THREE ESSAYS ON SECULAR STAGNATION HYPOTHESIS

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BY

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PLAGIARISM

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Date :12.04.2022

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ABSTRACT

In this thesis, The Secular Stagnation hypothesis is investigated from emerging and developed markets perspectives. The first chapter investigates the contagiousness of safe asset shortages as an implication of the secular stagnation hypothesis. Our motivation is to quantify the degree of financial contagion of safe asset demand among developed and emerging markets. In the second chapter, inspired by the universal law of gravitation, a new metric to measure the financial distance of countries has been created. In this metric, financial distance is directly related to Credit Default Swap (CDS) Spreads and is inversely associated with the Foreign Exchange (FX) Rate. The new metric has been used to optimize the hedging global fixed income portfolios. The third chapter aims to provide a new financial gravity framework to understand the nature of dependency on US monetary policy and its results. This thesis provides significant theoretical and empirical take aways by analyzing different aspects of secular stagnation hypothesis.

Key words: Secular Stagnation, Financial Gravity, Financial Distance, Multivariate Times Series, Panel Data

ÖZET

Bu tezde, seküler durgunluk hipotezi, gelişmekte olan ve gelişmiş piyasalar perspektifinden araştırılmaktadır. İlk bölüm, seküler durgunluk hipotezinin bir sonucu olarak güvenli varlık kıtlığının bulaşıcılığını araştırmaktadır. Amaç, gelişmiş ve yükselen piyasalar arasında güvenli varlık talebinin finansal bulaşma derecesini sayısal olarak ölçmektir. İkinci bölümde, evrensel yerçekimi kanunundan esinlenerek ülkelerin finansal mesafesini ölçmek için yeni bir metrik oluşturulmuştur. Bu metrik, finansal mesafe, Kredi Temerrüt Swap (CDS) Spreadi ile doğrudan ilişkilidir ve Döviz Kuru ile ters orantılıdır ve küresel sabit getirili varlık portföylerinin riskten korunma işlemlerini optimize etmek için kullanılmıştır. Üçüncü bölüm, ABD para politikasına bağımlılığın doğasını ve sonuçlarını anlamak için yeni bir finansal çekim çerçevesi sağlamayı amaçlamaktadır. Bu tez, seküler durgunluk hipotezinin farklı yönlerini analiz ederek önemli teorik ve ampirik çıkarımlar sağlar.

Anahtar kelimeler: Seküler Durgunluk, Finansal Çekim, Finansal Mesafe, Çoklu Zaman Serileri, Panel Veri

DEDICATION

To my wife Neslihan, my daughter Arya, and the dearest friend and a brother Mehmet Ali without whose support completing this thesis would not have been possible.

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CHAPTER 1 CONTAGION IMPACT AND SAFE ASSET SHORTAGES: IMPLICATIONS FOR SECULAR STAGNATION

ABSTRACT

This paper investigates the contagiousness of safe asset shortages as an implication of the secular stagnation hypothesis. Our motivation is to quantify the degree of financial contagion of safe asset demand among developed and emerging markets. We know that the insufficient supply of safe assets in developed economies led to increasing demand for risky EM Bonds. However, lower yields might not be observed in Emerging Economies due to expected inflation. To investigate this idea, we proxied expected inflation via a new variable called the Marginal Impact of Inflation (MII). Our dataset consists of 2-year and 10-year generic government yields, and we analyzed the reaction of developed and emerging economies to the United States and the United Kingdom's safe asset demand. Our findings confirm that demand for US and UK safe assets shows the contagious impact for Developed Economies, not for Emerging Economies. Additionally, longer yields show stronger statistical evidence than shorter yields, as suggested by the secular stagnation hypothesis. According to empirical results, expected inflation is statistically insignificant for long-term and short-term yields for emerging economies. Thus, we can conclude that the Secular Stagnation Hypothesis is the problem of Developed Economies rather than Emerging Economies in that manner.

Keywords: Secular Stagnation, Safe Asset Shortage, Contagion Impact, Volatility Spillover, DCC-Garch

1.1 Introduction

The "Global Saving Glut (GSG)" hypothesis argues that capital flows from emerging countries to the United States created a demand for US safe assets, i.e., US Treasury Debt and Agency Debt, and lowered interest rates.

