

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Our hypothesis is that domestic consumption taxes will increase in developed countries that limit tariffs and that this relationship will be stronger in those countries with high import to GDP ratios than in countries with low import-to-GDP ratios. All else being equal, high-import countries rely on international trade for government revenue, so tariff reductions create larger revenue gaps that governments offset by increasing domestic consumption taxes. Optimal taxation theory predicts that under certain conditions, governments may raise domestic consumption taxes in order to maintain overall revenue when tariff revenue decreases. (Broadway, Maital and Prachowny, 2002). This effect should be strongest in countries that rely heavily on tariff revenue to finance federal funding.

To explore this question, we analyze data for 11 countries: Switzerland, Korea, Australia, France, Norway, Israel, the United States, Belgium, Ireland, Canada, and New Zealand over the years 2001-2020. We selected these 11 countries over the 2001-2020 time period because they represent a broad range of import-to-GDP ratios, allowing us to test whether substitution patterns differ between high trade-dependent countries and more closed ones. Additionally, because consistent data on tariff revenue and domestic consumption taxes are available for that full period. We distinguish between high and low import countries based on import-to-GDP ratios. We find little evidence that domestic consumption taxes increase as tariff revenue from declining tariffs decreases, regardless of the countries' import dependence. The empirical evidence between tariff levels and domestic consumption tax revenues is weak and inconsistent, and their directions are inconsistent with our hypothesis: high-import countries show a slight positive correlation, while low-import countries show a slight negative one. Visually, our scatterplots reinforce this finding. Some countries cluster at low levels of tariff revenue, with little variation in domestic consumption tax revenue as tariffs change. Countries with the highest import dependence, such as Ireland and Belgium, do not show stronger substitution patterns than countries with lower import-to-GDP ratios. Overall, our data suggests that developed countries may not rely on domestic consumption taxes to replace tariff revenue, or that any substitution effect is too small to detect in this sample. These findings provide mixed evidence on the prediction from optimal taxation theory and suggest that tariff and tax substitution may be weaker in developed countries.

The remainder of the paper includes literature reviews, data, results, and conclusion. The literature reviews summarize existing research on tariff revenue and domestic consumption taxation. The data section describes the data sources and variables. The results section presents the descriptive statistics and tables, and how we analyzed the data.

2 Literature Review

The relationship between tariff revenue and domestic taxation is the main focus of this research. There is a significant amount of research examining how governments adapt their fiscal systems in response to tariff reductions. Broadway, Maital, and Prachowny (1973) show that optimal tariff design follows the same principles regardless of revenue constraints and that domestic taxes should be structured as they would be in a closed economy. However, they reveal an important distinction: while the optimal structure of each tax system can be determined independently, governments must set actual tariff and domestic tax rates jointly to satisfy budget constraints.

Keen and Ligthart (2002) build on this framework, arguing theoretically that public revenue can increase through trade liberalization if domestic consumption taxes are increased while consumer prices remain stable. They show that replacing tariffs with consumption taxes enables countries to obtain efficiency gains from tariff reform without reducing public revenue. However, Keen and Ligthart

(2002) focus primarily on theoretical conditions rather than empirically testing whether high-import countries demonstrate different substitution patterns than low-import countries.

Benzarti and Tazhitdinova (2021) provide crucial empirical evidence on whether value-added taxes (VAT) actually affect international trade flows. Using VAT changes across EU countries from 1988 to 2016, they find that VAT rate changes have little effect on imports or exports. This supports the idea that VATs are largely trade neutral, meaning they don't significantly distort trade patterns the way tariffs do. This finding is relevant to our research because it addresses whether countries can replace lost tariff revenue with VATs without undermining the benefits of trade liberalization.

Furceri (2018) examines the broader macroeconomic consequences of tariffs using data from 151 countries over 1963–2014. They find that tariff increases lead to significant declines in domestic output and productivity, higher unemployment, while having only small effects on the trade balance. These findings are particularly important for understanding fiscal substitution because they demonstrate that trade liberalization doesn't just affect trade, it affects the whole economy. When countries reduce tariffs and experience economic growth, this could change both how much tax revenue they need and how much they can collect from domestic sources.

