Multiple Industry Allocations in the Barra US Equity Model (USE3)

The Impact of Multiple Industries on Risk Forecasts and Return Attribution

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Introduction

The Barra US Equity Model (USE3) utilizes a proprietary industry scheme which includes multiple industry membership. A stock can have up to five non-zero industry exposures which sum to 100%. The methodology is detailed in the Barra USE3 Model Handbook (1998). A similar approach is taken in the Barra Japan and Barra Mexico equity models. Multiple industry allocations provide more accurate risk prediction as well as more insight into sources of return. Additionally, Barra's multiple industry models capture changes in a company's risk profile as soon as new business activity is reported.

In this paper, we examine the impact of accurately attributing multiple industry membership on risk forecasts. First we analyze the characteristics of equities with multiple industry allocations. We then demonstrate the impact of multiple industry exposures on risk forecasts. We focus on the inaccurate risk estimation that single industry allocation introduces to individual equity risk forecasts. Lastly we perform a case study on a stock with a varied history of industry membership - Ford Motor Company – analyzing its industry exposures, industry factor returns and their contribution to the return of Ford stock.

Multiple Industry Exposures for US Equities

The Barra USE3 Model Estimation Universe comprises a large, liquid segment of the US equity market, (see Barra USE3 Model Handbook (1998)). Table 1 shows the market capitalization distribution of USE3 Estimation Universe stocks with different number of industry memberships at the end of 2000, the end of 2005 and the end of June 2011. The tables show that a significant portion of the US equity market has exposure to multiple industries in the Barra USE3 model. As of December 29th, 2000, over 48% of stocks by market cap in the US equity market were exposed to more than one industry. 11 stocks had exposure to the maximum five industries. While that figure dropped slightly by June 30th, 2011 stocks that were exposed to more than one industry were larger market capitalization companies. The average capitalization of stocks with five industry exposures was over $60bn on June 30th, 2011.

Table 1, Market Capitalization Distribution of USE3 Estimation Universe

Date: December 29, 2000

Number of distinct industries	**1**	**2**	**3**	**4**	**5**
Number of companies	1534	360	122	45	11
Capitalization (Million $)	7,579,662	3,128,488	1,934,354	1,352,996	660,325
Percent of total market cap (%)	51.7%	21.3%	13.2%	9.2%	4.5%
Average capitalization (Million $)	4,941	8,690	15,855	30,067	60,030

Date: December 31, 2005

Number of distinct industries	1	2	3	4	5
Number of companies	1,295	377	131	34	9
Capitalization (Million $)	7,207,035	3,220,432	2,718,161	874,847	703,903
Percent of total market cap (%)	48.9%	21.8%	18.4%	5.9%	4.8%
Average capitalization (Million $)	5,656	8,542	20,749	25,731	78,211

Date: 30 June, 2011

Number of distinct industries	1	2	3	4	5
Number of companies	1,409	311	69	17	9
Capitalization (Million $)	8,362,970	3,895,954	1,752,132	991,197	543,201
Percent of total market cap (%)	53.08%	25.06%	11.27%	6.38%	3.49%
Average capitalization (Million $)	5,935	12,527	25,393	58,306	60,356

Figure 1 shows the general consolidation trend across US equities. For example, the number of stocks with the maximum number of industries, five, decreased from eleven to nine over the 11-year period. The number of stocks with both three and four industry exposures approximately halved.

