

Financial Framework for Global Investment and Implications

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Abstract

The objective of this paper is to describe a valuation decision model for a firm in a multi-country environment. The paper extends the works of Myers, Myers and Pogue and Lev to include individual investment project decisions to the global marketplace. The model integrates the buy or builds decision, the location of production, distribution decision and tax effects into the capital investment decision of the firm. The model shows that a firm's production decision (buy or build), the customer location and tax effects are interdependent. The model to optimize the value of the firm is a function of the interdependencies of the input and financing factors. This will require significant modification of the traditional theories used for the determination of a firm's capital structure and cost of capital. This implies the current methodology used to learn finance needs to be modified. The paper also briefly discusses its implications on government policy for the economy and the firm.

Keywords: Global Capital Investment, Capital Structure, Cost of Capital

1. Introduction

The objective of this paper is to describe a valuation decision model for a firm in a multi-country environment. The paper extends the works of Myers, Myers and Pogue and Lev to include individual investment activity decisions. The model views the firm as a portfolio of activities to be owned or bought (extends leasing and outsourcing concepts). The model allows one to incorporate factors that are relevant to a firm that produces and provides products to a global marketplace as well as the traditional financing factors. The paper's conclusions and financial implications are briefly discussed after the model is presented.

2. Review of the Literature

Myers (1974) in a prior paper presented a financial mathematical model that included the impact of financial leverage on a firm's cost of capital and capital budgeting decision based on the original works of Modigliani and Miller (1958, 1963). The paper described the adjusted present value model (APV) that was used as the foundation for this paper. Myers and Pogue (1974) presented a short-term financial model that extended the APV model to include the use of short-term assets and liabilities. Myers, Dill and Bautista (1976) extended the APV model to include financial leasing contracts. Their paper showed the present value of tax differential cash flows and changes individual cash flow components are used to determine the value of the investment when leasing is used. A paper by Schauton and Spronk (2006) reviews the capital structure literature and extends it to include non-financial factors such as real options and firm control. They showed that the capital structure is optimized based on the maximization of a set of multiple criteria rather than only based on the traditional approach. Lev (1974) examined the impact of operating leverage on the beta or risk of the firm. He shows the selection of how a product or service is produced will be one of the determinants of a firm's risk and therefore capital structure. The paper extends Miller's (1977) paper describing the effect of personal taxes on capital structure that showed the optimal capital structure depends on the tax differentials between the firm and the individual. This paper extends it and shows the optimal capital structure depends on tax differentials between firms involved in the firm's operations.

A paper by McGrattan and Prescott (2007), Burstein and Monge (2007), and Holmes and Schmitz (1995) point out that the integration of economically sovereign states almost surely leads to fewer barriers to efficient production and higher productivities through competition. Their results show the need to take into account how a firm organizes its operations across borders. This paper builds on their efforts and extends the valuation model to include the impact of location and outsourcing on a firm's operational and investment activities.

3. The Model

The paper uses as its foundation the net present value (NPV) financial model. The *new* NPV model is used by firms for their investment decision as well as by investors to determine the value of a firm. The NPV model is described as follows:

Let assume that value of the firm (VF) is derived from its n various investments/projects

$$VF = \sum_i NPV_i$$

and each investment i currently generates cash flows from its various j activities denoted by CF_{ij} or is expected to be in operation in future.

Value of the firm can now be expressed as sum of the present value of ongoing operations and the net present value of new and future investments

$$VF = \sum_i NPV_i = \sum_i \sum_j PV(CF_{ij}) + \sum_i NPV(\text{future}) \quad (1)$$

Where

$i = 1, 2, \dots, n$ and

$j = 1, 2, \dots, m_i$

CF = Free After-tax Cash Flow

The goal of this paper is to examine a model for the global operational framework. Let us assume, for simplicity, that the new investments are relatively independent of current operations. Therefore, we can ignore the effects of the future investments and examine only the first part of the equation (1). Further, the calculation of the present value for each activity j for investment i uses each activity's discount rate that depends on the riskiness of each activity's cash flow. We can expand the model even more by controlling for ownership and location of individual activities. Let k and l denotes binary variables, where $k = 1$ for own or make the activity, $k = 2$ for buy (outsource, lease, etc.), $l = 1$ for domestic and $l = 2$ foreign location (variable l can be further expanded to include more specific continent or economical region, but for the sake of simplicity only two options are considered). The value of the investment i can be now expressed as follow:

$$NPV_i = \sum_j \sum_k \sum_l PV(CF_{ijkl}) \quad (2)$$

Equation (2) represents the aggregate model showing the value of investment i as the sum of the NPV of the activities for the investment that recognizes the activities can be a blend of owned, bought, domestic and foreign activities. Instead of using aggregate cash flows of a firm's investments, we can make the model more operational by expressing it in terms of revenues, costs (variable and fixed), accounting effects, taxes and already introduced ownership and location of the individual activities.

