

FACTORS OF BETA SHIFT IN TATA MOTORS,
MOTHERSON SUMI SYSTEMS, AND HERO MOTOCORP

by

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The globalization of firms and the effect of this on returns is far from being completely understood. Yet, higher accuracy in modeling returns and better knowledge of what influences them is crucial to achieving optimal portfolio performance and making informed business decisions. There are two significant shifts in a previously domestic company entering a global market that are not well understood: international ownership and international revenues. This thesis investigates these changes through a study on three Indian automotive firms: Tata Motors, Motherson Sumi Systems, and Hero MotoCorp. The effects of globalization on the returns of a stock are much too complicated and numerous to be completely explained in any paper, but this will serve as a starting point in understanding these issues. I compare return betas of three companies as they go through different stages of becoming international to learn more about how international ownership and international revenues influence returns. The results suggest that international ownership is useful in explaining returns.

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Introduction

Financial markets are essential in allocating capital across the many businesses and individuals that power the world economy. Trillions of dollars are managed by pension funds, retirement accounts, and university endowments whose performance directly affects millions of people across the globe. The managers of these funds are held by fiduciary duty to achieve the best possible performance for their clients. However, in these large funds, differences of a single percentage point in annual performance can result in billions of dollars either lost or gained. Because of this, it is crucial that investment strategies are created in such a way that they achieve target performance with the least amount of possible risk.

Unfortunately, there is no simple answer to defining and reducing risk. Standard deviation of returns is a common measure of risk in financial portfolios, and a smaller standard deviation is better with an equivalent expected return. Many strategies have been developed which attempt to improve risk-adjusted performance. Markowitz (1952) influentially wrote about the optimal balance between risk and return and how return correlation can be used to lower risk in a portfolio. Understanding what influences stock returns allows better estimation of potential risk and allows for more effective risk reduction.

Globalization, the integration and free movement of people, goods, services, and capital across national borders, has a vast and influential effect on financial markets. As countries reduce regulation, companies are shifting from existing solely inside an individual nation to interacting globally and, in doing so, are exposed to new risks and potential for growth.

Understanding how the influences of underlying factors, like the economies of each nation, change as a company becomes more global is necessary for a better estimation of a stock's future risk and expected returns. Especially with a knowledge of what influences returns, adding more options to the investment pool is helpful. Including international assets in a portfolio results in a "larger expected return at any given level of risk." (Fabozzi, Gupta, and Markowitz, 2002). This is especially true when the returns are not driven by the same underlying factors as previously available investments.

While understanding how international ownership and international revenue influence companies' returns is crucial, it is still only a single aspect of how globalization can impact investments and the economy. There are numerous scenarios when financial losses could have been avoided if investors had a better understanding of how companies react to increased globalization.

For example, China has been restructuring its markets since the late 1970's, moving from a "centrally planned system to a more market-oriented one that plays a major global role." (World Factbook, 2016). The market still maintains restrictions, but this shift has allowed many Chinese companies to become more international. Trade has become much less restricted, allowing companies to export goods. This shift has also drawn in foreign investors, who are interested in potential gains from Chinese businesses now that there are less restrictions. Chinese businesses are a large global force, with China having the second largest Gross Domestic Product (GDP) in the world.

Lack of accurate valuation of Chinese companies has had significant negative effects on the economy in the past. More than 100 Chinese companies were delisted or suspended from trading in 2011 and 2012 partially due to fraud and accounting scandals. This compares to the total of around 800 international companies listed in the U.S. on the largest stock exchanges five years earlier (Fernandes and Giannetti, 2014). This incident destroyed over \$40 billion in value and had lasting effects on the market and how Chinese stocks are viewed in America (Cogman and Orr, 2013). Many of the Chinese executives agreed, even before the delisting, that US investors did not understand their companies. They felt that United States investors were too distant to understand the risks and opportunities in China. After the delisting, many Chinese executives said that they had also been underprepared for listing in the United States, citing investor relations issues and claiming that U.S. investors' analysis was clouded by their familiarity with the more mature companies that had been listed in the past. In the future, most executives would prefer to relist domestically, either in China or Hong Kong, because analysts there would be better able to accurately understand their companies. Between countries, there is often a significant difference in regulatory burden and investor relations like those that caught many Chinese companies by surprise. With the spread of globalization, avoiding incidents like this is a major need in the markets. While firm behavior was the primary cause of this incident, better understanding of foreign companies by United States investors could have avoided losses.