Figure 1, Number of Companies with Different Industry Exposure

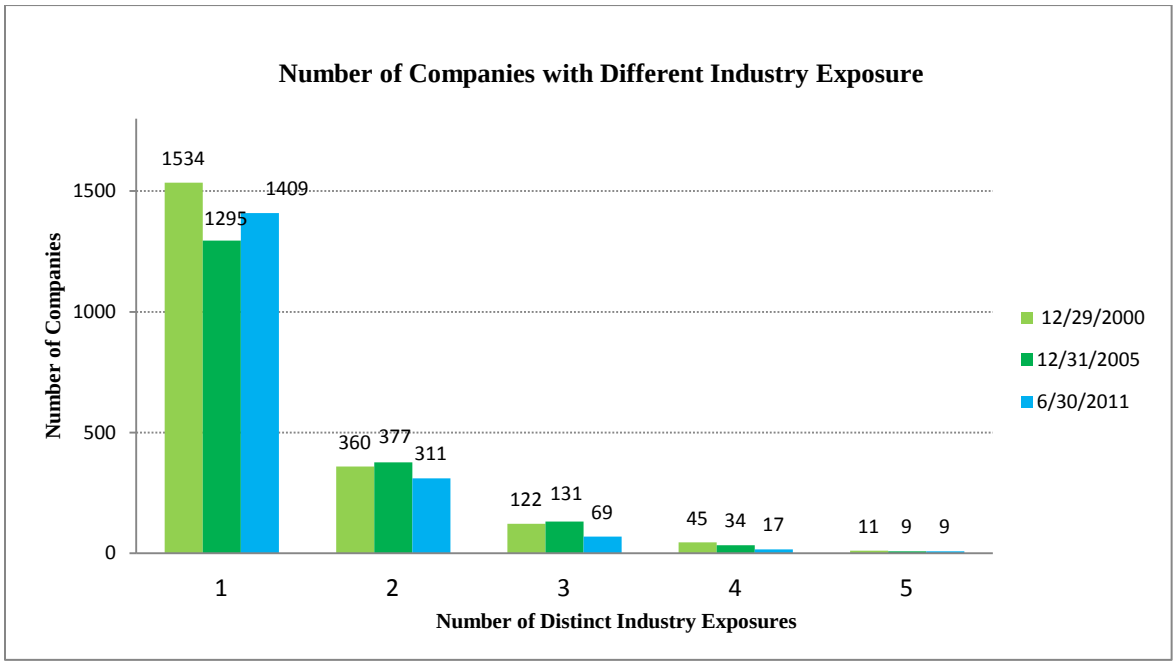
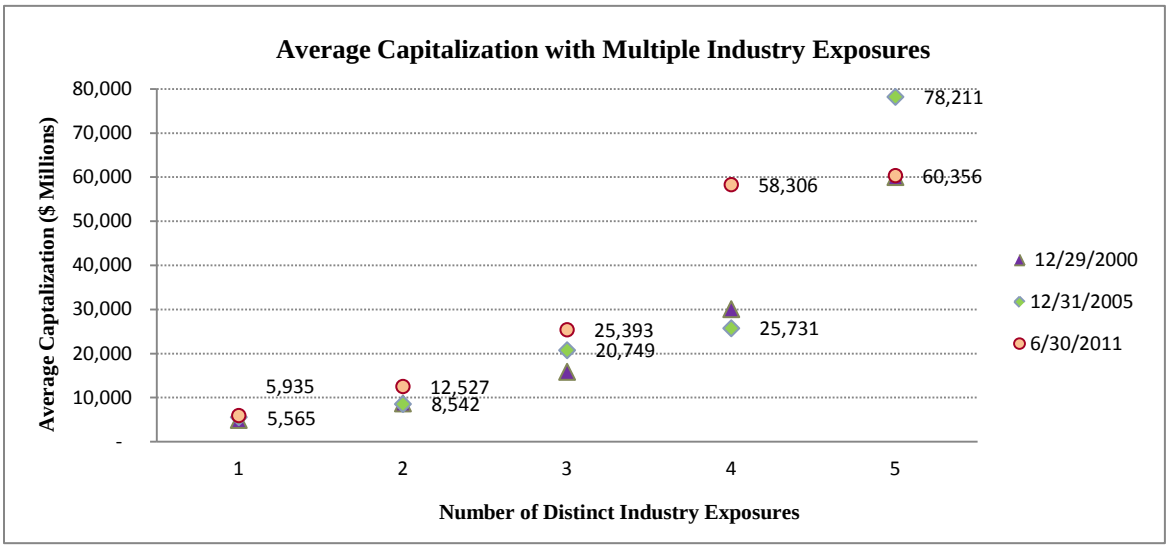


Figure 2 shows that the average capitalization of stocks with five different industry exposures was the highest on December 31st, 2005. On June 30th, 2011, the average market capitalization of stocks with four and five different industry exposures was almost the same.

Figure 2, Average Capitalization for Multiple Industry Exposures



As an example of a large capitalization stock decreasing in number of industry membership, we look at Procter & Gamble Company. On December 31st, 2005, Procter & Gamble Company industry exposures were as shown in Table 2.