Cash Flow Definition of Investment i

Definition of Symbols:

R = Revenue of an Investment

VC = Variable Cost for Investment (includes taxes on production activities)

FC = Fixed Cost for Investment

Dep = Depreciation for Investment

NCF – Non-cash flow accounting adjustment effects for an investment

t = income tax rate for investment activity j

P = price for product or service of investment

Q = quantity of product or service sold of investment

CapEx = capital expenditures for investment for investment dependent on current operations

TVC = total variable cost for investment i .

Note: Income tax rate t is assumed to incur at location of customer sales c . In practice would depend on multi-country income tax systems as applied to the firm for cross-border transactions (domestic and international).

Value of the investment i can be now expressed as follow:

$$NPV_i = \sum_j PV(CF)_{ij} = \sum_j PV[(R_{ij} - TVC_{ij} - FC_{ij} - Dep_{ij}) * (1 - t_{ij}) + NCF_{ij}] - CapExp_{ij} \quad (3)$$

Or

$$NPV_i = \sum_j PV(CF_{ij}) = \sum_j PV[[Q_{ij}(P_{ij} - VC_{ij}) - FC_{ij} - Dep_{ij}] * (1 - t_{ij}) + Dep_{ij}] - CapExp_{ij} \quad (4)$$

The above expressions represent an aggregate model. They do not show explicitly differences in cash flow between buy-own decisions k , location decisions l , and tax differentials depending on the k and l selected for activity j .

Let 's assume now , that revenue, price and quantity are in fact dependent of the k or l selected. This allows us to isolate the impact of the location and outsourcing on the value of an investment.

The equations (3) and (4) can be now expanded to the following form:

$$NPV_i = \sum_j PV(CF_{ij}) = \sum_j \sum_k \sum_l [(R_{ijkl} - TVC_{ijkl} - FC_{ijkl} - Dep_{ijkl}) * (1 - t_{ijkl}) + NCF_{ijkl}] - CapExp_{ijkl} \quad (5)$$

Or

$$NPV_i = \sum_j PV(CF_{ij}) = \sum_j \sum_k \sum_l [[Q_{ijkl}((P_{ij} - VC_{ijkl}) - FC_{ijkl} - Dep_{ijkl}) * (1 - t_{ijkl}) + NCF_{ijkl}] - CapExp_{ijkl}] \quad (6)$$

The above equations show that the cash flow of an investment i can vary depending on the blend of the k and l selected. At this stage, it is also assumed, that price and quantity are not dependent on selected location and ownership (different k and l). This assumption can be further relaxed by including effects of interactions of these two variables. The complete generalized model is an APV model that includes the value and the interactions of all of the firm's activities rather than only the financial effects. The model shows that VC (kl), FC (kl), T (kl), NCF (kl) and CapEx depend on the k and l selected. The selected k and l are a function of both the previous stand-alone operational costs (e.g. administrative, production and investment) as well as the impact of the cost to the firm to deliver the products to their customers. Below is a discussion of how the presented model can be partitioned into various cash flow decision-making components similar to the APV presentation found in financial textbooks.

1. The production of the goods or services decision - Own or Buy

- a. Production activities will be a function of the location of customers, comparative operating cost factors and utilization of invested capital
- b. Location of customers will affect the logistical costs (as discussed below)
- c. Comparative operating costs will be a function of differentials of the local cost of standard of living (e.g. wages, employee housing, food and clothing costs), regulation costs (e.g. labor rules, environmental), health care costs, energy costs, natural resource costs (e.g. land), government subsidies, tax regulations and administrative cost efficiency (e.g. informational technology, human resources, customer service).
- d. Utilization of invested capital will depend on the alternative investment opportunities (e.g. optimal use of capital) and impact on operating and financial leverage. Operating leverage could be reduced depending on the supplier's operations (i.e. the more the supplier's production is customer diversified the lower its operating risk), the pricing and contractual relationship (i.e. does lower operating cost leads to lower pricing or changing the firm's fixed operating risk into a variable cost) and the impact on the firm's valuation if operating risk or cost is reduced (i.e. lower operating risk or cost enables the firm to lower its cost of capital and/or increase it financial leverage (i.e. obtain tax benefits)).