With these de-listings, capital markets were briefly pushed away from integration. This is detrimental for investors in every country because “integration

provides the opportunity for better diversification as investors shift to higher risk and expected return projects because they are able to diversify their overall risk” (Obstfeld, 1994). In addition to avoiding situations like this, a better understanding of the effects of globalization on a stock have important implications for asset allocation decisions of investors. If listing on a foreign market causes a stock to co-move with stocks in the foreign country, then investors using that stock to diversify or expecting it to move with the company’s home country economy may not receive the results they expect.

To avoid these issues and create portfolios that use properly estimated inputs which respond to changes over time to optimize their risk and return, it is necessary to be able to better approximate the price of the individual securities which they are constructed with. Price is inversely correlated to the expected return of the security, and expected returns and risk are both important in creating portfolios. A discounted cash flow analysis uses the expected free cash flow of a company and adjusts for risk to find the current value of a stock. Estimating a company’s beta is necessary to evaluating risk and knowing which markets a company is exposed to is important for estimating the beta. Making a mistake here can drastically affect the valuation of a stock and greatly effect investors.

Before going further, it’s useful to clarify the meaning of beta, as this will be discussed more going forward. In a regression, beta is the slope of the line of best fit and represents the relationship between a dependent and independent variable. A high absolute value beta means that the movement of the dependent variable is very sensitive to the movement of the independent variable. A positive beta means that the dependent

variable moves in the same direction of the independent variable, and negative means that they move in opposite directions.

In my time investing, I have often assumed that a company is exposed to a certain country's market based on where it is headquartered or where it is traded. After beginning to research international companies and what drives their risks, I found that a company's exposure depends on many factors including the ownership of a company and the regions in which it earns its revenues. This thesis aims to provide undergraduate students studying finance an overview of some potential differences between companies operating and financing internationally through an investigation into how these shifts in companies going global can affect stock returns.

Fundamentals and Ownership

Globalization may have varied and widespread effects but learning about its intricacies is very useful. Because of this, it's valuable to know whether fundamentals or ownership has the most importance in determining this shift. To investigate this, I evaluated three companies that are in various stages of becoming global in terms of investors and revenues and compared the stock's betas for the markets of their home country and the international market to their shift in fundamentals and shift in ownership.

As a company expands internationally, it will begin exporting goods to other countries. When this occurs, the company's revenues, and therefore the performance of the company and its stock, are more reliant on demand and influential factors from those other countries. This will be referenced for the remainder of this paper as a shift in fundamentals.

Second, a company can cross-list or list itself on another country's exchange, increasing its access to foreign capital and investors with different investing styles. There are often restrictions on foreign investors, making it more difficult or impossible for them to purchase ownership in stocks offered exclusively in foreign countries. By listing a depositary receipt, the company reduces barriers to international investors and will see more international ownership. Investors from different countries have different investing styles and ideas of "good business," which can affect the price of the company and the company's operations through the decisions investors make. The degree of this influence will change depending on how large the foreign ownership is. Going forward, this will be referenced as a shift in ownership.

Fundamentals

A company's fundamentals, primarily the revenues of a company, and where those revenues originate from are a potential influencer in this change. A company's fundamentals are affected strongly by the economic conditions of the regions in which it operates. As companies grow, they often begin to expand across border lines, selling their products in foreign countries. Doing this changes their exposure to risk as they become less reliant on their home country's economy and more reliant on foreign economies, which will have a corresponding effect on the stock price and what markets they move with.

For example, In-N-Out Burger only operates in the United States and is therefore inherently more exposed to risks associated with the United States than international firms. If people in the United States begin to purchase less fast food, In-N-

Out will suffer decreased revenue because In-N-Out does not have another region earning income to balance out this decrease.

Compare this with McDonald's, which operates in over 100 countries across the globe. If one of these countries faces a sales downturn, the company could see a lag in that region's revenues but could still have 99 regions that are operating as usual and are unaffected by whatever caused the decrease in the first region. Because of this difference in risk, McDonald's stock will be priced differently. The price will change depending on the change in expected return and overall risk. Since the company is less sensitive to each individual economy, it will likely have lower standard deviation of cash flows. If all else was equal, lower standard deviation should be better. The company's returns would become more sensitive to other economies, but less sensitive to any specific economy.