The GSG story originally referred to foreign exchange policies and an export-oriented development strategy in much of Asia and parts of Latin America that caused the accumulation of massive stockpiles of official reserves. These reserves were recycled into global bond markets, depressing yields in the major developed countries below levels justified by their macro fundamentals.

The financial crisis and ensuing Great Recession reinforced the rise in global savings, though incremental accumulation has been concentrated in Europe, the U.S. and other advanced economies. Governments have tightened their belts even as the private sector deleveraged. Thus, all three sectors have been trying to save more (or dis-save less) at the same time: government, households, and businesses. A rising propensity to save and waning appetite for capital investment drove equilibrium interest rates sharply lower.

Looking ahead, we agree that household savings will come under downward pressure in the major countries, as a greater portion of the population moves into retirement and thus begin living off accumulated savings.

Moreover, there are three other reasons why capital spending will remain depressed relative to GDP:

- Potential real GDP growth will be slower by historical standards for demographic reasons and because of the disappointing trend in productivity growth. In the U.S., we estimate that potential real GDP growth will be about 1% lower over the next decade compared with the pre-crisis generation, in part reflecting a return of productivity growth to the levels that preceded the dotcom boom. Faced with the prospect of slower demand growth, firms are likely to react by investing less in new capacity.

- The secular decline in manufacturing, increased outsourcing and the shift to a knowledge-based economy have all depressed domestic capex requirements.

- Finally, the steady decline in the price of capital goods has allowed firms to meet their capital spending needs while still cutting capex budgets.

The bottom line is that, reflecting demographic trends, ex-ante investment spending requirements in the major advanced economies will fall relative to GDP by more than the decline in the household saving rate, sustaining if not compressing the low level of equilibrium interest rates even further.

This view is supported the Japanese experience, a leading indicator for the developing world's aging problem.

First, the stock of publically-available government bonds is poised to shrink dramatically, The ECB and the Bank of Japan will more than make up for the cessation of asset purchases by the Bank of England and the Fed, once we consider that net government bond issuance is much smaller today than was the case when those two central banks were expanding their balance sheets. The stock of bonds available to the private sector rose under QE2 and QE3, but will contract by about $800 billion over the next couple of years given the ECB and Bank of Japan's planned QE programs.

Second, the Liquidity Coverage Ratio (LCR) standard contained in Basel III will require global banks to maintain a large stock of high-quality liquid assets. With tighter capital adequacy rules, banks are financially incentivized to hold high-quality government bonds rather than make new loans. The IMF estimates that Basel III will boost bank and non-bank demand for investment-grade bonds by $2-$4 trillion.

The shortage of government paper will be especially acute in Germany, where there will be very little net new issuance. The issuances of new papers yielding negative even before ECB announced its asset purchase programs.

Pre-2008, the abundance of savings was driven in large part by emerging economies that were leaning against appreciation in their exchange rates, which resulted in them building up massive foreign exchange reserves that were recycled into developed bond markets. The GSG story remained in place after the Great Recession and financial crisis, although the source of savings has pivoted toward the advanced economies as a result of the deleveraging cycle.

- Household saving rates have increased sharply since 2006 in many countries, reflecting the loss of housing and financial wealth.
- The corporate sector in the advanced economies was shell-shocked from the recession, leading to the build-up of a cash war-chest of retained earnings. While investment spending has recovered since 2009, so too have profits, causing the corporate sector's financial balance to soar.
- Meanwhile, governments around the world embarked on a fiscal consolidation crusade. As a result, the drain on the pool of savings from the government sector has moderated.

It is no wonder that bond yields have dropped to record lows, given that all three sectors of the advanced economies have tried to save more and spend less at the same time.

From markets perspective, we may anticipate that real interest rates could erode further as global capital spending demand falls as a share of GDP in the coming years. Global savings must equal global investment at the end of the day. Post Lehman, a flood of investment in emerging markets absorbed a large fraction of the surge in global savings. The commodity boom, along with the availability of cheap funding from the advanced economies, drove a capital spending binge in the emerging world. However, the commodity boom has turned into a bust and capital spending in EM is set to plunge. The end of the Commodity Supercycle will weigh on capital spending in the advanced economies as well.