2. The cost to monitor production

Logistical costs are a function of customer location, the location of the production facilities, the supply chain distribution costs, the risk monitoring of the firm's production and suppliers of the goods and services and risk and cost of litigation to protect intellectual property.

3. The value of real options

- Strategic Options – growth options (e.g. cost R&D, barriers to entry (i.e. proprietary information, creation of future competitor, learning curve), and production flexibility (i.e. production constraints)
- Abandonment Option – ability to avoid stranded costs and exits costs if a product or activity is terminated; risk of abandonment by supplier at end of contractual relationship
- Scalar option – ability of a firm to expand its production with lower capital expenditure requirements (i.e. amount of initial investment, use supplier excess capacity rather than additional capital expenditures)

4. The value of governmental environment

Government impact on firm's cash flow due to subsidies, tax rates, regulations, infrastructure and employee benefits (e.g. healthcare costs, educational costs)

5. The value of financing effects

The change in value of debt financing, supplier financing; currency management and economies of scale of global financing activities

6. The value of interaction effects. This will be the result of the following:

- The portfolio of activity's interaction effects is the residual impact as well as any unintended consequences that are a function of the specific production weights of k and l selected.
- The value of interaction effects of the portfolio of the firm's individual projects (i.e. independent products)
- Efficiencies of the supply chain due to economies of scale and structure (i.e. better alignment of a supplier's hubs with firm's customers - lower costs)
- Financing the supply chain can occur when the firm's cost of capital is lower than their suppliers.
- Includes interaction effects between differentials in income taxes incurred on sale to customers (e.g. cross-border tax differentials, tax credits for taxes paid in other locations)

In order to model above discussed effects lets introduce for each investment/product i additional symbols: P_{ic} = price paid by customer c where $c = 1$ to w_i and Q_{ic} = quantity purchased by customer c and Q_{ijklc} = quantity produced as a result of activity j at the location l and ownership k and sold to the customer c . The following relation must hold:

$$\sum_c Q_{ic} = \sum_j \sum_k \sum_l Q_{ijklc} \quad \text{for each investment } i$$

In summary, the maximization of a firm's value is a function of the portfolio of activity weights of the k and l selected. A summary of the APV model is described below. Please note that the model is not an all inclusive description of possible additional benefits and costs for the globalized model.

Value of investment i or $APV(i)$ can now be expressed as:

$$APV_i = \sum_j PV(CF_{ij}) = \left[\sum_j \sum_k \sum_l \left(\sum_c Q_{ijklc} * (P_{ic} - VC_{ijkl}) - FC_{ijkl} \right) \right] * (1 - t_i) + \sum_j t_i Dep_j + \\ + \sum_i \sum_j \sum_k \sum_l (NCF_{ijkl}) + \sum_i \sum_j \sum_k \sum_l (TS_{ijkl}) - \sum_i \sum_j \sum_k \sum_l (CapEx_{ijkl})$$

+

Cost of monitoring + Value of Real Options + Value of Government Environment + Value of Interactions from Non-Long-term Financing Effects and Operations (7)

Where, TS is the incremental present value of the net tax savings from the interest deductibility of the firm's debt financing and its cost of financial distress.

Where, t_i is an aggregated tax rate calculated as a weighted average tax rate at the customers' locations. The weight used is the ratio of the marginal profitability at the customer location to the total marginal profitability related to the investment i

$$t_i = \sum_c w_c * t_{ic} = \sum_j \sum_k \sum_l (P_{ic} - VC_{ijkl}) * Q_{ijklc} * t_{ic} / \sum_j \sum_k \sum_l \sum_c (P_{ic} - VC_{ijkl}) * Q_{ijklc}$$

The APV can be used as the objective function for the mathematical programming model that determines the set of decisions that maximizes the value of the firm. The model allows for the interaction between the operational variables as a separate value component or included in the value of the affected component. It also allows for different prices for each product to each customer. The changes in price can have an impact on the quantity demanded by customer c . The impact of changes in price and quantity, and customers can impact the buy-own, location and tax decisions for activity j as well as the other added variables. The relaxation of the independence between price and quantity can increase the firm's value if the cost of delivery to the customer their good or service is reduced and if the quantity of demand for the product is elastic. The relaxation of the location assumption increases the complexity and monitoring costs but does allow a firm to value the complete supply chain from raw materials to delivery of the good and service to the customer.