Ownership

Cross-listing, when a company is listed on a foreign stock exchange in addition to its domestic exchange, is another way for investors to buy shares of foreign companies. It's been argued that cross-listing on a United States exchange creates value for the company because cross-listed firms are better able to take advantage of growth opportunities and a smaller percentage of cash flows are expropriated by controlling shareholders (Doidge, 2001). Research on the valuation of companies that have cross-listed is still very active.

This brings much difficulty in estimating future returns when a foreign company is listed on a U.S. exchange. The collision of two groups of investors with differently diversified risks and views of investment risk can cause pricing affects as the investor

mix shifts from primarily domestic to a more equal distribution between foreign and domestic. Beyond differences in familiarity with the markets, there are also differences in the average investor from different markets. It's been found that in a large sample, Chinese workers were more risk tolerant in their financial decisions than Americans (Fan, 2006). With all else equal, the difference in risk tolerance would mean that Chinese investors would price stocks at a premium, or higher price, as compared to U.S. investors. However, the U.S. investors likely see a greater diversification benefit than Chinese investors, which pushes prices higher.

It has also been shown that cultural aspects of a country influence the ways investors from that country trade stocks. For example, countries that tend to be more collectivistic as opposed to individualistic have higher correlation in stock returns within the country (Eun, Wang, and Xiao, 2014). This can cause large changes in prices when two groups of investors interact. Assuming there are only two markets, then investors that are highly collectivistic will place a much higher value on the international stocks because they have fewer alternative options for diversification than the more individualistic investors that have access to less mutually correlated domestic stocks.

Investment restrictions play an influential role in the difference in price and trade between countries. Restrictions on foreign investors in some countries mean that not all investors are able to purchase ownership in a stock.

If investors have different opinions on an appropriate price, and some investors are not allowed to participate in the market, then the price will be different than it would be if there were no restrictions. It is very difficult to sort through all of these and many other influences of ownership on a stock's returns to find an accurate price.

Literature Review

This section will provide a clearer context in terms of existing research and serve as a more detailed explanation of some of the key principles influencing this research. Please see the referenced papers to explore these additional topics in more depth.

Portfolio Construction

Modern portfolio theory (MPT) is one of the foundational concepts of finance and can help in understanding the importance of diversification. It follows common sense that one would not risk their entire portfolio on one stock, but MPT built on this using correlation. Essentially, instead of simply buying many stocks, it's important to purchase stocks that are not highly correlated with each other. If a portfolio of stocks is highly correlated, then if one of the stocks decreases in value, it is likely that most of the other stocks will also decrease in value, which would severely affect the portfolio. Instead, if the portfolio consists of stocks which are not highly correlated with each other, then portfolio returns will not be affected as significantly by a decline in whatever a single stock is responding to. It's likely they aren't all strongly influenced by the same factors.

Depository Receipts

Darius Miller (1999) found abnormal returns in stock prices immediately after international listings. This paper also provides a good background of Depository Receipts (DR) and their related research. To summarize, DR's are a means for investors to participate in and purchase stocks in foreign markets that would otherwise be

difficult or impossible to access. DR's are certificates issued by a depositary bank in the same country as the investors that correspond with shares of a company's stock held by the depositary bank in the foreign market. The DR and the underlying stock should be perfect substitutes for each other (Miller, 1999). However, they are not perfect due to other influences like transaction costs.

Differences in Risk and Return for Multinational Corporations

Fillat and Garetto (2015) discuss differences in risk and return between multinational companies and those operating in one country. They state that multinational companies can exhibit higher stock returns and higher risk than non-multinational companies, and that exporters earned higher returns than non-exporters. They write that this is mostly due to productivity differences along with the presence of sunk costs and aggregate risk.

There are a large variety of factors that influence the risk in multinational companies. Perhaps the most obvious is country risk, and Aswath Damodaran (2016) provides a very readable overview of these causes. Some of the main influencers are where the country is in the economic growth cycle, differences in political risk, the country's legal system, and whether the country's economy is disproportionately dependent on a sole product or service.