The adjustment in EM capital spending is already underway and is clearly undermining global trade and the manufacturing sector in the developed world. The Baltic Dry Shipping Index, a measure of shipping costs for commodities and a barometer of global trade activity, dropped to a record low in November 2015. Annual growth in industrial production for the major countries is still positive, but decelerating.

A typical Safe Asset is a financial tool that stores value and have certainty in its cash flows in the future. Furthermore, safe assets are generally used as collateral to create funding (Huber and Punzi 2017). The demand for US securities combined with financial innovation, excess leverage appetite and, reliance on credit agencies are the leading causes of the housing bubble and great crises of 2008. GSG economies mainly invest in US treasuries and credit-worthy agency debt, which led long-term interest rates to move down, which led investors to replace their low interest-earning US bonds with high risk and high yield investments (mortgage-backed securities and CDO's) in their portfolio (Bertaut et al. 2011).

Even many years past over crises of 2008, the real yields even in emerging economies hit negative areas. As shown below graph, fifteen of twenty emerging economies suffer from negative yields due to higher inflation pressures. The changes in real interest rates[1] and CPI[2] are shown in the graphs below.

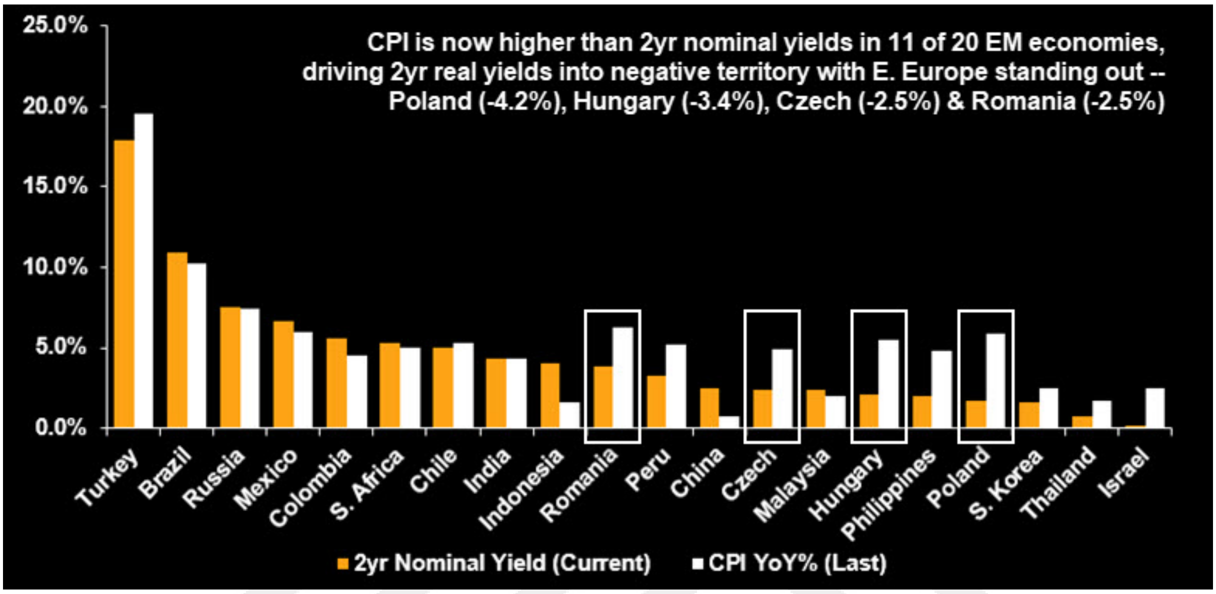

Figure 1: CPI vs 2-year Yields[3]

[1] Real interest rate is spread of nominal interest over inflation where negative spread means negative real yield.
[2] CPI: Consumer Price Index, main financial indicator of inflation