4. Implications of Model

Below is a brief discussion of some of the implications of the presented model. Future research is needed to confirm the validity of the some of the implications. On the other hand, the model does confirm some prior research.

1. The model to optimize the value of the firm is a function of the interdependencies of the input and financing factors. This will require significant modification of the traditional theories used for the determination capital structure and cost of capital of a firm.
2. The model requires an optimization mathematical programming solution. It is not only an accounting financial model. This is similar to the conclusions of Myers and Myers and Pogue. This implies the current methodology used to learn finance needs to be modified.
3. A firm's financial ratios are a residual value of its activities decision. It is a function of the portfolio of activity weights of the k and l selected and the firm's customers. The value of the use of financial ratios for a comparable analysis becomes more subjective the more complex the production decision. The validity of using industry ratios becomes questionable given the number of firm specific activity decisions.
4. A firm's financial reporting (e.g. income statements and balance sheets) become less transparent with the increase in complexity of a firm's production. The reports may no longer provide an accurate understanding of the contractual relationships between the firm and its suppliers.
5. International trade will be positive for global markets but can be sub-optimal for local markets. Global production competitiveness is a function a cost of standard of living differential (i.e. local market cost differentials) that is independent of the standard investment decision. Emerging countries with large scale of resources will lead to a reallocation of the portfolio of activity weights k and l . The wealth of local markets can be reduced depending on the change in weights. This conclusion supports the argument made by Samuelsson (2004).
6. A firm's cost of capital and optimal capital structure are optimized as a function of its production decisions and customers. It is therefore a sum of each product lines optimal capital structure since the financing, investment and operating decisions are no longer independent. This result is similar to Miller's (1977) conclusions when personal taxes are included. A firm's operating risk can vary depending on the investment decision. The increase in the buy decision can lower a firm's risk by reducing the firm's operating leverage. The potential added value arises due to differences in economies of scale of operations. The lower operating risk can lead to a change in the firm's debt capacity and the use of debt financing. Additionally, the increased variability of the customer set would increase cash flow risk beyond the cyclicity factor.
7. Performance compensation systems need to be adjusted to reflect the impact of the model on a firm's return on invested capital or total shareholder return if publicly traded. The level of capital investment depends on production decision on whether to buy or build and customer locations. For example, a firm can become the management of a web-page with links to all of the required activities to deliver the good or service to their customer. The firm would have minimal invested capital as measured by accounting.

8. Countries and firms do not have aligned self-interests. A country has a local market perspective (national boundaries) whereas many firms will have a global market perspective. Countries can either respond by restricting free trade [i.e. a trade-off between protecting the citizens negatively impacted (e.g. employment, wages, wealth) by global effects compared to citizens positively impacted (e.g. prices, product innovations)] or take actions to improve its global competitiveness. Countries will now have to compete globally (i.e. a free trade passive government policy will reduce the wealth of its citizenry if other countries follow policies beneficial to firms –country comparative advantage effects).
9. Globalization with large scalar emerging countries with significant cost of standard of living differentials leads to higher returns on invested capital. Owners of firms that take advantage of globalization will increase their share of the global distribution of wealth. This will also lead to a transfer of wealth from one country to another. A country will either have a lower growth rate of wealth (i.e. wealth increases but relative global wealth share decreases) or an absolute decline in wealth.
10. Globalization will reduce the correlation between a firm's returns and a country's economy. This will reduce the forecasting ability of economic models that have used stock prices as a forecasting factor.
11. The described activities of the model imply the increased need to measure impact of real options (strategic, abandonment, scalar) in the valuation decision. The model shows that the location of production and customers matter. This means the valuing of the abandonment option is important as the probability of change in the customer portfolio increases. The model implies contracting out production and location globally will increase a firm's value. This creates a risk of loss of process engineering skills and knowledge given the firm's potential loss of control of the production process. This implied the potential loss of potentially valuable future growth opportunities Grove (2010).

5. Summary and Conclusions

The paper presents an expanded globalized APV model that includes location and outsourcing variables. The paper demonstrates that the operating and financial structure of the firm will vary based on the activities selected by the firm to maximize its value. The paper shows the traditional models found in textbooks and other materials are insufficient to understand how a firm operates in the global marketplace. It also discusses a set of implications that can assist managers and economic policy makers in a global setting.

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