Waglé (2011) examines the fiscal consequence of trade liberalization in developing countries using data from 35 low income countries for 25 years. Waglé determines that as countries move away from trade based taxes, they only partially offset revenue losses with domestic sources of taxation. While many of these countries adopted VATs, that alone did not ensure successful revenue replacement. Our research differs by analyzing developed countries and explicitly testing whether import intensity affects fiscal substitution.

Ho (2023) examines how tax revenue and economic growth interact with trade openness in developing countries, building on Keynesian demand theory to argue that reducing tariffs decreases government revenue and weakens aggregate demand. Their paper finds that trade openness has mixed effects on tax revenue depending on the stage of development and institutional capacity. This is important to our research for several reasons. First, their work demonstrates that the relationship between trade policy and fiscal outcomes varies significantly from country to country. Some countries experience significant revenue losses from tariff reductions while others do not, depending on their level of development and institutional strength. Second, while Ho assumes that developing countries increase domestic taxes to offset tariff losses, our research tests whether fiscal substitution actually occurs in developed countries. Our results show that even developed countries with much higher tax revenues do not systematically substitute domestic taxes for tariff revenue based on import intensity, suggesting that fiscal substitution is not automatically driven by import dependency.

Sova (2011) takes a different angle by examining trade balance outcomes and whether Europe Agreements produce symmetric or asymmetric effects on exports and imports in Central and Eastern European countries. They found that association agreements have a positive and significant impact on exports and imports with the estimated coefficients being higher for imports than for exports, suggesting trade asymmetry. This finding is relevant to our research because it demonstrates that trade liberalization agreements can have differential effects on imports versus export activity.

3 Data

Trade and tariff data was made available from the World Bank's World Integrated Trade Solution (WITS) database. The International Centre for Tax and Development Government Revenue Dataset

(ICTD-GRD) provides detailed tax and government revenue data for nearly all countries. Our sample includes eleven developed countries 2001-2020: Australia, Belgium, Canada, France, Ireland, Israel, South Korea, New Zealand, Norway, Switzerland, and the United States, amounting to 220 country-year observations. We classify these countries as "developed" based on their Organization for Economic Co-operation and Development (OECD) membership status, which indicates advanced economies with established institutions capable of implementing diverse revenue strategies.

Table 1: Summary Statistics

VARIABLES	N	mean	sd	min	max
Exports (% GDP)	220	43.49	26.23	9.036	133.3
Imports (% GDP)	220	40.08	22.11	13.15	124.4
Domestic Consumption Tax Revenue (% GDP)	220	7.564	3.618	0.424	13.17
International Tax Revenue (% GDP)	220	0.291	0.307	-0.0130	1.087
GDP (Current USD, Billions)	220	2,193	4,505	53.87	21,540
Import Value (Billions USD)	215	503.3	670.2	16.83	3,121

Note: Sample consists of 11 developed countries over 20 years (2001-2020): Australia, Belgium, Canada, France, Ireland, Israel, Korea, New Zealand, Norway, Switzerland, and the United States. Tax variables from ICTD Government Revenue Dataset; trade and GDP variables from World Integrated Trade Solution (WITS).

We obtained four trade indicators to create our key variables from WITS: Exports of goods and services (% of GDP) measures the value of all exported goods and services as a percentage of GDP; Imports of goods and services (% of GDP) measure the value of all imported goods and services as a percentage of GDP; GDP (current USD) represents the gross domestic product of each country in current US dollars; and Import Value (Current USD) captures the total value of imports in current US dollars. We also obtained two tax revenue variables from ICTD-GRD: Domestic Consumption Tax Revenue (% of GDP) measures total taxes on goods and services; and International Tax Revenue (% of GDP) which is taxes on international trade, primarily consisting of tariffs and customs duties on imports.

