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A Distributionally AI Robust Islamic Portfolio Approach- A Case Study of The Impact of Sanctions on The Incorporation of Chinese Stocks into Islamic ETF

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Abstract

Sanctions have long been utilized as a form of forcing the sanctioned countries and entities to change their course and conform to the objectives of the sanction imposing country or entity. Sanctions have been primarily used for trade embargoes and restrictions on the types of goods and services that can be exported from a specific country. Financial sanctions have been instituted primarily in the last century, given the growing importance of the international financial system and interconnection between countries. Furthermore, the role of the US Dollar as the international reserve currency, combined with its extraterritorial legal aspect and the prevalence of US institutions to facilitate cross-border transfers, has made financial sanctions an attractive tool of international coercive action. While the effectiveness of financial sanctions is debatable, they have still been attractive for many nations to be employed. The United States and China have experienced considerable disagreements with respect to their view on trade terms and the exchange of information. This has led to the sanctioning of several businesses by the United States and even forced some corporations to delist from US exchanges. For investors, this poses a significant risk as corporations may be required to delist, which will lead to significant losses. We present a distributionally robust optimization framework for the optimal Islamic portfolio when taking into account the risk of sanctions. The key feature of the framework is that it both integrates Islamic values in addition to ensuring robustness against the impact of possible sanctions. The results demonstrated that the investments are within a limited number of enterprises in order to avoid potential significant downside risks related to sanctions. The framework and study represent an important step towards greater risk assessment of sanctions-related effects on *Shariah*-compliant portfolios and safeguarding the returns of Islamic ETF investors. This contributes significantly to maintaining *Shariah* principles that focus on value investment and reduce the risk of fund managers engaging in gambling risks to drive returns.

Keywords: *Islamic finance, economic sanctions, distributionally robust optimization, Islamic law, robust portfolio*

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1. Introduction

Economic sanctions have become a major constituent of the international financial system with several major countries imposing sanctions in order to achieve political or economic objectives (Jazairy, 2019). Such sanctions are commercial or financial penalties and aim to challenge the ability of an economy or entity to conduct business within an international environment. The topic of imposing sanctions is a contentious one in international law. The state sovereignty principle under the UN Charter suggests that the sovereign state system internationally accepts that it is a horizontal system that considers all sovereign states as equal. Article 2(7) of the U.N. Charter restricts any U.N. intervention in "matters which are essentially within the domestic jurisdiction of any state." This forms the international law principle of 'non-intervention' that prohibits states from intervening in the sovereign affairs of any other state. Effectively the principle translates that, 'any state

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may not adopt policies or engage in conduct that effectively coerces other states to change or modify their choices regarding socio-economic systems or their domestic or foreign policy.'

Recent events in Ukraine have led many countries in Europe and North America to impose sanctions on Russia, specifically focusing on certain entities and individuals that are sanctioned. Sanctions have a long history and were highly prominent during World War 1 when the League of Nations permitted the use of sanctions for five different cases. The form in which sanctions are applied may differ widely based on the different countries and entities involved (Peksen, 2019). Early sanctions were mostly in the form of embargoes where the imposing entity forbade the trading of certain goods. This was in most instances connected to natural resources, such as oil, and was displayed in the Embargo Act of 1807, where the focus was on maintaining neutrality between the UK and France and ensuring that the US trading relationship with each of the nations was not affected by these nations (Drezner, 2019). The Act was, in general, ineffective and was repealed afterward.

An important question from these different forms of sanction is the effect they have on the target countries and what overall effect there is on specific sectors. A general study outlined that, economic sanctions have a significant impact on the GDP growth rate, decreasing by an average of 3 percentage points a year (Neuenkirch and Neumeier, 2015). The effects may be significant and can last up to 10 years, which may reduce the target country's GDP per capita by more than 25 percent within these years. A key aspect is that the imposing country is conventionally also affected by the sanctions imposed, specifically when there are import or export restrictions applied. For example, for import restrictions, the consumers may experience a limitation in goods and services, while in the case of export restrictions, the imposing country and businesses may lose market and investment opportunities (Early and Peksen, 2019).