Effects of Ownership and Fundamentals

Pirinsky and Wang sought to understand why investors have a bias for local companies. To achieve this, the authors evaluated whether locality affects security returns for companies that switch headquarter location. They estimate betas for returns

as compared to those of old-location and new-location indices. Both local and national fundamentals show significant explanatory power but importantly lose their significance after the inclusion of the local market index in the regression. From this, they conclude that stock return comovement cannot be explained by fundamentals. They find that local comovement is stronger for companies with a larger percentage of local investors, which suggests that investor trading patterns are important in local comovement.

Methods

To expand on the currently available literature and bring it into a paper more understandable to an undergraduate business student, I decided to evaluate some of the differences in international companies that would exemplify some of the many issues that complicate the risk estimation of international companies. To accomplish this, I would need to choose an appropriate country, representative companies, and evaluate data in a meaningful way.

Broad Market Research vs. Case Study

At the beginning of this research process, I was faced with two alternative ways to conduct my research: evaluating a large set of securities to identify market-wide trends or to conduct a more in-depth analysis of a few companies that could exemplify the complexities that are involved in pricing international securities. The results of research on a large set of securities could potentially be widely useful in the field, while the case evaluation could identify an area for further investigation and provide a good example of international complexities for undergraduate students. After some initial research and refinement of this paper's intent, selecting a case study was an easy decision.

There were many factors that contributed to this decision. First, and most influential of those factors is that presenting these concepts in the context of a few companies is easier to understand. Being able to delve into three companies from the same country and showing how much variation there can be inside of that group would help undergraduates understand the complexities of this issue.

Second, the data availability of international companies can be an issue. Many financial databases charge fees in the thousands for access, making financial research of this type more suitable for well-funded research programs or corporations. There are also few examples of companies that match as well as those I found in their transition from segmented to global. To find more firms, I would have to expand my parameters for size and industry, while being more flexible on the timeline and degree of fundamental and ownership changes. Additionally, as the number of involved countries and companies grows, there are many more factors that need to be accounted for in the analysis that makes this type of research much less feasible in the time frame of this project. By keeping my sample size small I was able to find a few companies that had a minimal number of differences to isolate the influence of their differing international strategies.

Country Selection

Again, to reduce the number of external factors that would influence the results of this case study, I decided that selecting companies that were based in a single country would be the most beneficial. This would allow the use of a single domestic market and prevent country-specific factors from overly influencing my results. This left the decision of selecting a single country.

As mentioned earlier, developing nations are becoming increasingly important in the world economy. As companies contribute more to world GDP and expand internationally, their home countries often become more accommodating to foreign investment. This provides many new opportunities and challenges for investors across the world. Companies from these nations are growing quickly and will draw even more

attention in the future. I found that India is both a developing economy, has one of the largest populations in the world, and consistently ranks among the best for economic growth. Because of this, I narrowed down my search for companies that were based in this country.

Company Selection

To best determine the effects of shifts in fundamentals and ownership, I aimed to identify two pairs of companies. For approximating the effect of listing in a foreign market, I would compare a company that is only domestically listed to one that is listed on international exchanges. For this comparison, relatively similar fundamentals would be beneficial in reducing the effect that a fundamental shift would potentially have on the stocks' beta. The other pair of companies would be the inverse, with comparable listings, but very different shifts in fundamentals. The three companies I identified as fitting these criteria are Tata Motors, Motherson Sumi Systems, and Hero MotoCorp.

All three of these companies operate in the automotive vehicle industry. This is important because industry factors are common in explaining differences in returns, so having all companies in the same sector allows for simpler comparison between companies.

The first comparison, which aims to highlight the difference that listing choices have on stock behavior, is Tata Motors and Motherson Sumi Systems. These companies have similar shifts in revenue from domestic to international, with very different stock listings. Tata Motors has been listed on the New York Stock Exchange since October 2004, while Motherson Sumi Systems is only listed on Indian stock exchanges.

The second comparison, which aims to highlight how differences in revenue affect beta is Motherson Sumi Systems and Hero MotoCorp. These companies have different fundamentals, with Hero MotoCorp earning almost all its revenues from India and Motherson Sumi Systems having a shift in revenue from mostly India to largely international revenue. Both companies have comparable listings, both being exclusively listed in India.