The eleven developed countries in the sample demonstrate substantial variation in both trade openness and economic size, which is crucial for testing our hypothesis that fiscal substitution patterns differ by import intensity. The wide range of imports as a percentage of GDP, averaging 40.08% and a minimum of 13.15% enables comparison between economies like the United States and heavily trade dependent countries like Ireland and Belgium. Exports show variation as well with the average of 43.49% of GDP and ranging between 9 and 133%. The similarity in average export and import percentages reflects the overall trade openness of these economies. This allows us to compare fiscal behavior across countries with different levels of import dependency. Economic size also varies across the sample. ¹

¹See the reproducibility package for more detailed instructions here.

4 Results

Before conducting a formal correlations analysis, we examined the relationship between international and domestic consumption tax revenue visually to assess whether the predicted substitution pattern would present itself in the aggregate data. Figure 1 displays the relationship between international tax revenue (primarily tariffs) and domestic consumption tax revenue across all eleven countries. Each point represents a country-year observation, with countries distinguished by color. If our hypothesis is correct then we would expect to observe a negative relationship; as countries reduce tariffs, domestic tax revenue should increase (move right on the horizontal axis) to offset the lost tariff revenue.

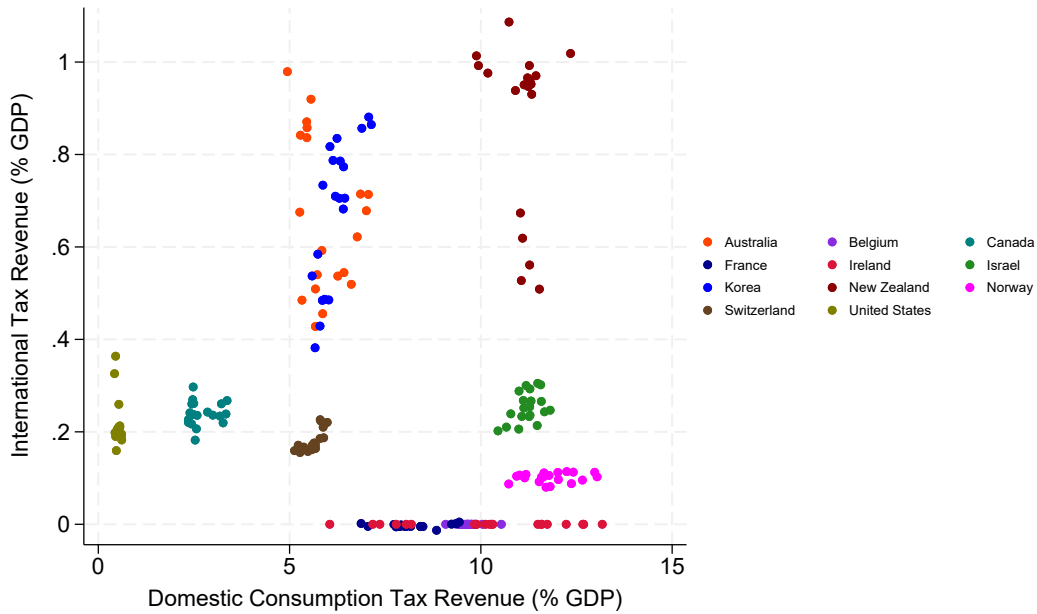


Figure 1: International and Domestic Consumption Tax Revenue Across Countries
Note: Each point represents a country-year observation from 2001-2020. The horizontal axis shows Domestic Consumption Tax Revenue as a percentage of GDP, while the vertical axis shows International Tax Revenue (primarily tariffs) as a percentage of GDP. Countries are distinguished by color. A negative relationship would suggest fiscal substitution, where countries increase domestic consumption taxes as tariff revenues decline.