While there are various reasons for the imposition of economic sanctions, the fostering of regime change is one of the major objectives. While this may not necessarily be rather effective, with estimates for the success ranging from 4 to 34 percent, the main reason is the popularity of such measures and the lack of alternatives besides military actions or words. However, sanctions may not be rather effective given that most of the sanctioned countries are led by non-democratic regimes whose response to popular will is rather minimal (Early and Peksen, 2019).

2. Literature Review

Economic sanctions represent significant challenges for fund managers in the financial industry as they may affect their ability to invest in certain corporations or be active in certain markets. The associated risk that is connected with the imposition of sanctions is especially significant in portfolio management, where investment durations are over several years in which government sanctions may change rather abruptly (Korotin *et al.*, 2019).

For Islamic compliant fund options, economic sanctions may make it rather challenging to have access to the financial system infrastructure in order to access the financial markets. Specifically, many economic sanctions may either restrict investment into sectors that may be considered sensitive, or banks are sanctioned to not provide any transactions with the sanctioned entities. While most Islamic funds have been set up in a variety of different countries, many of these have connections to the capital markets in the United States or are conducting transactions that interact with financial institutions in the United States. Given the size and accessibility of the major US stock markets, this makes these markets very attractive and readily accessible to many institutional and retail investors (Samadi *et al.*, 2021).

China has in the last several decades become a major economic powerhouse, multiplying its GDP within the last 20 years by multiple folds and becoming the second-largest economy in the world by the 2010s. With increasing economic growth, the investment in Chinese corporations has become of increasing interest for many investors that want to participate in its growth. Additionally, the Chinese market has become increasingly more accessible, with Chinese regulations permitting investment in the Chinese stock market. Investors interested in *Shariah*-compliant financing options for Chinese equities have encountered increasing accessibility by both *Shariah*-compliant funds and individual investors (Froese *et al.*, 2019).

Given the increasing rivalry between the United States and China, there were several economic sanctions instituted between the two countries that affected the economy of both countries. While previous economic sanctions primarily focused on arms and military infrastructure sanctions, the last several years have led to

considerable broader sanctions being imposed, such as the banning of Huawei and ZTE from US federal governments contracts and imposing export restrictions on Chinese entities (Jaisal, 2020). Specifically, Huawei was restricted from utilizing US originating technologies that are subject to licensing requirements. This has literally made it impossible for Huawei to continue to use the Android operating system due to the fact that it is provisioned by Google, which is an American entity. Another major sanction is executive order 13959 which forbids all US investors from purchasing or investing into securities that are classified as companies that support the Chinese military (Robinson, 2020).

Likewise, Chinese regulators have significantly increased their regulations for Chinese corporations that are doing business or list overseas. One of the most recent examples was the IPO of Didi ride hailing that immediately drew the attention of the regulators that warned the company not to list before a cybersecurity assessment was to complete. The company went public without the consent of the Chinese government, and then was subject to a data protection inquiry based on the Data Security Law. The data security law was passed on June 10th, 2021 by China's Standing Committee of the National People's Congress and seeks to strengthen regulations on data collection, storage and distribution within its digital economy (Parasol, 2018). This was primarily due to the fact that Didi collects significant amount of data of Chinese users that are the telephone number, user information and payment profiles as well as identification information. Specifically, in the case of an IPO these data have to be handed over to the Security Exchange Commission for audits if these are requested. Recent scandals, such as those of LuckinCoffee, have increased associated concerns with Chinese IPOs and stocks listed abroad and the challenges with data transparency (Peng *et al.*, 2022). Furthermore, there have been recent discrepancies between the US and Chinese authorities in the permission of providing audit data of Chinese corporations listed in the United States, and investing into foreign companies, in addition to US investors being allowed to invest in corporations in China.

Given the growing challenges between the two nations, investors need to take into account the associated risks of sanctions and regulations affecting their ability to invest into corporations within both China and the United States.

3. Conceptual Framework

Robust optimization has been widely utilized in practical application, where most often it is assumed that the distribution of the uncertain data set is known. While this allows to utilize robust optimization approaches efficiently and determine a data confidence region with respect to bounded support, it disregards the distributional information when determining the worst-case scenario. Most individuals resort to stochastic programming that incorporates all distributional information but optimizes the expected values in contrast to robust optimization that aims to focus on the worst-case value (Gabrel *et al.*, 2014).

