How to model a trade war – just in case…

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Renewed optimism that the long-awaited trade deal between China and the US may finally be within reach has propelled stock markets to yet more record highs. That said, we've seen this movie before. Similar expectations were in the air in the first quarter of 2019, only to be dashed in May by the announcement of additional tariffs. And despite plans for Xi Jinping and Donald Trump to sign a "phase one" agreement in December, the US president reiterated his readiness to "substantially" raise import duties, if the deal were to fall apart at the last minute. At the same time, Trump called the trade barriers imposed by the European Union "worse than China", keeping the threat of special levies on car imports from the bloc alive by postponing his decision by another six months.

Either way, one thing is certain: the trade conflict between the world's two largest economies has been the single most important driver of financial market performance in the past three years. Even expectations of monetary policy—and the accompanying yield curve dynamics—seemed to depend more on the latest progress in the negotiations than on the state of the underlying economy. This not only affected the United States, but also European markets, which frequently seemed to be decoupled from macro-economic factors, such as GDP growth. In this paper, we revisit some of the research we conducted over the past months on how to model a trade war—just on the off-chance that it may come in handy sometime soon.

Previous research and findings

Since the onset of the trade conflict in the spring of 2018, we have published a wide range of blog posts and feature articles, and held numerous talks and webinars on the topic. Here, we try to identify common themes and potential diversification strategies.

What all the examined environments had in common were "flight-to-quality" movements from riskier assets into the relative safety of highly rated government bonds and safe-haven currencies, such as the Swiss franc and the Japanese yen. Defensive stocks, such as utility companies and producers of consumer staples, tended to outperform their more cyclical peers, in particular technology and industrial companies, as well as discretionary consumer goods manufacturers. The automobile industry (part of consumer discretionary), with its heavy reliance on cross-border flows of components and parts, was hit particularly hard. This, in turn, meant that Germany was always among the worst-performing countries, putting further pressure on the already fragile manufacturing sector of Europe's powerhouse.

Having said that, German government bonds were among the biggest beneficiaries. Investment-grade corporate bonds also frequently benefitted from lower risk-free interest rates, though to a lesser extent than same-duration sovereign issues. High-yield bonds, on the other hand, often showed negative returns, due to the overriding spread effect.

Current environment

In our latest whitepaper, Minimum Variance: A Leg Up on Geopolitical Risk?, in which we analyzed the impact of recent geopolitical risk events on STOXX® minimum-variance indices vis-à-vis their corresponding global and regional market benchmarks, we noted the one-sided influence of American politics, economic growth and monetary policy on other parts of the world. While 'regional' concerns, such as Brexit or the French presidential election, had a notable impact on European markets, the effect on the US and global indices was much less pronounced. Yet, conversely, the scenarios relating to the trade negotiations between China and the US, and to

Federal Reserve policy, affected European markets almost as much as their North American counterpart—and often more significantly than the 'local' issues.

More recently, we observed that even the expectations of future Federal Reserve policy seemed to be driven by the perceived progress of the trade negotiations rather than the state of the underlying economy. In the first half of September, US Treasury yields experienced their biggest rise since the US presidential election, as traders reassessed their interest-rate expectations, effectively pricing out an entire 25-basis point cut before the end of the year. The move was also strong enough to more than reverse the curve inversion that spooked investors only a few weeks earlier.

The predominance of US economic development and politics became acutely apparent in the first half of 2019, when European stock markets posted their best half-year performance in almost 10 years, even though all important leading indicators had been pointing toward an economic contraction for many months. The explanation for this apparent disconnect between financial markets and the "real" economy was, in our view, that European stocks were swept along by their US counterparts, which had, in turn, been fueled by the resumption of trade negotiations at the start of the year, combined with the moderation in the Fed's monetary policy stance.

Defining a stress test

As we highlighted in our past whitepaper and webinar on *Stress Testing Best Practices*, scenario analysis is a good way of estimating the impact of extreme, yet plausible, adverse market movements on a portfolio. Stress tests complement traditional, statistical models by enabling the user to shock factors that need not necessarily be related to the actual portfolio, thus highlighting hidden exposures and vulnerabilities.