Table 2

Industry	Forestry And Paper	Food & Beverages	Home Products	Drugs
Exposure	7%	2%	88%	3%

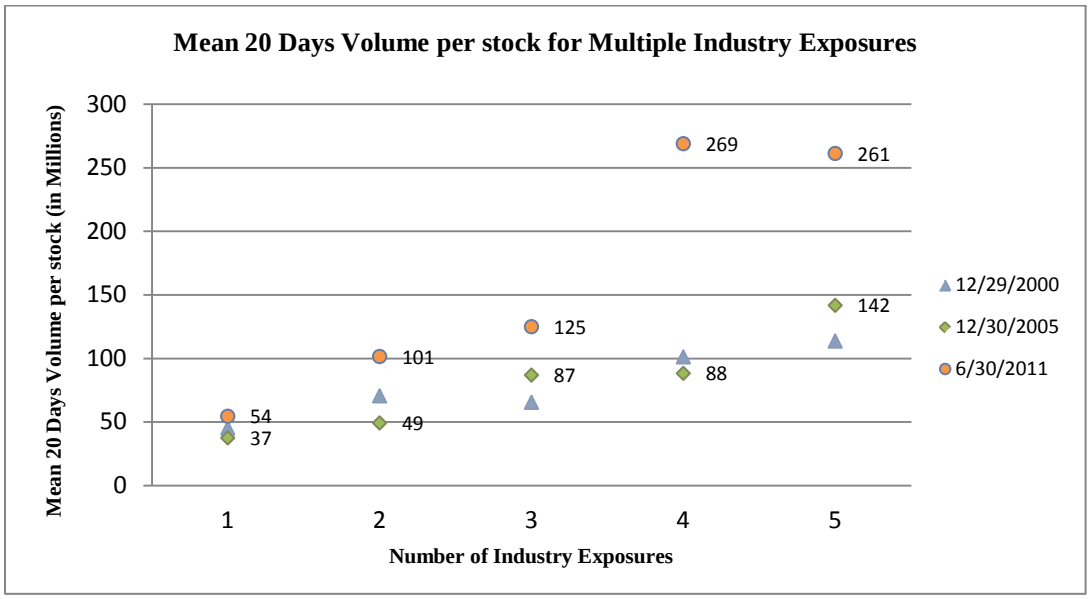
On June 30th, 2011, Procter & Gamble Company industry exposures were as shown in Table 3. While Home Products remained the main industry of Procter & Gamble, it no longer has exposure to the Drugs industry.

Table 3

Industry	Forestry And Paper	Food & Beverages	Home Products
Exposure	5%	1%	94%

We can also examine trading volume over time for different industry exposures. Mean 20-day volume is the average number of shares traded over the last 20 trading days multiplied by today's closing price. It is a measure of liquidity. Figure 3 shows that the mean 20-day volume per stock increased over time and reached a high at June 30th, 2011. The stocks with four industry exposures had the highest level. This is due to the fact that stocks with four industry exposures halved, and the remaining stocks were very liquid. Figure 3 also shows that stocks with five industry exposures were heavily traded at each of the points in time. It reflects the greater liquidity in these large and diverse businesses, as well as their importance to the US equity market.

Figure 3, Mean 20 Days Volume per stock for Multiple Industry Exposures



The Impact of Multiple Industry Membership on Risk

Stocks are affected by market trends in each of their business lines. If a risk model only uses one industry for risk calculations, it could inaccurately calculate the risk number for stocks. We examine the difference that multiple industry exposures make for both total risk and industry risk calculations through a simple study case.

Table 4 shows the industry risk forecast calculated for all nine stocks with five industry exposures in the USE3 Estimation Universe as of June 30th, 2011. First we calculate risk assuming the stock has singular exposure to its main industry. Second we calculate the risk using the USE3 multiple industry allocation model. Table 4 shows that significant differences in total risk exist at the asset level when using the two approaches. Loews Corp, Caterpillar and GE all show significant differences in total risk. Calculating risk using multiple industries generally results in a lower total risk forecast, reflecting the diverse nature of these companies. Using a single industry approach may mask a small exposure to a particularly volatile industry.

Table 4, Total Risk Forecast Calculation of Stocks using Single Industry Exposures vs. Multiple Industry Exposures

	Total Risk		
Stock	**Single Industry (%)**	**Multiple Industries (%)**	**Risk Difference (%)**
Loews Corp	31.79%	28.12%	3.67%
Caterpillar Inc Del	37.64%	33.77%	3.87%
General Electric Co	34.97%	31.40%	3.57%
MDU Resources Group Inc	23.84%	25.59%	-1.75%
3M Co	23.75%	22.84%	0.91%
Berkshire Hathaway (A)	22.47%	21.64%	0.83%
Leucadia National Corp	31.27%	31.93%	-0.66%
Matthews International Corp	27.07%	27.39%	-0.32%
Otter Tail Corp	23.82%	23.67%	0.15%

Table 5 focuses on the industry risk of the same stocks. The table shows similar information to Table 4, but the magnitude of the difference is generally larger as this calculation is the most directly impacted by the industry exposures.