The scatter plot reveals no clear pattern of fiscal substitution. The countries cluster into distinct groups. Most observations cluster at very low levels of international tax revenue showing that tariff revenues are minimal for the countries. The absence of a clear negative slope provides preliminary evidence against fiscal substitution in developed countries. This prompts a country-by-country approach, examining each country individually to identify whether any individual cases exhibit the hypothesized relationship and to assess whether import intensity correlates with substitution patterns.

To examine whether import intensity predicts fiscal substitution behavior, Table 2 represents the import-to-GDP ratio for each country, calculated as the ratio of import value to GDP multiplied by 100. This is important to understanding the variation in import dependency across countries allowing

Table 2: Import-to-GDP Ratio by Country (2001-2020)

Country	Mean	Std. Dev.	Min	Max
Ireland	84.61	15.31	65.65	111.54
Belgium	76.64	5.76	65.34	83.49
Switzerland	53.06	5.73	42.52	61.63
Korea, Rep.	38.82	7.21	29.24	52.81
Canada	32.95	1.49	30.00	36.26
Israel	32.59	4.80	23.37	40.11
France	29.57	2.77	25.15	34.08
Norway	29.38	2.51	26.62	34.30
New Zealand	27.76	2.14	22.59	32.75
Australia	21.76	1.19	18.84	24.07
United States	15.14	1.44	12.87	17.35

Note: Import-to-GDP ratio calculated as (Import Value / GDP Current USD) \times 100. Countries sorted by mean import-to-GDP ratio (highest to lowest). Data from World Integrated Trade Solution (WITS), 2001-2020.

us to test the hypothesis that higher import countries should demonstrate stronger fiscal substitutions patterns than low import countries. These high-import countries should exhibit stronger negative correlations between international and domestic tax revenues, reflecting the systemic substitution of domestic taxes to offset lost tariff revenue.

Table 2 reveals substantial variation in import dependency across the sample, with countries having a range from 15.14% to 84.61% of GDP. Ireland demonstrates the highest import intensity, averaging 84.61% of GDP over the 20-year period, with substantial year-to-year variation indicated by a standard deviation of 15.31, reflecting Ireland's economy experiencing significant fluctuations in trade dependency. Belgium follows at 76.64% average import intensity but with a standard deviation of 5.76. Belgium's imports consistently remained between 65.34% and 83.49% of GDP. Switzerland averages 53.06% showing similar stability to Belgium with imports ranging from 42.52% to 61.63%. These three countries represent the most import-intensive economies in the sample and, according to our hypothesis, should be the most likely to substitute domestic taxes for declining tariff revenues.

The remaining countries display import intensities that range from 15.14% and 38.82%. Korea averages at 38.82% and presents variability with a standard deviation of 7.21. Korea's imports ranging from 29.24% and 52.81%. The remaining six countries Canada (32.95%), Israel (32.59%), France (29.57%), Norway (29.38%), New Zealand (27.76%), Australia (21.76%) and the United States (15.14%) demonstrate stability over time with standard deviations between 1.19 and 4.80.

The wide dispersion of average import intensity is another reason for conducting individual correlation analysis for each country. This approach will reveal whether high-import countries like Ireland and Belgium demonstrate negative correlations between tariff and domestic tax revenue.

The country-level correlation results between international tax revenue and domestic consumption tax revenue reveal patterns that directly contradict our hypothesis. Table 3 presents the correlation

Table 3: Correlations Between International Tax and Domestic Consumption Tax Revenue by Country

Country	Correlation	P-value	Import-GDP
Ireland	0.088	0.7124	84.61%
Belgium	0.261	0.2662	76.64%
Switzerland	0.740	0.0002	53.06%
Korea, Rep.	0.769	0.0001	38.82%
Canada	0.127	0.5945	32.95%
Israel	0.432	0.0574	32.59%
France	0.268	0.2542	29.57%
Norway	0.187	0.4302	29.38%
New Zealand	-0.182	0.4427	27.76%
Australia	-0.319	0.1703	21.76%
United States	-0.397	0.0829	15.14%

Note: Pearson correlation between International Tax Revenue (% GDP) and Domestic Consumption Tax Revenue (% GDP) for each country over 2001–2020. Import-GDP ratios shown for reference.

coefficients for each country along with their statistical significance and corresponding Import-GDP ratios. Out of the eleven countries, only two exhibit statistically significant correlations and rather than them being negative like predicted they are positive.