Stress tests can come in many shapes or forms. The simplest would be a **sensitivity analysis**, in which one applies a shift in one or multiple factors. These are then translated into monetary and percentage returns, using the sensitivities of security or portfolio to the factor changes. The advantage of this type of analysis is that it is easy to implement and that it requires no assumptions about correlations between factors. However, the latter also means that only securities sensitive to a certain factor are affected by the shock. For example, if one were to apply a shift in interest rates to a multi-asset class portfolio, only the fixed-income portion would move, while equities would remain completely unaffected.

A relatively straightforward way of incorporating the interplay of all market drivers is to run a **historical scenario**. In this case, the analysis replays actual historical pricing factor movements and—similar to the sensitivity analysis—uses the portfolio's current sensitivities to calculate the return impact. Again, no explicit assumption is required about the underlying distribution, which is implied by the factor histories. Yet, that also means that the extent of the factor shocks is limited by the actual realizations, which may not be suitable for the current environment.

A so-called **'transitive' stress test** combines the advantages of the previous two approaches. It allows the user to define individual factor shocks, similar to the sensitivity analysis, but at the same time uses historical correlations and betas to estimate the movements of the remaining pricing factors relevant for the portfolio. The user, therefore, needs to make two decisions: (1) which variable(s) to shock and by how much and (2) which historical period to use for the calibration of pricing factor covariances and betas. In our experience, less is often more, both with regards to the number of stressed factors and the length of the calibration period.

With regards to the latter, we found that daily returns over a three-month horizon offer a good compromise between having enough observations and still obtaining significant correlations and betas. As to the number of shocked factors, we would rather use fewer variables and find a calibration period that adequately reflects the co-movements of the major factors. Otherwise, the results of the stress test would merely reflect what the user

input in the first place. Also, if the direction of some of the defined factor shocks is contrary to that implied by the correlation matrix, the estimated betas are in danger of becoming spurious and meaningless.

The following case studies mostly use the described transitive method, sometimes complemented by historical scenarios.

The phases of the trade war

Since its **onset** in early 2018, the trade dispute between China and the US has been cycling through various phases of escalation and de-escalation. The conflict started when President Trump introduced tariffs on solar panels and washing machines in January 2018, although the market impact was limited at the time. The first real shock came in March, with the announcement of significant levies on Chinese steel and aluminum imports into the US. The next **escalation** point was the Trump administration's threat of a further $200bn of duties in June.

The second half of June 2018 was also when Trump first introduced the idea of penalties on automobile imports from the European Union. The White House subsequently commissioned the US Commerce Department to provide a report on whether motor vehicles and parts posed a national security threat for the United States. The President was to decide on this by mid-May 2019, but chose to postpone his verdict by another six months. A similar delay is expected for the upcoming review in mid-November, which would enable the US administration to retain it as a bargaining chip for future discussions.

The **resumption of trade negotiations** in the first quarter of 2019 provided a temporary reprieve, which saw share prices rise alongside Treasury yields and the US dollar. The rally, however, ended abruptly and the conflict **re-escalated**, when Trump announced a hike of existing import duties on $200bn of Chinese goods from 10% to 25% in May.

Common correlation patterns

What all these different phases had in common was the interplay between the major asset classes. After the first tariffs were announced in early 2018, and during the escalation in the second quarter, we saw a "flight to quality" from risky stocks and the US dollar to the safe havens of high-quality governments, gold and the Swiss franc and the Japanese yen. The exact mirror flows could then be observed in the first four months of 2019, when growing optimism about the reopened talks between China and the US revived risk appetites.

Though the absolute market movements were different for each scenario, the relative flows and, therefore, the correlations were very similar: losses/gains at the stock markets were offset by rising/falling prices in fixed-income securities. This provided good diversification opportunities, especially in down-markets.