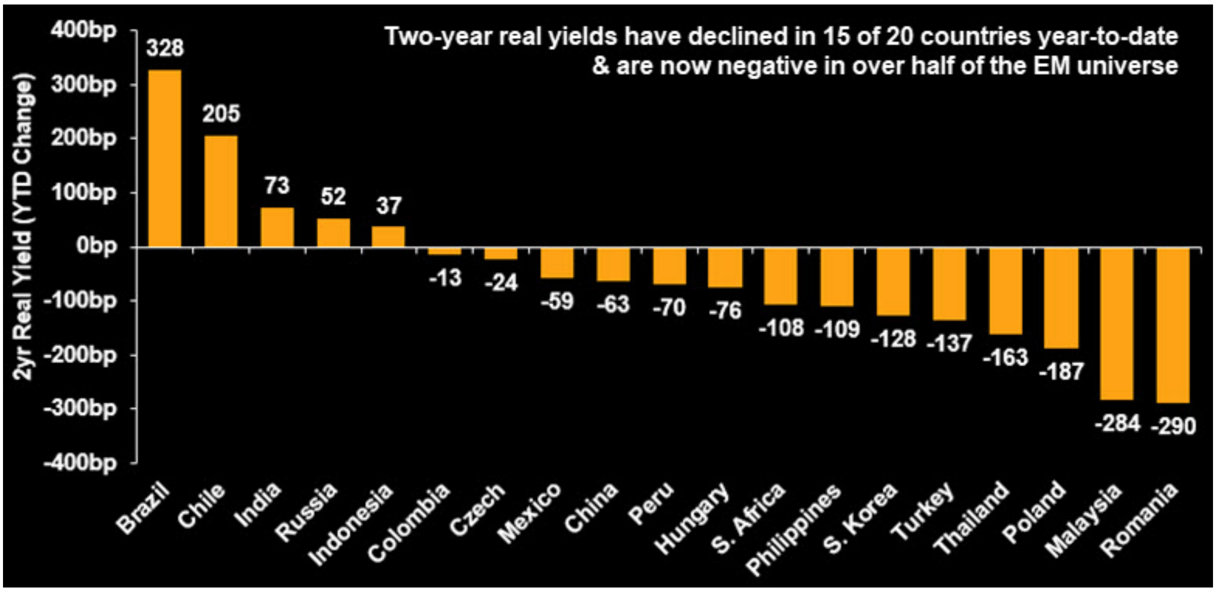

Figure 2: 2-Year Real Yield Changes[3]

Figure 1 and Figure 2 shows Consumer Price Index and Real Yield Changes of selected countries. For inflation targeting central banks, a surge in inflation that becomes increasingly embedded in longer-term inflation expectations is a direct challenge to their credibility. The policy prescription must involve monetary tightening to raise real interest rates in a bid to stabilize inflation expectations. At the same time, given the starting point of near-0% nominal policy rates and high inflation, deeply negative real interest rates have a lot of room to rise before becoming a serious restraint on economic growth. This limits how far bond yields can decline in response to a generalized risk-off move like the one seen over the past week.

For financial markets hooked on easy monetary policies, an inflation-induced monetary tightening cycle will lead to even higher bond yields – especially real yields - and more frequent bouts of market volatility this year.

[3] Source: Bloomberg Weekly Chartbook, as of October 22th, 2021

This study aims to measure the contagion impact of safe asset demand for developed markets and emerging markets. Firstly, we take the United States as the main domain and quantify volatility spillover. After we performed an analysis for the United States, we noticed that it might not be the main source for volatility spillover, especially for developing economies.

Then, we check the UK's case is the main domain for contagion impact for developed and emerging economies. We also distinguish the impact of the long term and short term yields. The study includes 2-year and 10-year bond yields separately.

Our contribution to recent literature is the new variable called the Marginal Impact of Inflation (MII). Due to Large-Scale Asset Purchase Programs (LSAP[4]) by Fed or Long-term Refinancing Operations (LTRO) by ECB, financial markets are expected further rate cuts. Expectation about further rate cuts by major central banks led the yield curves to be inverted. The reason why the yield curve might not be inverted is higher expected inflation. We embed MII, a proxy for expected inflation with an adjustment parameter of λ, to add the impact of the shape of the yield curve into the econometric model. The value of λ is obtained by the long-run equilibrium of 2-year and 10-year bond yields, which is nothing but a result of the co-integration analysis. In order to calculate the parameter, we follow the Engle-Granger methodology.