Korea is one of the countries with statistical significance with a correlation of 0.769 (p-value = 0.0001) and Switzerland is the other with a correlation of 0.740 (p-value = 0.0002). These positive relationships indicate that when tariff revenues increase in these countries, domestic tax revenue also increases rather than moving inversely. However, it is important to consider that these positive correlations may not reflect deliberate fiscal policy decisions but rather the effects of business cycles. When an economy is doing well, both imports and domestic consumption tend to increase at the same time. This means that during economic expansions, countries naturally collect more international tax revenue and domestic consumption tax revenue simultaneously, even if the government hasn't made any deliberate policy changes.

The most import intensive countries show no evidence of fiscal substitution. Ireland, with the highest import-to-GDP ratio, displays a correlation of only 0.088 (p-value = 0.712) suggests that changes in tariff revenues have no relationship with domestic tax policy, despite Ireland's economy being more dependent on international trade than any other country in our sample. Belgium, the second most import-intensive economy also fails to reach statistical significance with a weak positive correlation of 0.261.

The remaining eight countries display weak, statistically insignificant correlations. The United States has a correlation of -0.397, which matches our hypothesis' prediction but also fails to reach statistical significance because the p-value is 0.0829.

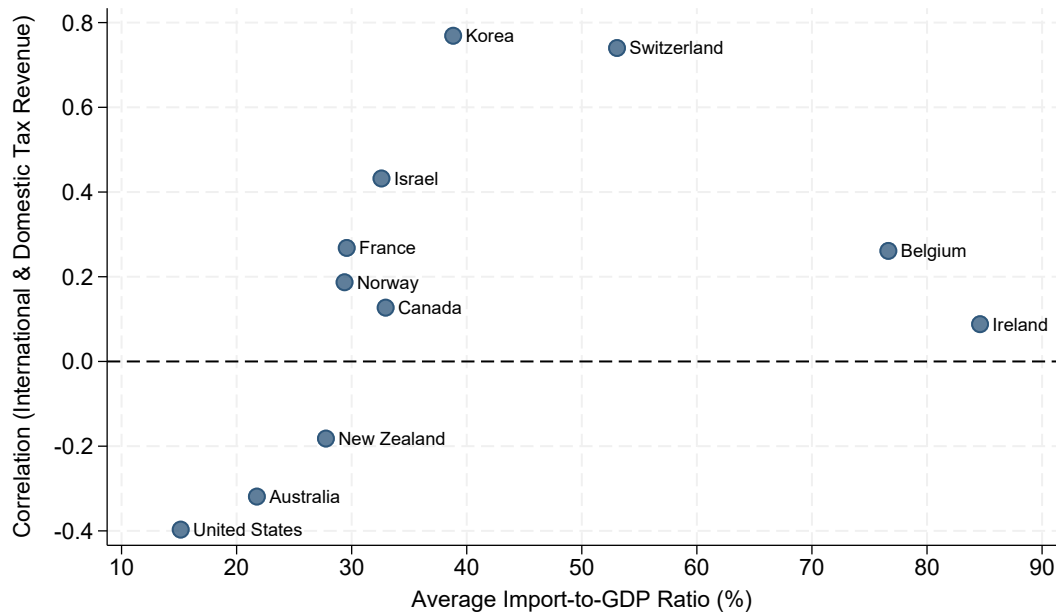


Figure 2: Import Intensity and Correlation Between International and Domestic Tax Revenue

Note: Each point represents one country. The horizontal axis shows the average import-to-GDP ratio (2001-2020). The vertical axis shows the correlation coefficient between international tax revenue and domestic tax revenue for that country. Negative correlations suggest fiscal substitution (taxes move inversely), while positive correlations indicate taxes move together (no substitution).