The effect of the currency allocation, on the other hand, depended on the location of the portfolio manager. US investors experienced the biggest risk reduction, as their foreign stock-market losses were dampened by FX gains against the falling dollar. In contrast, Europeans invested in the American stock market had their losses amplified by a weaker exchange rate.

Due to their strong and consistent correlation patterns, all the described periods constituted suitable time windows for the calibration of pricing factor covariances. The stress tests in the examples below will use several or all of the following periods:

- Onset of the conflict with China: January 15 to April 6, 2018
- Escalation and extension to Europe: April 9 to June 29, 2018
- Resumption of trade negotiations: January 14 to April 5, 2019
- Renewed escalation: April 8 to May 31, 2019

Case study 1: Re-escalation between China and US

In the first case study, we examined the effect of a renewed escalation of the trade conflict with China. As described above, we needed to select the variables we wanted to shock and by how much, and which historical time periods to use for calibrating the pricing factor covariances and betas. In this case, the second decision was easier, as we simply used the four periods identified above. We also looked at more recent correlations to compare them with the historical precedents.

The first question of suitable factor shocks was more difficult to answer. Most forecasts for the impact of an escalating trade war centered around GDP growth in various countries and regions. Few analysts were willing or able to predict the effect on financial markets. When Donald Trump announced the first levies in March 2018, the immediate reaction was a drop of almost 5% in US share prices, while the dollar depreciated about 1.5% against both the yen and the euro. At the same time, the 10-year Treasury yield plummeted 8 basis points, extending its total decline to 0.17% over the subsequent two weeks.

As we were looking to model a slightly more severe, yet still plausible, scenario, we decided to roughly triple those numbers to a 15% drop in the S&P 500 index, a 5% depreciation of the Dollar Index (DXY) and a 45-basis point decrease in the 10-year US Treasury yield. As we expected an even bigger impact on the Chinese market, we applied a further shock of -20% to the CSI 300 index.

The results for the different phases are shown in the table below. The individual country returns are in local currency. US equities are further broken down by sector. In all the different calibration periods, cyclical sectors, such as information technology, industrials and consumer discretionary significantly and consistently underperformed their defensive counterparts, namely healthcare, consumer staples and utilities. The latter even exhibited a positive return in two of the five scenarios.

The poor results of technology and consumer discretionary—the latter of which contains automobile manufacturers—hit Germany particularly hard, meaning that Europe's biggest economy was the worst-performing developed market. Spain, on the other hand, with its much higher weight of utility companies, fared better. The Japanese market seemed to be least affected.

The Japanese yen was also the biggest beneficiary among the world's major currencies, reflecting the strong risk aversion of the country's investors. The Swiss franc similarly thrived on its status as a safe haven. Gains for the pound, though always positive, tended to be much less pronounced, due to its weak correlation with other markets, stemming from the ongoing Brexit uncertainty.

The ensuing flight-to-safety pattern also benefitted high-quality sovereign bonds, such as US Treasuries, British Gilts and German Bunds. Peripheral issuers, on the other hand, were adversely affected by higher risk premia. Having said that, contagion seemed fairly contained, as investors still appeared to distinguish between countries with a high debt-to-GDP ratio, such as Italy (around 130%), and those with more moderate public debt, such as Spain (just below 100%).

The performance of corporate bonds depended on the credit quality. While investment-grade issues still benefitted from lower risk-free rates—though to a lesser extent than their corresponding Treasury benchmarks—the spread increases in the high-yield universe were much higher, due to their strong inverse relationship with both share prices and sovereign yields. The oil price was also strongly coupled with stock-market performance, while gold tended to benefit from the same flight-to-safety flows as the other safe-haven assets.