The following is a brief description of each of these three companies:

1. **Tata Motors** was founded in 1945 and is based in Mumbai, India and has grown to be a large international firm. The company designs, manufactures, and sells a wide range of automotive vehicles. On October 1st, 2004, Tata Motors listed an American Depositary Receipt (ADR) on the New York Stock Exchange, trading under “TTM.” In 2003, Tata Motors earned more than 90% of its revenue from India, shifting drastically over the past 15 years to earning less than 20% of its revenues from India today. Tata Motors is a fitting example of a company that has had a large shift in revenue from domestic to international and has listed its shares internationally.
2. **Motherson Sumi Systems** designs and manufactures automotive vehicle parts, including wiring harnesses and rearview mirrors. The company was founded in 1986 and is headquartered in Noida, India. Like Tata Motors, Motherson Sumi Systems has recently seen a large shift in revenues as sales rapidly expanded internationally. In the past twenty years, the company has

transitioned from earning only 16% of its revenue from international markets to earning 84% in 2017. However, Motherson Sumi Systems has chosen to avoid listing its shares internationally and remains traded exclusively in India.

3. **Hero MotoCorp** is the largest two-wheeler manufacturer in the world, selling motorcycles and scooters in India. This company was founded in 1984. Hero MotoCorp has historically earned all its revenue from India, and just recently began to see a small volume of international sales, most recently only 2%. Hero MotoCorp trades exclusively on Indian stock exchanges. This is the least globalized company of the three.

Data for each company's stock price and revenue mix were obtained from S&P Capital IQ. Stocks were analyzed from 2002 through 2017, which captured all large revenue shifts and ADR offerings.

Index Selection

An index is a way of measuring a section of the market. Indices are hypothetical portfolios of stocks that are used to track a certain market or industry. Essentially, the movements in returns of an index represent the returns of the entire market which they represent. To select indices, it was important to choose those which most completely represented the relevant economies. For example, in choosing the MSCI All Countries World Index for the global market, I aimed to capture as many countries as possible to approximate the entire market. The MSCI All Countries World Index includes twenty-three developed and twenty-four developing economies (Modern Index Strategy, 2018).

To represent India, I selected the MSCI India Index. This index covers roughly eighty-five percent of the Indian equity universe and includes all three companies I selected (Modern Index Strategy, 2018). For the Indian automotive industry, I chose the S&P BSE AUTO index, which includes all three of the selected stocks among its sixteen constituents (Modern Index Strategy, 2018). Importantly, these indices all had data over the whole period from 2002 through 2017. All data for index returns was gathered from Capital IQ.

Regression Equation

After gathering the necessary data as described above, I began my analysis using R, a programming language, because it allowed for processing substantial amounts of data and was able to run regressions and other analyses. This program is also commonly used in finance. stargazer was helpful in displaying results in an easily readable way (Hlavic, 2018).

Betas are important in estimating the amount of influence that an independent variable has on a dependent variable. So, to determine how stock returns are affected by market returns, it makes sense to regress stock returns against a variety of markets and evaluate the results. To examine the exposure of each stock's returns to the world and Indian markets, I used equation (1).

$$R_t = \alpha + \beta^W R_t^W + \beta^I R_t^I + \beta^A R_t^A + \varepsilon_t \quad (1)$$

In this equation, R_t represents the weekly return of a single stock. R_t^W is the weekly return of the MSCI All Countries World Index which represents the world market. R_t^I is the MSCI India Index and represents the Indian Market. Finally, R_t^A is the S&P Indian Automotive Index, which is intended to control for movements in the

automotive industry. Initially, betas were tested without including the automotive index, but the index proved to be very helpful in clearing up the results and removing a lot of the noise that was interfering with the other betas.

Weekly returns were used because this reduces some of the noise in daily returns, while having more data points than monthly returns. Weekly data have a lower sample size than daily, but with the multiple year range of the time periods there are still plenty of datapoints. An example of how noise can be reduced is in the case of low trading volume. If individual or groups of stocks are not traded as frequently as others, then the infrequently-traded stocks will react more slowly to news than higher-volume stocks. Using weekly returns addresses this because a weekly return includes all stock movements over the entire week. So, by using weekly returns, if the low volume stocks react to news in less than a week, most of this noise is avoided.

It may be also helpful to clarify what correlation represents. Correlation measures how closely the relationship between two variables represents a linear relationship. Correlation represents both the direction and degree of this relationship.