Table 5, Industry Risk Forecast Calculation of Stocks using Single Industry Exposures vs. Multiple Industry Exposures

	Industry Risk		
Names	**One Industry (%)**	**Multiple Industries (%)**	**Risk Percentage Difference (%)**
General Electric Co	27.94	23.50	3.44%
Caterpillar Inc Del	31.22	26.51	4.71%
Loews Corp	30.10	26.15	3.95%
MDU Resources Group Inc	19.75	21.75	-2.00%
Matthews International Corp	19.81	20.76	-0.95%
3M Co	23.45	22.54	0.89%
Berkshire Hathaway (A)	21.17	20.58	0.59%
Leucadia National Corp	20.45	20.74	-0.29%
Otter Tail Corp	19.01	18.88	0.13%

Ford Motor Company

Ford Motor Company (Ford) is a producer of motor vehicles and related parts. Ford is also engaged in other businesses, including vehicle finance and leasing. It operates under two segments: Automotive and Financial Services. Financial services include the operations of Ford Motor Credit Company and Real Estate.

Figure 4 shows the evolving USE3 industry exposures of Ford from 1976 to 2011. From 1976 to 1988, Ford was solely engaged in production of Motor Vehicles and Parts. Ford was exposed to the Financial Services industry from 1988. Ford was briefly exposed to the Industrial Services industry from 2005 to 2006. In the Barra USE3 model, the definition of the Industrial Services industry includes truck and auto fleet management, car and truck leasing and auto repair.

Figure 4, Ford Industry Exposure History

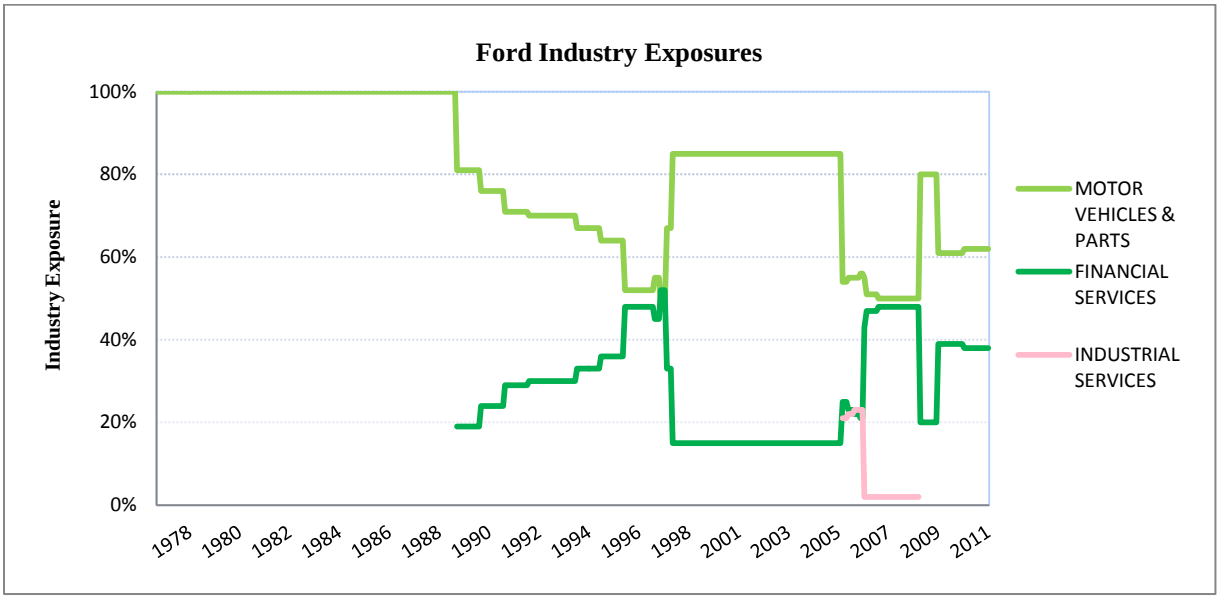
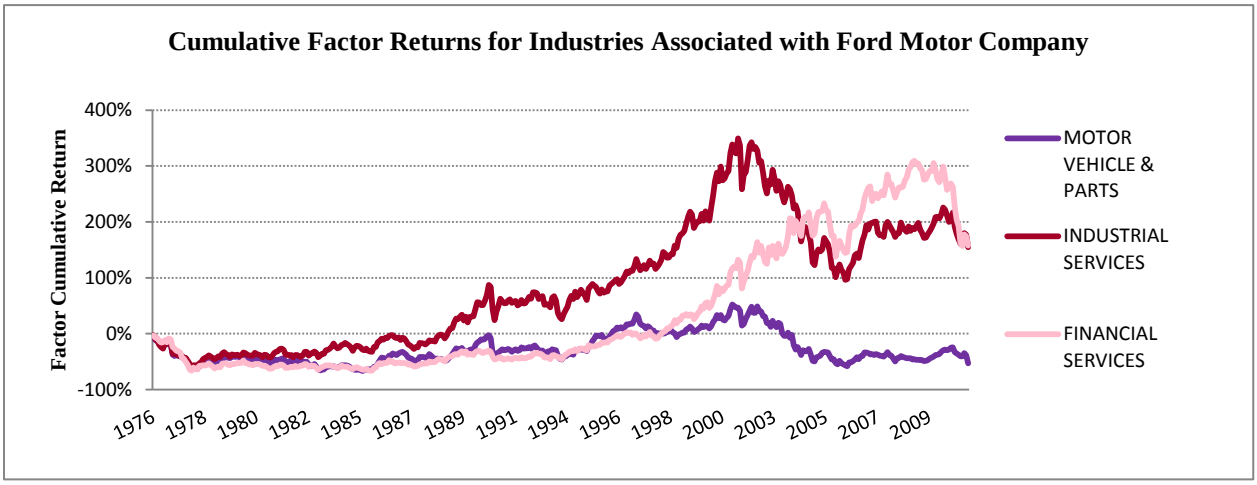