Re-escalation between China and US: simulated returns

Asset Class	Onset	Escalation	Resumption of talks	Renewed escalation	Current
US Equity by Sector	-14.5	-14.3	-14.9	-14.5	-14.8
Information Technology	-15.3	-22.4	-19.3	-21.9	-20.9
Industrials	-16.1	-17.3	-17.0	-18.7	-15.7
Consumer Discretionary	-16.4	-16.6	-15.2	-17.1	-13.6
Financials	-18.1	-12.7	-15.5	-15.1	-14.4
Materials	-13.0	-18.2	-12.1	-15.5	-10.4
Energy	-13.3	-14.4	-18.4	-11.4	-22.9
Communication Services	-13.8	-20.8	-13.2	-16.9	-15.6
Health Care	-15.3	-11.2	-13.7	-8.3	-10.7
Consumer Staples	-8.8	1.9	-9.0	-5.3	-9.8
Real Estate	-7.7	-4.4	-6.6	-4.1	-5.6
Utilities	-4.0	12.6	-4.7	5.1	-5.2
Equity by Country					
China	-19.6	-19.5	-19.7	-19.5	-20.3
United States	-14.5	-14.3	-14.9	-14.5	-14.8
United Kingdom	-13.9	-12.4	-13.3	-11.0	-13.2
Germany	-19.3	-14.6	-13.0	-19.0	-16.8
France	-16.6	-11.6	-12.9	-16.3	-18.7
Italy	-15.2	-11.2	-10.8	-12.6	-18.3
Spain	-15.6	-9.2	-9.1	-11.1	-12.4
Japan	-16.1	-6.0	-9.8	-4.4	-5.8
Sovereign Bonds					
United States	3.2	3.4	3.3	3.6	3.0
United Kingdom	1.5	2.4	0.7	2.1	0.8
France	0.6	1.3	0.7	1.2	2.7
Germany	1.1	1.8	1.0	1.1	1.4
Spain	0.9	0.3	-0.5	0.2	-0.3
Italy	-0.1	-5.4	-2.9	-0.6	-6.2
Corporate Bonds					
USD Investment Grade	1.6	2.2	1.7	1.8	1.6
USD High Yield	-3.3	-1.7	-2.1	-2.9	-3.5
Foreign Currency vs USD					
JPY	8.3	4.9	3.9	8.0	5.5
CHF	6.0	3.8	1.8	4.3	6.2
EUR	4.6	4.2	1.4	3.2	4.7
GBP	2.7	2.1	4.5	2.1	1.5
CNY	-0.4	-2.8	-0.5	-2.3	-3.4
Commodities					
Gold	8.1	3.1	5.5	12.2	7.7
Oil	-12.5	-10.5	-14.8	-24.3	-18.9

Source: Qontigo via Axioma Risk™

Case study 2: EU car tariffs

The second case study focused specifically on the effects of the special tariffs on automobile imports from the European Union, which President Trump first proposed in June 2018. At the time, the market response was a 6% decline of the German stock market over the course of two weeks. The automobile sector was hit particularly hard, experiencing share-price declines of twice that amount. The average for the whole of Europe, on the other hand, was a mere -3.6%. We considered a 6% downward shock in the DAX® index a reasonable starting point for our analysis, and therefore decided to use this as the initial shock in our analysis.

As the calibration period, we used the 12 weeks to the end of June 2018, which represented not only the run-up to the announcement, but also coincided with the timeframe we characterized as the escalation period above (April 9 to June 29, 2018). For comparison purposes, we also added a historical stress test, which simply replayed the actual pricing factor movements during the last two weeks of June 2018 and a transitive scenario based on recent correlations.

As the proposed tariffs were aimed at the European Union, we took a closer look at the sector breakdown for the Eurozone. The distribution of actual and simulated returns showed a similar pattern as we noted in the previous section on an escalating conflict with China. Information technology was once more the worst-affected sector, followed by other cyclical industries, such as consumer discretionary, materials and industrials, while losses for utility companies and producers of consumer staples were again much more subdued.