To assess whether import dependency predicts fiscal substitution behavior, Figure 2 displays each country's average import-to-GDP ratio against the correlation between international tax revenue and domestic tax revenue. This visualization is meant to examine whether more import intensive economies exhibit stronger evidence of fiscal substitution, defined as a negative relationship between tariff revenue and domestic consumption tax revenue. If import dependence were a key driver of substitution, high - import countries would be expected to display more negative correlations than low - import countries. Instead Figure 2 shows no systematic relationship between import intensity and domestic consumption tax revenues. These findings suggest that factors other than simple trade dependency are associated with cross - country differences in tax revenue outcomes.

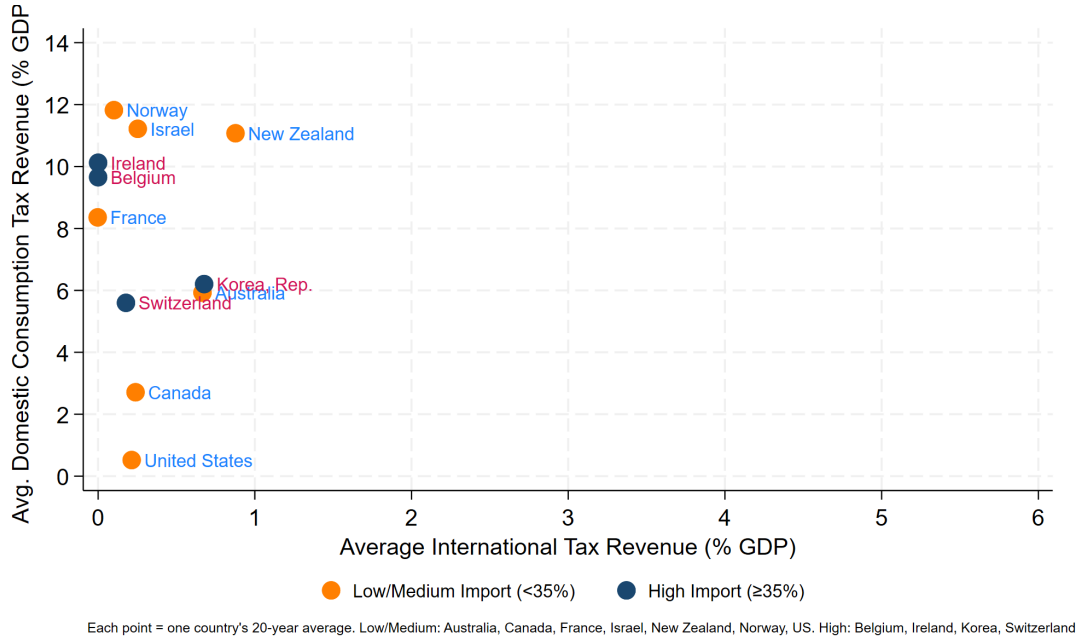


Figure 3: Import Intensity and Tax Revenue Correlation Patterns

Note: Each point represents one country's 20-year average (2001-2020). Orange circles indicate low/medium-import countries (import-GDP ratio <35%). Navy circles indicate high-import countries (import-GDP ratio ≥35%).

Figure 2 presents the within-country correlations between international and domestic tax revenue for each country individually, Figure 3 examines the between-country relationship by plotting each country's average tax revenue levels grouped by import intensity. Each point represents one country's 20-year average. High-import countries include countries with a import-GDP ratio greater than or equal to 35% which are Belgium, Ireland, Korea, and Switzerland. Low- and medium import countries with an import-GDP ratio less than 35% include Australia, Canada, France, Israel, New Zealand, Norway, and the United States.

At first glance, Figure 3 appears to support the hypothesis. High-import countries tend to combine very low international tax revenue with relatively higher domestic consumption tax revenue compared to most medium- and low import countries. Belgium and Ireland exhibit higher domestic consumption tax revenue than many low import economies such as the United States and Australia. This pattern is consistent with the idea that import-dependent economies rely more heavily on domestic consumption taxes in an environment of limited tariffs.