Figure 5 shows cumulative factor returns for the three industries that Ford was exposed to over this period. Financial Services and Industrial Services were the better performing industries over the period, while the factor return for Motor Vehicles and Parts declined from the late 1990s to 2011. There was a significant decrease in the returns to Financial Services and Industrial Services in late 2008, reflecting market events at that time.

Figure 5, Cumulative Factor Returns for Industry Factors Associated with Ford Motor Company



Next we examine the impact of these industry factor returns on the return to Ford stock. We need to consider both the exposure of Ford to these industries, and the returns of the industries themselves. Figure 6 shows the contribution of each industry to the total industry return of Ford. Ford has a significant exposure to the Motor Vehicles & Parts industry, which we know performed poorly over the period. The Motor Vehicles & Parts factor therefore contributed negatively to the return of Ford after 2000 and more strongly negatively in late 2008. Ford had a relatively small exposure to the Financial Services industry factor over the period, but that small exposure still contributed positively to the return of Ford. Consider that a more simple risk model built using a single industry classification would incorrectly allocate this return as stock-specific return.

Figure 6

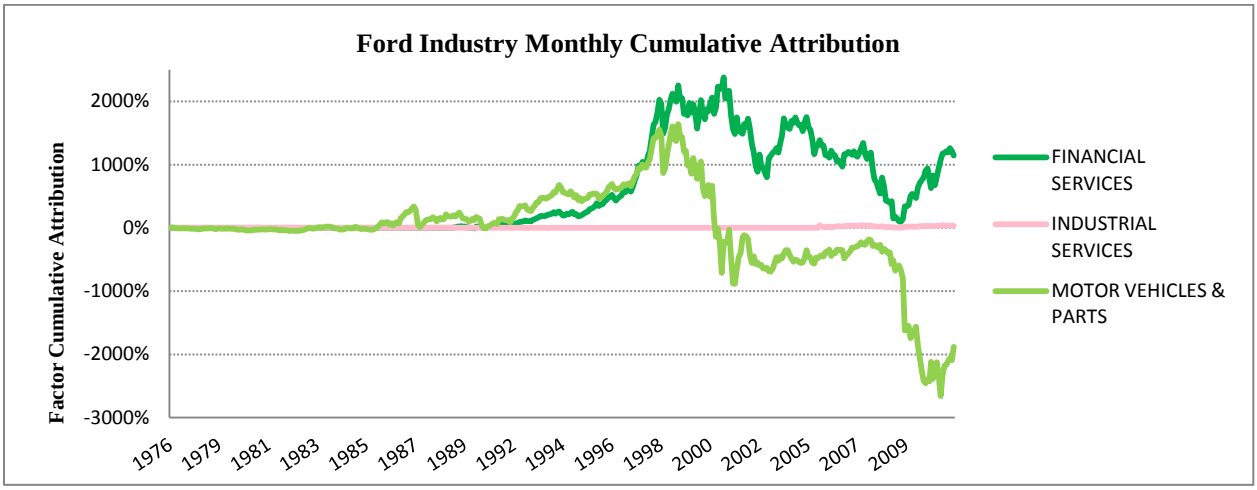
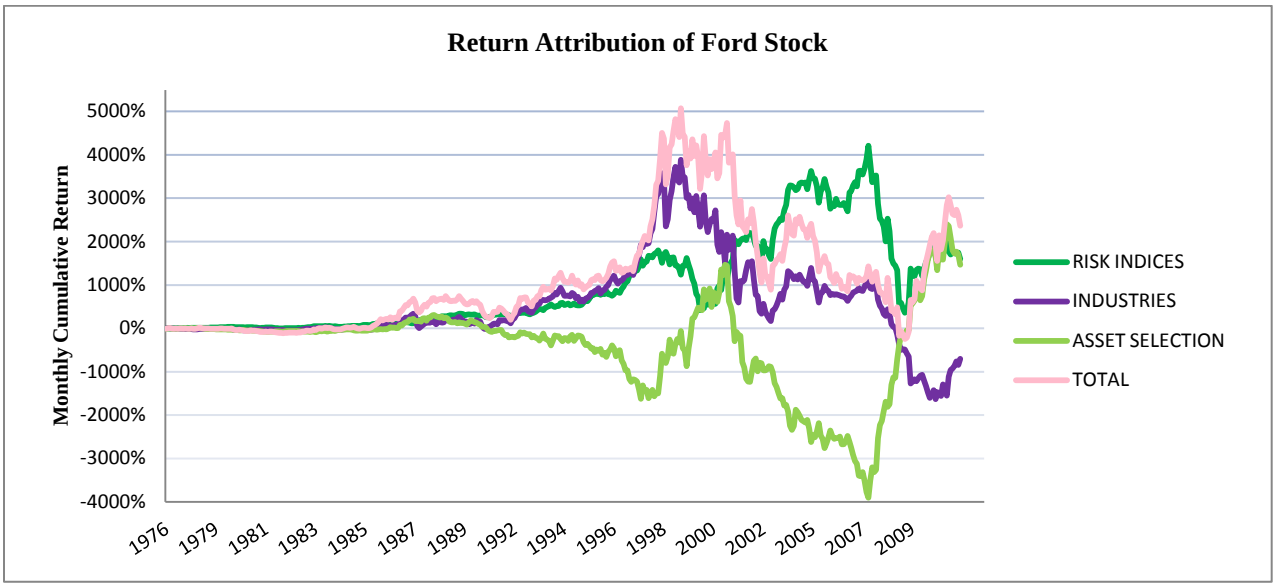


Figure 7 shows the return of Ford over the period 1976 to 2011, as well as the attribution of that return to Industry, Risk Index/Style and stock-specific sources. The total cumulative return for Ford was positive over the period. The strongest