Direction: If correlation is positive, then the higher values of one variable correspond with the higher values of the other variable and the lower values correspond with lower values of the other variable. If correlation is negative, the higher values of each variable correspond with the lower values of the other variable.

Degree: This represents how closely the variables resemble a linear relationship. A correlation of 1 or -1 would mean that if the variables were plotted on a scatter plot, they would form a straight line. If the correlation was 0, the variables have no linear relationship, potentially appearing as a cloud of dots on the graph.

Test Predictions

Again, the first comparison aims to highlight the difference that listing choices have on stock behavior and compares betas between Tata Motors and Motherson Sumi Systems. Tata Motors listed on the New York Stock Exchange and quickly exposed itself to international ownership. From this, I predicted that Tata Motors' beta against the world would increase significantly, while its beta against India would decrease. I predicted that Motherson Sumi Systems would stay relatively unchanged, with a small increase in world beta and decrease in Indian beta to reflect its revenue shift.

The second comparison aims to highlight how differences in fundamentals affect beta and compares Motherson Sumi Systems and Hero MotoCorp. Motherson Sumi Systems has a shift in revenue from mostly domestic to mostly international. I expect similar results as in the first comparison. I predicted that Motherson Sumi Systems would have an increase in world beta and a decrease in Indian beta. For Hero MotoCorp, I expected little change.

Results

To examine the effects of shifts in ownership and shifts in fundamentals on the dependence of a company's returns on their domestic market, I made two comparisons between the companies that were selected earlier in this paper.

Ownership

To evaluate the impact of listing on a foreign market, I examined the returns of Tata Motors and Motherson Sumi Systems. Tata Motors has listed on the New York Stock Exchange, while Motherson Sumi Systems has not. Both companies have seen a large shift in international revenues as seen in Figure 1. Because the two companies have similar revenues by country, the changes relating to a shift in fundamentals should affect both companies equally and the difference in beta change between the companies is due to other factors. Since the other large factor is the shift in ownership, the results here suggest that investors likely have some effect.

Using equation (1), I regressed returns for each company against the world market, the Indian market, and the automotive industry in India. The regressions were done for both companies from January 2002 until a week prior to Tata's New York Stock Exchange initial public offering in October 2004, and from the week following the listing until December 2017.

If listing in a foreign market increased the influence of the world market on stock price, then the beta representing how Tata Motors reacts to changes in the world market would be larger after its listing. In Figure 2, it's clear that the results conform to this expectation.

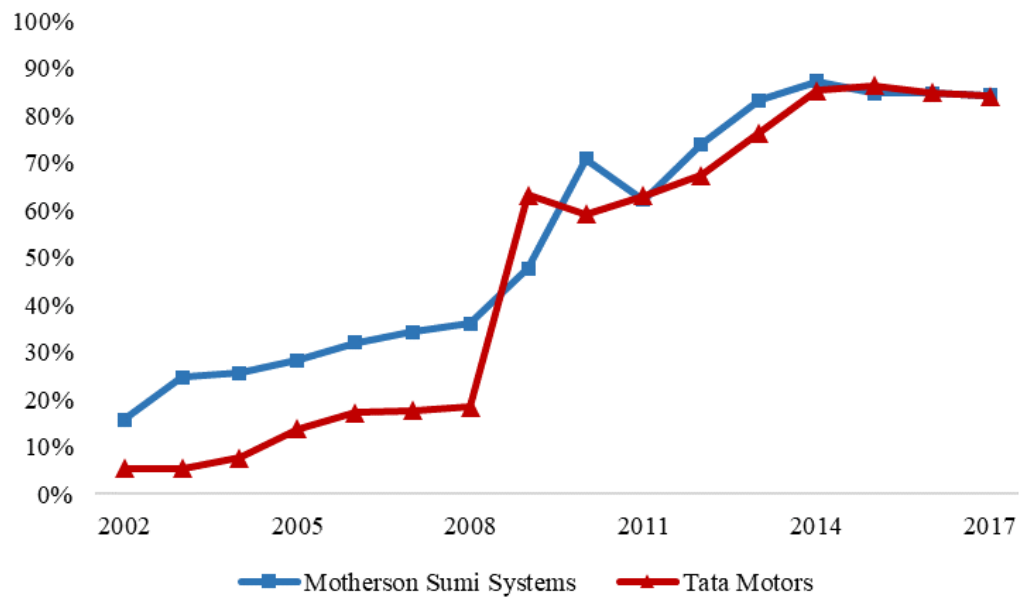


Figure 1: Tata Motors and Motherson Sumi Systems' Percentage International Revenue