The challenge with these both approaches is that the distribution is in practical applications only approximated and needs to be estimated from the observed data auxiliary assumptions. Likewise, this may introduce errors that arise from the assumption of the specific distribution. When considering the impact of sanctions on the performance of stocks, then such an approach may be easily considered to be rather biased given the lack of knowledge of the impact. These challenges the probabilistic guarantees provided by robust optimization, and also reduces the appeal of objective functions based on the expectation. Therefore, both the data uncertainty and estimation uncertainty should be taken into account in the optimization routine in order to capture accurately the beliefs about the data (Quaranta and Zaffaroni, 2008).

Distributionally robust optimization is based on the approach established by Scarf in 1958 to tackle the newsvendor problem. This implies that the author aimed to solve a stochastic program where robust optimization is applied to the estimation of the distribution information. The objective function is evaluated based on the expected value of random data but a worst-case distribution is applied (Bertsimas *et al.*, 2019). This implies that the distribution itself is uncertain and contained within an ambiguity set, which allows to model the conservatism of the assumptions in the distribution. If the ambiguity set only contains a single distribution, then the optimization result transforms into a stochastic program. Likewise, if the ambiguity set contains all the distributions and its support, then a robust optimization problem is solved. In many instances, the ambiguity set is a set of scalar distributions that have a known mean and variance such as to maximize the worst-case expectation within a piecewise linear function. Various other ambiguity sets have been defined and investigated, and in order to solve there are two major solution approaches. The first relates to cutting-plane methods, which solve a finite inner approximation in series in terms of the ambiguity set. The second method is focusing on solving a finite representation of the finite problem (Wiesemann *et al.*, 2014).

In order to apply the distributionally robust optimization approach to the optimization of a portfolio consisting of US and Chinese *Shariah* compliant stocks, the worst-case expected utility is maximized. The optimization problem is then transformed into:

$$\max_{x} \inf_{\rho \in \Gamma} E_{\rho}\left(U\left(\sum_{i=1}^{n} d_i x_i \right) \right)$$
$$\text{s.t.} \sum_{i=1}^{n} x_i = 1$$
$$x_i \in \mathbb{R}_+, \forall i = 1, \cdots, n$$

With the assumption of the utility function being piecewise affine and concave, the problem can be transformed into an adaptive problem readily solvable with distributionally robust optimization frameworks such as RSOME (Chen *et al.*, 2020).

4. Research Methodology

The framework was evaluated on a dataset consisting of the constituents of the MSCI USA Islamic ETF that is one of the premier *Shariah* compliant ETFs for the investment in US equities (BlackRock, 2022). The index fund experienced a return of more than 67 percent in the last five years, and represents single-country exposures with all constituents being compliant with *Shariah* principles. The largest constituents of the fund by March 31st, 2022 were Johnson & Johnson, Procter & Gamble and Exxon Mobil corporation, which are all large multinational corporations in various sectors.

The corporations in China are the second batch and based on the MSCI China A ETF, which was filtered according to the constituents that are violating *Shariah* principles (BlackRock, 2022). The Chinese A-share stock market was largely inaccessible to international investors in the past, but recent greater openness enables large institutional investors to invest directly within the market. While several corporations are listed in the United States, risks of delisting as well as non-direct investment into these corporations makes this rather uncertain to link these corporations to the real value of the assets. Specifically, in the context of Islamic Law, this may lead to the view that these stocks are more of speculative form rather than representing their real value. When it comes to Islamic principles, several stocks are automatically removed from the analysis, such as Kweichow Moutai Ltd A, which is a producer of alcohol. On the other hand, the second largest constituent of the fund, Contemporary Amperex Technology Ltd is one of the largest manufacturers of lithium batteries, and a key player in the energy transition and move towards battery systems. These principles are used to manually filter out any corporations that due to their business do not adhere to Islamic principles (Hasan *et al.*, 2020). The remaining corporations are then analyzed according to various financial performance parameters.

5. Results and Discussion

The key objective was to determine the differences between *Shariah* compliant US corporations and their Chinese counterparts. Figure 1 compares the debt to equity, price to book and revenue growth for the various corporations. The comparison indicates that Chinese corporations are significantly higher leveraged as compared to their *Shariah* compliant US counterparts. Specifically, the debt-to-equity ratio versus the price to book ratio is considerably higher for some Chinese corporations as compared to *Shariah* compliant equivalents. This represents an important aspect to take into account when assessing the incorporation of Chinese stocks within a *Shariah* compliant fund and the impact of any possible sanctions on the company's performance.