While several high-import countries occupy regions on the graph consistent with fiscal substitution, the pattern is not uniform across the group. Switzerland, despite being a high-import country, exhibits low levels of both international tax revenue and domestic consumption tax revenue, contradicting the expectation that tariff limitations would be offset by higher domestic taxation. Korea, while showing relatively high domestic consumption tax revenue, also maintains higher international tax revenue than Switzerland, indicating that domestic and international tax revenue move together rather than inversely.

Low-/medium import countries demonstrate patterns that directly contradict our hypothesis. Norway, Israel, and New Zealand show the highest domestic consumption tax revenue, ranging from

11% to 12% of GDP, despite maintaining very low international tax revenue. If our hypothesis were correct, these patterns should have appeared in the high-import countries.

There is no clear negative relationship between international tax revenue and domestic consumption tax revenue. These findings show that our hypothesis is not supported. High-import countries do not demonstrate stronger fiscal substitution than low - or medium - import countries. Countries like Norway, Israel, and New Zealand show very low international tax revenue paired with high domestic consumption tax revenue, which could suggest they have substituted domestic consumption tax revenue for tariff revenue. Similarly, the clustering of most countries at very low levels of international tax revenue with varying domestic consumption tax levels might indicate that as tariffs have declined across developed countries, different countries have responded with different levels of domestic consumption tax adjustment. Future research could investigate why low-import countries like Norway, and Israel show clear substitution patterns and not the high import countries, perhaps by examining actual changes in tax rates over time rather than just revenue levels, or by expanding the sample to include more countries at different stages of trade liberalization. The variation within the two groups suggests that other factors, such as overall fiscal policy, tax system history, and political considerations play more of a role than import intensity in determining how countries structure their tax systems.

5 Conclusion

This paper examined how domestic consumption taxes relate to tariff revenue in developed countries and whether this relationship varies with a country's import-to-GDP ratio. Using data from 11 developed countries from 2001-2020, our analysis combined trade indicators from WITS with tax revenue variables from ICTD-GRD. These countries were ranked according to import intensity to see whether a high dependence on imported goods was associated with fiscal substitution between tariff revenue and domestic consumption tax revenue.

The descriptive statistics show large variation in import-to-GDP ratios. Our empirical analysis shows that the correlations between international tax revenue and domestic consumption tax revenue are overall weak. The correlations do not provide strong support for our hypothesis. High import countries exhibit slightly positive correlations, while low import countries exhibit slightly negative ones, but neither pattern is statistically significant or indicates fiscal substitution. Only Korea and Switzerland show a strong relationship between international tax revenue and domestic consumption tax revenue, and both correlations were positive instead of negative like we predicted. For the other countries, the correlations were weak.

Taken together, these findings suggest that revenue-based measures provide limited evidence of fiscal substitution, and that import dependence alone does not explain cross-country differences in tax revenue composition. This outcome contrasts with our hypothesis, which predicted that high import countries would show stronger evidence of substituting domestic consumption tax revenue for decreasing tariffs. This could be due to several limitations. First, our selected countries have small tariff revenue, leaving little variation in identifying substitution effects. Second, our analysis is restricted to 11 countries over 20 years, which limits the ability to detect statistically significant relationships. Third, the analysis focuses on import-to-GDP ratios as the main signal of import dependence, while other factors such as tariff structure and trade balance, may also influence how tariff revenue and domestic consumption tax revenue move relative to each other. Lastly, institutional and fiscal differences

across countries, such as tax systems and policy priorities, may shape how tariff revenue and domestic consumption tax revenue changes over time, independent of import intensity. Overall, while optimal taxation theory may predict substitution between tariff revenues and domestic consumption tax revenues, our evidence is mixed and does not strongly support a clear pattern across these developed countries.

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