Tata Motors has clear changes in beta after it listed shares internationally. The world beta shifts from being slightly negative to 0.376. After the listing, the world beta is highly significant. The world beta before the listing and the world beta after the listing are also both outside of each other's 95% confidence interval. The stock's returns are clearly more influenced by the world market after the listing. Additionally, the beta with the Indian market does the inverse. Before the listing, the Indian market beta is 0.221. After the listing, this drops to -0.189. This result is generally what would be expected if the returns of the stock became more dependent on international factors after the international listing.

Motherson Sumi Systems does not fit the return model quite as well as Tata Motors, with a lower R^2 . Both the world and Indian betas remain relatively unchanged. The automotive industry is the only significant beta and, being the highest for Motherson Sumi Systems, has by far the most predictive power.

The results of this analysis show that the stock prices generally behaved as would be expected. Comparing the statistics between the two companies, the world market becomes more influential for Tata Motors, while there is not a clear change for Motherson Sumi Systems.

Figure 2: Tata Motors and Motherson Sumi Systems Regression Outputs

	Dependent variable:		Dependent variable:		Dependent variable:
	M		M		M
W	-0.022 (0.225)	W	0.185 (0.144)	W	0.353* (0.187)
I	-0.018 (0.250)	I	0.237 (0.163)	I	-0.109 (0.229)
A	0.894*** (0.213)	A	0.303** (0.147)	A	0.791*** (0.172)
Constant	0.008* (0.004)	Constant	0.004 (0.004)	Constant	0.006** (0.003)
Observations	261	Observations	261	Observations	261
R ²	0.198	R ²	0.204	R ²	0.247
Adjusted R ²	0.188	Adjusted R ²	0.195	Adjusted R ²	0.239
Residual Std. Error	0.070 (df = 257)	Residual Std. Error	0.057 (df = 257)	Residual Std. Error	0.041 (df = 257)
F Statistic	21.090*** (df = 3; 257)	F Statistic	21.934*** (df = 3; 257)	F Statistic	28.152*** (df = 3; 257)
Note:	*p<0.1; **p<0.05; ***p<0.01	Note:	*p<0.1; **p<0.05; ***p<0.01	Note:	*p<0.1; **p<0.05; ***p<0.01

	Dependent variable:		Dependent variable:		Dependent variable:
	H		H		H
W	0.149 (0.112)	W	-0.294*** (0.099)	W	-0.119 (0.121)
I	-0.100 (0.125)	I	0.101 (0.112)	I	0.095 (0.148)
A	0.935*** (0.106)	A	0.648*** (0.100)	A	0.819*** (0.111)
Constant	-0.003 (0.002)	Constant	0.003 (0.002)	Constant	-0.001 (0.002)
Observations	261	Observations	261	Observations	261
R ²	0.510	R ²	0.343	R ²	0.429
Adjusted R ²	0.504	Adjusted R ²	0.335	Adjusted R ²	0.422
Residual Std. Error	0.035 (df = 257)	Residual Std. Error	0.039 (df = 257)	Residual Std. Error	0.027 (df = 257)
F Statistic	89.112*** (df = 3; 257)	F Statistic	44.694*** (df = 3; 257)	F Statistic	64.265*** (df = 3; 257)
Note:	*p<0.1; **p<0.05; ***p<0.01	Note:	*p<0.1; **p<0.05; ***p<0.01	Note:	*p<0.1; **p<0.05; ***p<0.01

Figure 3: Motherson Sumi Systems and Hero MotoCorp Regression Outputs

Fundamentals

For the second comparison, I evaluated the returns of Motherson Sumi Systems and Hero MotoCorp. The comparison between these two companies is meant to measure how their dependence on different markets changes as their revenue shifts to being more international. Figure 4 shows that Motherson Sumi Systems has gone from 16% to 84% international revenue from 2002 to 2017, while Hero MotoCorp has maintained almost exclusively domestic revenue. There are three time periods for these regressions, which is done to evaluate the shift in revenues instead of measuring betas on either side of a single event.