Figure 1: Comparison of debt to equity, price to book and revenue growth ratios for the MSCI US Islamic and the MSCI China ETFs.

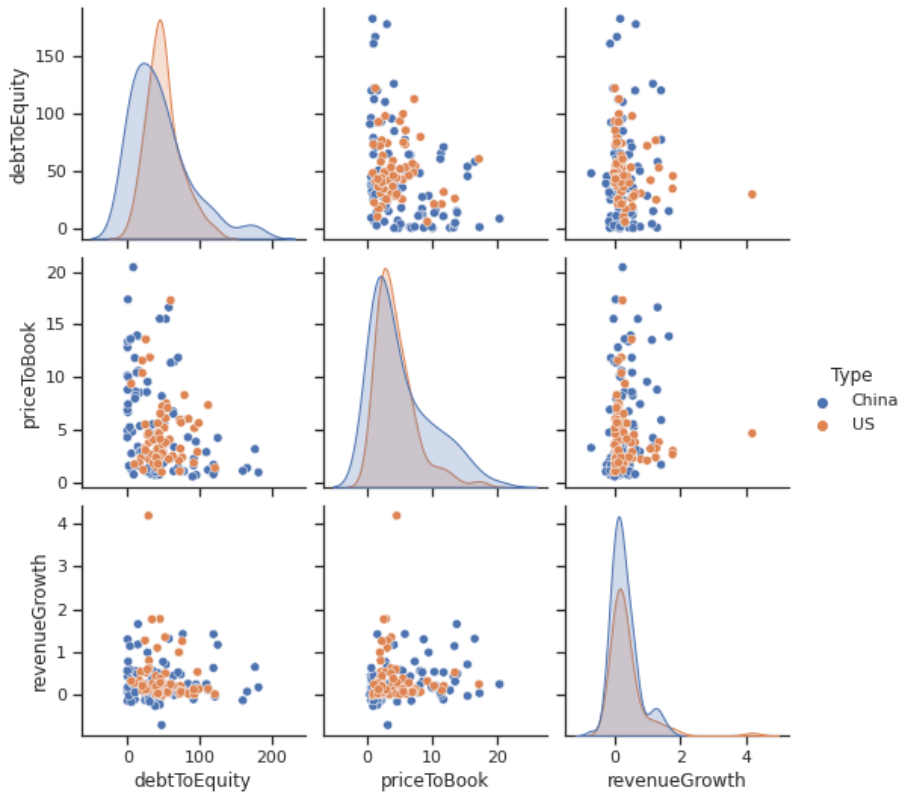
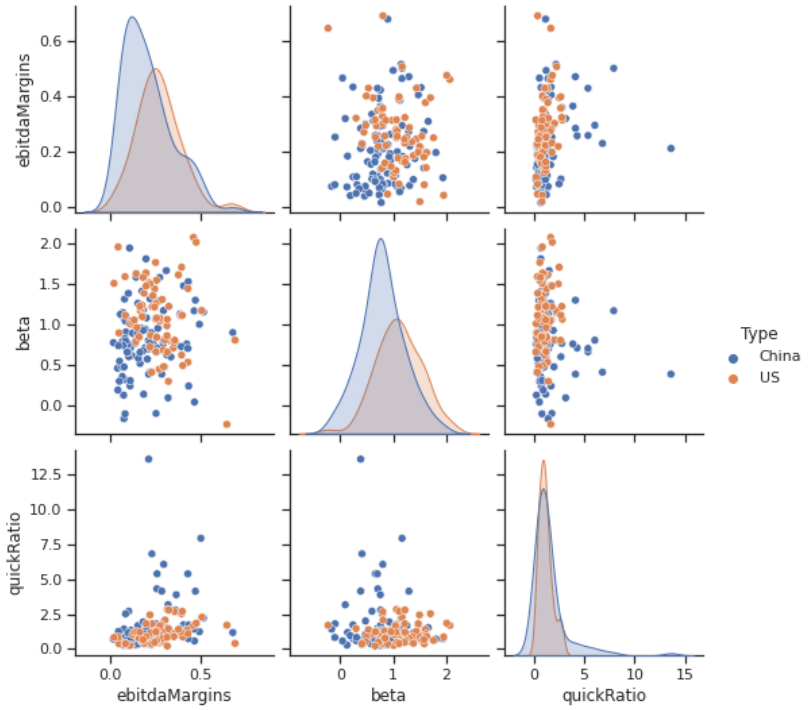


