**Incoterm Effects Throughout Global Supply Chains**

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**Abstract**

Blanco et al. in their 2015 paper, *Modelling the Impact of Trade Facilitation in Global Supply Chains* sought to establish “high resolution models that allow measuring the impact of trade facilitation policies in supply chain operations.” Five years later we seek to update this model by examining the impacts, if any, of the 2020 revision to Incoterms and the passing of the American Tax Cuts and Jobs Act of 2017. We additionally propose incorporating the choice of flag flown by ships into the equation. Finally, we will attempt to validate the model as much as possible using logistics data from Dole and Acesco.

Keywords: Cost modelling, international logistics, Incoterms, Tax Cuts and Jobs Act, Maritime Flags

# Introduction

Blanco et al.’s paper set out to try to model the cost of a supply chain from the point of inception to the point of receipt by the customer. Needless to say, there are a lot of components of this such as tier 2, tier 3, and so on suppliers, but also less subtle variables like the choice of Incoterms to reference or the pay terms used. Many models had existed before which Blanco et al. referenced in their paper, but Blanco et al. sought to further refine the model and add missing variables like those previously mentioned. Once their model was drafted, they attempted to use it to identify possible improvements to the Columbian logistics ecosystem. This yielded a number of insights; however, they were all at the macro level. We intend to update the model and apply it at a micro level. We will do this with two companies, Dole and Acesco.

As a second point of focus, tax policy impacts global supply chains by reworking companies’ business models and revenue streams. Tax Cuts and Jobs Act (TCJA) changes can cause base erosion and profit shifting (BEPS) to occur. Companies will then decide to move operations onshore or offshore in order to adapt their corporate tax planning strategy to government policy changes. For instance, onshoring to the US could result in a tax rate of 13.125% stated in the foreign-derived intangible income (FDII) (Zaiken 2019). FDII rules apply to onshoring, while global intangible low-taxed income (GILTI) rules apply to offshoring. In order to analyse the effects of FDII and GILDI rules, the supply chain’s performance must be modelled using the company’s facilities, inventory, transportation, and data on their systems.

Finally, our third point of focus is seeking to understand how the choice of flag a logistics carrier flies affects the model. The companies of Dole and Acesco will support the exploration of this concept.

# Literature Review

Tax policy changes made by one country affect the international trade between companies. By simulating models that can be adapted to the emerging market conditions set up by new tax policies, one will be able to monitor cash flow changes in international economies. Dr. Paternina et al. modelled supply chains in Colombia based on Colombian trade policies and concluded that there are 5 sectors that benefited the most: cosmetics and toiletries, leather and leather goods, machinery and electronic equipment, construction materials, and metallurgical industry (Paternina 2018). This conclusion was done by considering values and functions that involved Free Carrier (FCA) terms, inventory stocks, inventory cycle, lead times, sales price and margins, demands, and costs. The model does not include the trade impacts of more supply chain tiers, such as customers of importers and suppliers of exporters (Paternina 2018). Therefore, there is ample space to expand the model to involve trading conditions that can determine supply chain disruptions and impacts per supply chain tiers.

Other research in tax policy has focused more on remediation tactics for companies to base their business models in. For instance, Gkikopoulos et al. focus on the effects of Section 174 in the Tax Cuts and Job Act (TCJA) in the United States of America (USA). The model implements a function on tax avoidance, firm characteristics controls, firm fixed effects, and industry fixed effects (Gkikopoulos 2021). By comparing tax avoidance and productivity, the model is capable of being applied to market circumstances such as the one found in 1997 Ireland, where two legislations, the Tax Consolidation Act and the Finance Act. Although the model does allow an insight into the research and development possibilities due to tax avoidance, it lacks the ability to be extended to other economic constructs, since the productivity variables are proxies that fail to capture implicit taxation and conforming tax avoidance (Gkikopoulos 2021).