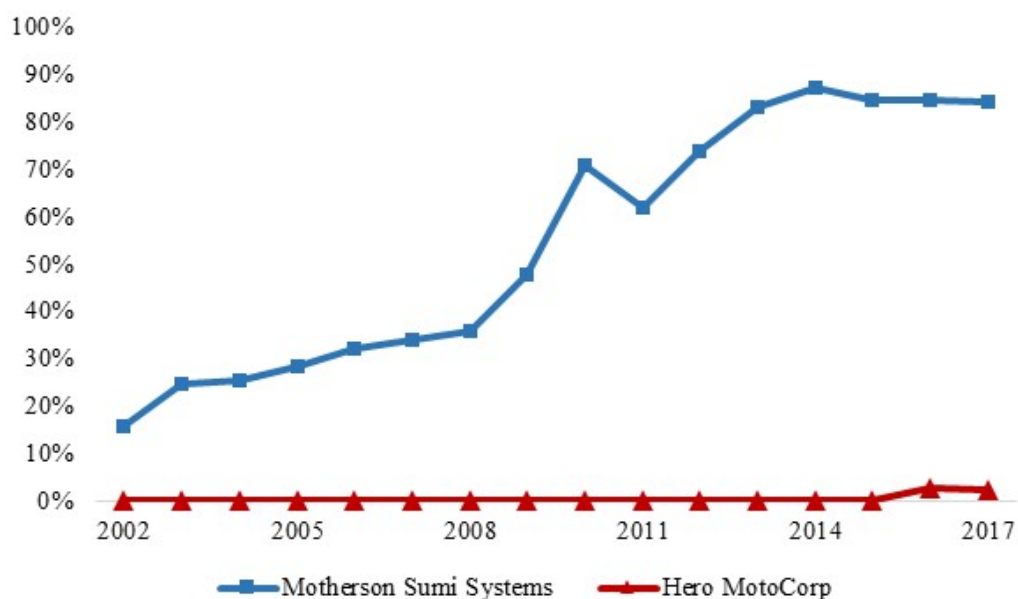


Figure 4: Motherson Sumi Systems' and Hero MotoCorp's Percentage International Revenue

Motherson Sumi Systems has similar results in this set of regressions as it had over the previous set. The world and Indian betas are never very significant, and all of them are near zero, especially considering the standard errors. This is not what would be

expected if the changes in fundamentals had a large effect on what markets the stock's returns are sensitive to.

Hero MotoCorp's world beta is negative in the middle period, from 2007-2012. Besides this instance, the other world and Indian betas range from -0.119 to 0.149 with no real trend in either beta over time. The Indian beta is never significant, and the world beta is only significant in the middle period.

For both Motherson Sumi Systems and Hero MotoCorp, the automotive industry index has a much higher beta that is consistently more significant than the others. If fundamentals had a large influence on what drives returns, then we would expect to see a large difference in world betas between these two stocks that have such different international revenues in the last period. Without this, the fundamentals seem to have little effect.

This is in line with what Pirinsky and Wang (2006) found in their paper on headquarters location. They did not see local fundamentals as having as large an effect on comovement of stock returns as indices. Extrapolating this, when both companies are earning their revenues in India, this is not the most important factor driving their returns. So, as one company shifts revenues internationally, they are not changing anything that was greatly affecting their relationship to the Indian market.

Other Potential Influences

There is a large list of other factors that could have affected this analysis. Using only three companies instead of a larger portion of the market is a very small sample size, which increases both type I and type II errors.

Another influence on beta is the tendency of companies in poorer economies correlate more with each other than those in rich countries (Morck, Yeung, and Yu, 2000). Knowing this, we would expect the companies to move more strongly with the Indian index since the stocks in this market should have correlated returns.

Conclusion

This thesis has highlighted some of the issues in comparing international companies to those operating and financed in segmented markets by examining shifts in beta that appeared to be affected by shifts in the company's fundamentals and ownership. Analyzing Tata Motors, Motherson Sumi Systems, and Hero MotoCorp has shown that a shift in ownership does have an effect on stock returns. These findings provide a platform for further research to be done on this topic, with a larger number of stocks and more countries. By learning more about what influences changes in returns as companies become more global, portfolios can be better optimized and earn higher return at each level of risk.

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