Figure 2 expands the previous analysis and compares EBITDA margins, beta and the quick ratio against each other. The analysis shows in general lower EBITDA margins of Chinese corporations as compared to their *Shariah* compliant US counterparts. The results indicate that there are several Chinese corporations that have high quick ratios, which implies that their financial position allows them to easily satisfy short-term liabilities.

Figure 2: Comparison of EBITDA Margins, beta and quick Ratio for the MSCI US Islamic and the MSCI China ETFs.



The subsequent step is to cluster the remaining corporations according to their financial performance in order to be able to select an adequate subset for the portfolio optimization. For the clustering, the k-means algorithm was utilized that delivered stable performance results. A key aspect in the k-means algorithm is the optimal number of clusters for the data under consideration, in order to better determine their uncertainties. A key objective is to determine corporations that may lead to significant uncertainties and risks that are beyond the scope of a distributionally robust portfolio, considering possible sanctions. The best clustering number was determined to be 3 with the cluster 2 incorporating those corporations that may not be adequate for a robust portfolio. Specifically, the components of the cluster 2 exhibit high debt to equity ratios, which may pose significant risks to the performance of the corporations in the possible situation of sanctions or trade challenges.

Figure 3: Clustering performance for the combined dataset for debt to equity, price to book and revenue growth values.