Tax policies bring unknown challenges onto the supply chain. Vidal et al. do not focus their model in tax or other policies, but instead their model reflects management strategies, data and information, and quantitative techniques, which allows fine tuning (Vidal 2000). This type of model is adequate to provide a flexible system that can analyse uncertainties in business models, but cannot provide the analysis that is involved in this paper. Dogan et al. have a model that can be used to provide savings opportunities through applying strategic and tactical decisions (Dogan 2001). Again, the model lacks tax application since it does not take tax credit for loss and uses Net Income After Taxes (NIAT).

Since companies want to limit their tax responsibilities, models that reflect corporate tax rates are crucial, especially for international countries. Goetschalckx et al. present a model that incorporates corporate tax of 2 countries as parameters and net income before tax (Goetschalckx 1999). Moreover, the net income before tax is used as decision variables. This model covers taxes, but does not allow analysis on how the taxes disrupt profit repatriation nor does it provide location decisions (Goetschalckx 1999). Taxes limit the maximum profit, therefore other models, such as the one He et al. developed, provide a means of portraying the connection between distinct products, assembly, costs, and demand (He 2020). He et al. present a model that provides the flexibility needed to analyse continuously changing market conditions, but lacks the variables needed to involve tax disruptions to the consumer.

# Data Sources and Possible Solution

Incoterms, generally speaking, are sets of terms that define at what point the costs and risks start and end for both the buyer and the seller. In addition, Incoterms lay out, to a degree, the path of travel a good will take. According to Deloitte and the education the ICC Academy, the key changes are as follows:

1. FCA (free carrier) rules updated “to allow the buyer and seller to agree that the seller will get an onboard bill of lading.” Not that significant. Was generally a thing before due to letter of credit requirements per the article.
2. DAT (delivered at terminal) changed to DPU (delivered at place unloaded) to make it more general. No meaningful change for costs.
3. Increased security clearance guidelines. This may increase costs by limiting the number of firms that can transport certain cargo.
4. Changes to the insurance requirements for CIP and CIF that make it so that the buyer can request the seller obtain more insurance. This can raise costs for the seller, but may reduce risk and lower costs for the overall supply chain in the long run.
5. Sellers or buyers can now move the goods themselves in FCA Non-Seller’s Premises, DAP, DPU, and DPP rather than having to contract it out. This theoretically reduces costs by removing the markup that would be paid to the third-party logistics providers.

Overall, the changes to incoterms in terms of costs are fairly minor, and we do not believe that they will have a significant impact on the cost of the overall supply chain.

*Dole - Acesco Case Study:*

Through the dataset on Acesco, we will study the experimental setting, which includes the values of market parameters. We will also describe the data that will be collected and fed to a practical, empirical model. The data collected consists of various segments, such as general data consisting of sales, margin, percentage of export of sales, number of export employees, and export department salary. The next segment is finance data, which consists of cost of capital, interest of profit, and payment terms in days. Product data consists of tons of exported products and the total annual export orders of the product. Supply chain data consists of order to dispatch, dispatch to port, port to port, port to importer’s warehouse, average delay, the percentage build to order, average manufacturing time of one order. Transportation data consists of the cost of local transportation, the cost of international transportation, and the cost of transportation from the importer’s port to the importer's warehouse. Inventory data consists of finished goods’ inventory time, safety stock time, raw material’s inventory time, and raw material’s safety stock time. The last segment is forecast accuracy data, which consists of forecast error, target service level, real service level, markdown, rate of discount, and the discount product.

We will be using the scenarios only for the finance data segment, supply chain data segment, transportation data segment, inventory data segment, and the forecast accuracy data segment. For working on the scenarios, we will be considering four scenarios, which are the best case, worst case, financial and modification. Apart from the total cost figures, we have also got the minimum and the maximum limits of the costs. We will calculate these scenarios based on the baseline figures provided in the Acesco dataset. After calculating the outcomes in each scenario, we will try to check for what is the percentage breakdown of all the figures as compared to whole figures of all segments. Furthermore, we can get the performance of each segment for the trade supply chain costs across all the scenarios we calculated. The assumptions which we will consider while computing is that a specific year will consist of 365 days, and the exchange rate of COL$ per USD$ is $2100. Financials for Dole, for instance, are available publicly through SEC files, which will provide real data for the model.

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