[4] One often-heard objection to QE is that it has exacerbated inequality by pushing up equity prices without doing much to help the real economy.

1.2 Literature Review

Alvin Hansen (1938) introduced secular stagnation the first time just after the Great Depression. In his presidential address, “Economic Progress and Declining Population Growth,” concentrated on demographic growth and productivity. However, Hansen’s hypothesis has not materialized as World War II. massive destruction and reconstruction required after the war.(Eggertsson and Mehrotra 2014)

In late 2013, Summers reuttered the hypothesis and defined secular stagnation as a persistent deficiency in aggregate demand, caused by the increasing tendency to save and decrease the desire to invest. This situation can be defined as the excess of saving against investment, which caused real interest rates to fall when rates could not sufficiently fall given zero lower bound situation known as the liquidity trap (Summers 2014).

Summers argued that today's negative equilibrium real interest rate did not simply reflect cyclical factors, such as ongoing household deleveraging, but rather was a manifestation of secular trends that have been in place for several decades. In particular, he stressed that a decline in the price of capital equipment relative to other goods and services meant that less savings was now required to finance a given level of investment. This, in turn, created a persistent glut of savings, which could only be extinguished if real interest rates declined further.

Other explanations for why equilibrium interest rates have fallen also come to mind. For example, up until the late-1990s, emerging markets ran current account deficits that they financed with excess savings from developed economies. Since the Asian Crisis, however, emerging markets as a group have run current account surpluses, leading them to funnel their excess savings to the rest of the world. The emergence of Germany as a major exporter of savings has further intensified this trend.

Demographic factors also appear to have played a role. As Alvin Hansen originally stressed, a decline in population growth will cause firms to cut back on new investment in response to slowing demand, leading to an excess of savings and a lower equilibrium real interest rate. The fact that Japan's labor force began to decline only a few years after its economy went into a tailspin lends some support to this view

Lastly, growing inequality[5] may have shifted income towards wealthier households that typically have a lower marginal propensity to consume. This, in turn, has reduced overall aggregate demand.

If the forces behind secular stagnation have been around for decades, why have they only become visible in the U.S. in recent years? The answer is that a series of asset bubbles starting with commercial real estate in the 1980s, equities in the 1990s, and residential housing in the 2000s, along with surging debt levels, helped prop up spending. Yet, even this was not enough to ensure that demand growth kept up with supply, as evidenced by the fact that inflation

[5] It is certainly true that inequality has risen sharply over the past 40 years, especially in the US. It is also true that the bulk of equity wealth is held by the very rich. According to Fed data, the wealthiest top 1% own half of all stocks. However, QE has pushed up not only equity prices. Falling bond yields have also pushed up home prices. Unlike stocks, housing wealth is broadly held across the population. Moreover, monetary policy operates through other channels. Lower interest rates tend to weaken a country's currency, boosting competitiveness in the process. Lower rates also encourage investment. Again, real estate figures heavily here. From previous studies we know that there is a very strong correlation between mortgage yields and housing starts. And while lower interest rates do penalize savers, the middle class is not the main victim. Interest receipts represent a much larger share of total income for ultra-wealthy individuals than for everyone else.

declined over this period

Regarding the classical IS-LM Model, in case of excess saving, new equilibrium in an economy is adjusted by lower interest rates, which decrease the opportunity cost of investment projects and stimulate the economy. However, the downward adjustment may not be sufficient when rates cannot stay below zero, accompanied by weak inflation. In this case, to adjust equilibrium output, cut back to adjust weak demand, reducing income and saving until saving matches to investment. As stated above, economic growth stays at the core of the secular stagnation hypothesis. An economy's future growth depends on the following factors; Long- run potential growth rate, deviation of actual growth from its potential, and one-off changes in the level of GDP.

Low real interest rates have contributed to the secular stagnation debate in two aspects. If real rates are low in normal times, in case of adverse economic conditions, force monetary authorities to lower interest rates more negative to restore employment and investment-savings balance. Secondly, Low-interest rates caused the risk of financial instability (Teulings and Baldwin 2014).