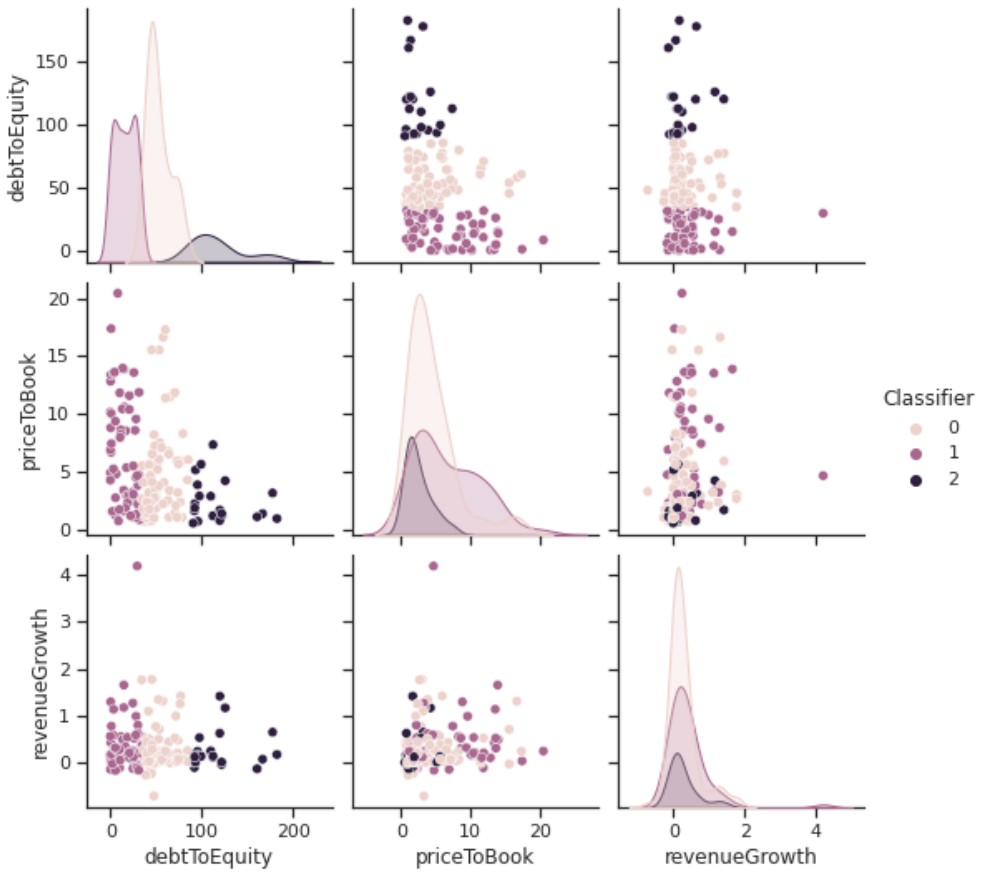
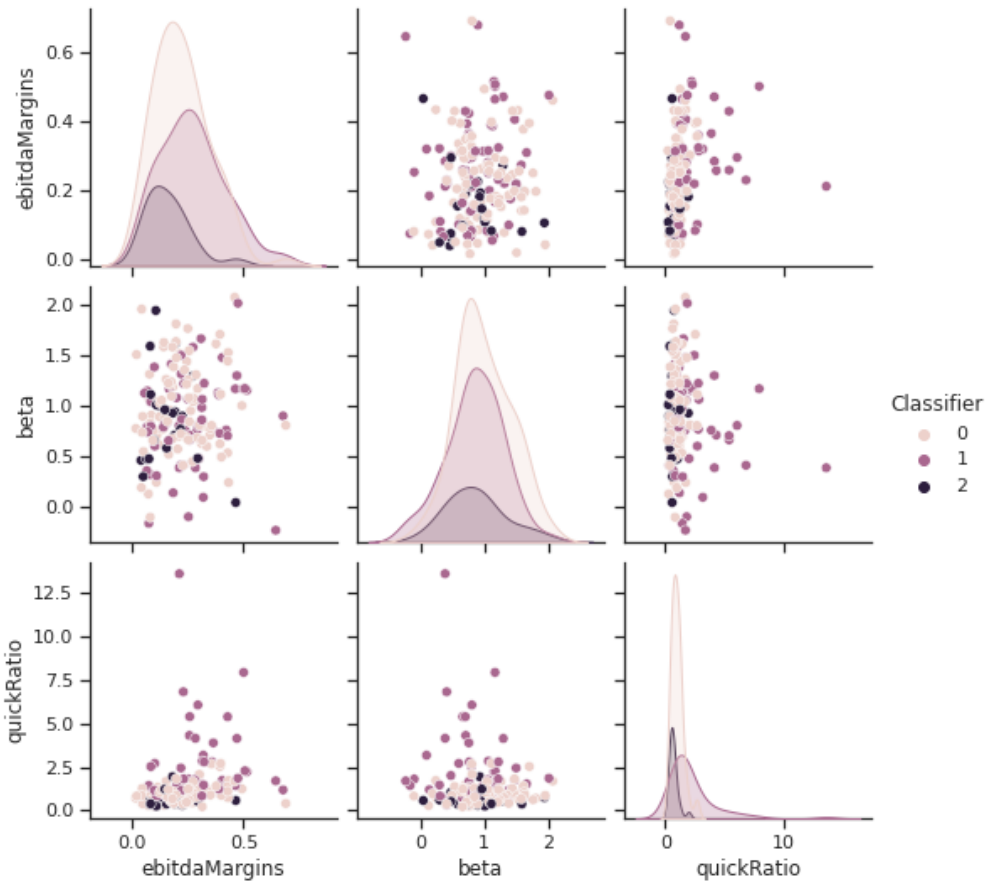


Figure 3 shows the clustering for the debt to equity, price to book and revenue growth where the corporations in the cluster 2 exhibit high debt to equity ratios which may be more affected in the case of sanctions. Price to book as well as revenue growth, and the comparison in Figure 4 shows that the debt-to-equity ratio is a major distinguishing factor. While beta and price to book ratios depend primarily on the developments in the stock price, debt to equity as EBITDA margins are reflective of the real performance of the corporation as compared to the stock prices. Given the high debt to equity ratios and possible illiquidity challenges, these corporations were excluded from the optimization.

Figure 4: Classification performance for the EBITDA margins, beta and quick ratio.