drivers of that positive return were Risk Index and stock-specific effects. Industry effects were strongly positive through 1998, and then became negative after 2008, related to the market effects illustrated in Figure 6.

Figure 7, Return Attribution of Ford Stock



Conclusion

We first examined the market capitalization distribution of the USE3 estimation universe to highlight the significance of the segment of the market impacted by the Barra multiple industry allocation scheme. We also showed how the mean 20-day volume is larger for stocks with a greater number of multiple industry exposures. We discovered that the most heavily traded stocks are the ones with five industry exposures.

Taking a step further, we showed the impact of multiple industry membership on risk forecast calculations for these large and highly traded stocks. There exist significant differences in an asset's risk forecast when using a single industry scheme versus a multiple industry scheme.

Lastly, we studied Ford Motor Company. Ford is an automotive company with a relatively small financial services operation. However, the biggest positive contribution to industry return over the period analyzed comes from Financial Services. If we were to only use single industry membership, we would miss the true source of return for Ford.

Barra, the leader in equity risk models and portfolio construction tools, is focused on identifying and properly measuring the common factors underlying the equity markets. Multiple industry allocation permits greater insight into the return drivers of a stock and better insight into a firm's business activities. Industry exposure and industry risk plays an important role in risk and return decomposition. This is just one example where the additional precision and sophistication employed differentiates Barra models from alternative methods.

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