To examine the specific effect on the automobile industry, we carved out the effects on that sector in chosen countries. In all three scenarios, German manufacturers took the hardest hit. But the impact was almost as bad on their American competitors. If part of the purpose of the punitive duties was to advantage US companies at the expense of their foreign competition, this seems to be difficult to achieve by setting up barriers that impede the cross-border flows of components and parts, which the auto industry so heavily relies on. This might also explain the comparatively better average performance of Japanese carmakers. In fact, a further drilldown into the results shows that the Asian manufacturers that produce most or all of their vehicles in the region can even exhibit a positive simulated return, unlike their more internationally operating competitors, who show losses similar to their European and American counterparts.

High-quality sovereign bonds from the US, Britain and Germany once again benefitted from the safe-haven status, alongside the Japanese yen. Even peripheral issuers, such as Spain and Italy, show a slight positive return under current correlations, although credit spreads appear to have widened, reflected by the lower (duration-adjusted) returns of both lower-rated sovereign as well as investment-grade and high-yield corporate issuers. The picture was very different, however, when using the second quarter of 2018 for pricing-factor calibration. Risk premia in that period were rocked by the uncertainty following the Italian parliamentary election in March 2018, leading to a projected loss of over 5% for the country's sovereign debt.

EU car tariffs: historical and simulated returns

Asset Class	June 2018 (historical)	June 2018 (transitive)	Current correlations
Equity			
Eurozone	-3.7	-4.4	-5.6
Information Technology	-7.1	-5.8	-7.9
Consumer Discretionary	-6.8	-5.1	-6.9
Materials	-5.2	-5.4	-7.0
Industrials	-4.4	-4.7	-6.1
Financials	-3.1	-5.0	-6.3
Health Care	-1.8	-4.3	-5.1
Energy	-0.7	-4.1	-5.7
Communication Services	-3.6	-3.0	-3.3
Utilities	-1.3	-3.5	-2.5
Consumer Staples	-1.1	-1.8	-3.6
Real Estate	-0.2	-2.2	-2.2
Germany	-5.7	-5.5	-5.9
Automobiles & Components	-12.3	-7.0	-7.1
Italy	-2.8	-5.5	-5.5
Netherlands	-3.7	-4.2	-5.5
France	-3.2	-3.7	-6.0
Spain	-2.6	-3.8	-4.8
United Kingdom	-1.6	-3.4	-4.3
United States	-2.0	-2.0	-4.3
Automobiles & Components	-8.9	-1.7	-5.9
Japan	-2.5	-0.8	-1.6
Automobiles & Components	-4.0	-1.0	-2.5
Sovereign Bonds			
United States	0.7	0.7	1.3
United Kingdom	0.1	0.6	1.1
Germany	0.9	0.6	0.9
France	0.5	0.4	0.8
Spain	0.1	-0.4	0.8
Italy	0.3	-5.2	0.5
Corporate Bonds			
Euro Investment Grade	0.2	-2.4	0.2
Euro High Yield	-0.9	-5.3	-0.1
Foreign Currency vs EUR			
JPY	-0.7	1.2	1.5
USD	-0.2	-0.1	-0.1
GBP	-1.2	-0.4	-1.3

Source: Qontigo via Axioma Risk™

Conclusion

The experience of the re-escalation of the trade conflict earlier this year and Donald Trump's recent saber-rattling have shown that the current optimism might yet prove to be premature. It is therefore important that investors prepare themselves for another possible change for the worse. Stress tests like those discussed in this paper can provide valuable insights on the potential impact of a range of adverse scenarios.

In addition to identifying potential vulnerabilities and unwanted exposures, they can also point out possible strategies for diversification and loss-minimization. While the typical safe-haven assets, such as high-quality government bonds, gold, the Japanese yen and the Swiss franc, are almost certain to benefit, the analysis also highlighted a consistent outperformance of defensive industries, such as utilities and consumer staples. Minimum-variance strategies have also demonstrated their superior risk-return characteristics. Lower-rated corporate bonds and peripheral sovereign issuers, on the other hand, are likely to suffer from increased risk premia, alongside cyclical stocks from the technology and automobile industries.