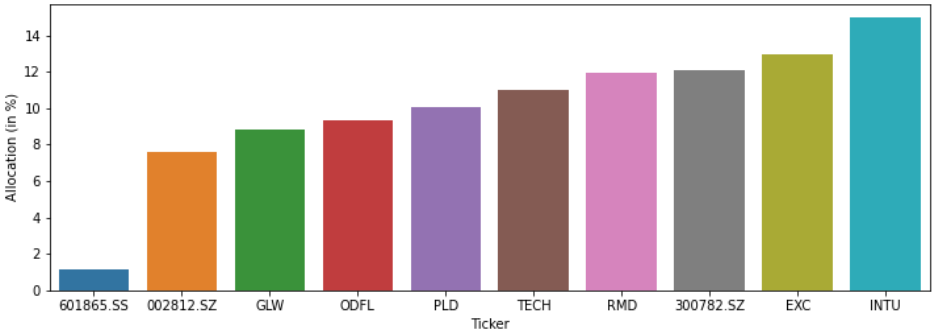


With the adapted subset corporations, the distributionally robust optimization then selects the most optimal stocks given the worst underlying distribution. This necessarily may lead to an optimal portfolio that incorporates only a limited number of stocks in order to minimize both the worst possible event while maximizing the expected returns from the optimization profile. In order to model the uncertainty arising from sanctions imposed by either the United States or China on each other, we assumed that Chinese corporations will be more significantly affected by sanctions as compared to their US counterparts. Specifically, economic sanctions against the economy, range of companies or specific companies may significantly affect these companies to both obtain technology, as well as access financial resources or conduct transactions. As violations would in many cases imply, that transacting corporations would not be able to conduct business with US companies, within the United States or utilizing US financial institutions, this will significantly affect the companies' ability to do business with foreign entities and may lead it to being restricted to domestic companies. Furthermore, general investment into such entities typically decreases given the risk aversity of most investors as well as reduction in potential funds.

The most optimal portfolio is displayed in Figure 5 that shows the percentage allocation of the distributionally optimal robust portfolio. Specifically, the most optimal portfolio consists of 10 constituents, where 3 constituents are Chinese-listed corporations. These are the Maxscend Microelectronics Company LTD (300782.SZ), whose optimal percentage is 11 %, and Yunnan Energy New Material (002812.SZ) with a percentage of around 7.5 %. The final Chinese corporation is the Flat Glass Group (601865.SS) that has an

allocation of around 1 %. All these three corporations are within different groups that may benefit from growing digitalization and the move to renewable energy sources. Furthermore, the impact of sanctions may be limited for these corporations given their business being primarily in sectors that may be less affected by sanctions given the overall significant demand.

Figure 5: Optimal portfolio obtained from the distributionally robust optimization framework.



The largest constituent is the Intuit Inc. that provides financial management and compliance products for small businesses and consumers. Sanctions imposed on China will minimally affect the corporation as it is primarily dependent on the United States and Canada for its turnover. Similarly, Exelon Corporation is an energy utility company solely operating in the United States and Canada and may be not be affected at all by sanctions related to China. This aspect is well observed in the various scenarios where the worst possible outcome for these corporations is limited to their current performance, while other corporations with a bigger international exposure to China may be more significantly affected. Corporations that may be heavily affected by sanctions are Dow Chemicals that have a significant presence within China and may require to divest or reduce their exposure to the country which will affect its business performance.

6. Conclusion and Recommendation

Sanctions have long been utilized as a form of forcing the sanctioned countries and entities to change their course and conform to the objectives of the sanction imposing country or entity. Sanctions have been primarily used for trade embargoes and restrictions on the types of goods and services that can be exported from a specific country. Financial sanctions have been instituted primarily in the last century given the growing importance of the international financial system and interconnection between countries. Furthermore, the growing importance of the US Dollar as an international reserve currency and the prevalence of US institutions to facilitate cross-border transfers, has transformed financial sanctions into very attractive tools for trying to achieve the sanction's objectives. While the effectiveness of financial sanctions is debatable, they have been still attractive for many nations to be employed. The United States and China have experienced considerable disagreements with respect to their view on trade terms and the exchange of information. This has led to the sanctioning of several businesses by the United States, and even forced some corporations to delist from the US exchanges. For investors, this poses a significant risk as corporations may be required to delist, which will lead to significant losses. We present a distributionally robust optimization framework for the optimal Islamic portfolio when taking into account the risk of sanctions. The key feature of the framework is that it both integrates Islamic values in addition to ensuring robustness against the impact of possible sanctions.

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