Summers (2014) stated that low-interest rates might increase the tendency to risk-seeking behavior and irresponsible lending. Moreover, he stated that the low-interest-rate environment promotes Ponzi Financial Structures.

Eggertson and Mehrotra (2015) outlines the secular stagnation debate as below;

- Definition of the hypothesis is the negative real interest rates required to equate saving and investment with full employment
- Secular stagnation is a contradictory factor for achieving full employment and Zero Lower bound (ZLB) on policy interest rates
- There should be new policy implications against secular stagnation if the secular stagnation hypothesis has been materialized.

The economic foundation of banking is based on performing two conflicting tasks: the transformation of maturity, i.e., borrow short vs. lend long, and risk transformation, i.e., borrow safe vs. lend riskily. There is a consensus on safe-haven assets demand among numerous researchers that are expanded shadow banking accompanied by high demand for high-quality liquid assets (HQLA) led leveraged banking sector and the crisis of 2008. (Magill, Quinzii, and Rochet 2019)

After the Global Financial Crisis of 2008 (GFC), Quantitative Easing (QE)[6] operations were in place to supply liquidity into financial markets. Due to the huge amount of purchase of debt by a monetary authority like Fed withdraw available high-quality liquid asset which can be used for money market REPO funding for banks.(Grilli, Giri, and Gallegati 2019)

Excess demand for safe assets lowered interest rates below equilibrium and prevented central

[6] Rather than QE exacerbating inequality, a more plausible story is that rising inequality led to QE. The rich tend to save more than the poor do. Consistent with estimates by the IMF, we find that the shift in income towards the rich has depressed US aggregate demand by about 3% of GDP since the late 1970s. A standard Taylor Rule equation suggests that real interest rates would need to be 1.5-to-3 percentage points lower to offset a 3% loss in demand. Thus, not only have the rich benefited directly from receiving a bigger share of the economic pie, they have also benefited indirectly from the fact that falling interest rates have pushed up the value of their assets.

banks lower the real interest rates even further. One alter- native solution is appreciating currency, which is called the paradox of reserve currency.(Habib, Stracca, and Venditti 2020)

As stated by Taylor (2012), after the Global Financial Crisis of 2008, the world becomes more financialized, called ’Great Leveraging". Bleich and Dombret showed their empirical analysis that leveraged the financial system can lead to a shortage of safe assets. Adverse economic conditions create a demand for high-quality liquid assets. On the other hand, these conditions require monetary authorities to purchase safe assets to inject liquidity into the market, which decreases the supply of safe-haven assets. (Bleich and Dombret 2015)

Sunderam (2014) stated that private debt issuance is part of the safe asset creation process. Krishnamurthy and Vissing-Jorgensen (2015) proved that private debt issuances replace government debt. These empirical results are signaling that shadow banking is existed due to the demand for safe assets. (Infante 2020)

Infante (2018) finds evidence for an inverse relationship between issuance of REPO transactions backed by US Treasuries and the demand for safe assets between 2009 till 2017. The research proxy for safe asset demand is a convenience yield calculated by a 4-week US Treasury bill yield minus Overnight Index Swap rate (OIS) (Infante 2020).

1.3 Data and Methodology

The dataset consists of G7 Countries (United States, United Kingdom, Canada, Japan, Italy, Germany, and France) and Emerging Countries (South Africa, Korea, Brazil, Turkey, Mexico) bond markets. To analyze each country's bond market, security tenors have been chosen concerning liquidity conditions and the term structure of interest rates. Thus, we retrieved 2-year and 10-year generic government bond yields consisting of interpolated compounding yields for each country. We used weekly data from Q2-2016 to Q3-2017 retrieved from Bloomberg Generic Government Rates Database. This time period is important because FED launched massive asset purchase and buy-back programs, which is called quantitative easing (QE), to inject liquidity into the US financial market in order to stimulate the economy.

Due to the insufficient supply of safe assets, EM bonds also rallied due to hedge and pension funds' yield enhancement purposes. Thus, increased demand for EM Bonds lowers the yields in this time period. However, the contiguous impact of safe asset shortage may not be observed in Emerging markets due to expected inflation. We proxied expected inflation via a new variable called Marginal Impact of Inflation (MII), the rate differential of 2-year and 10-year bond yields.

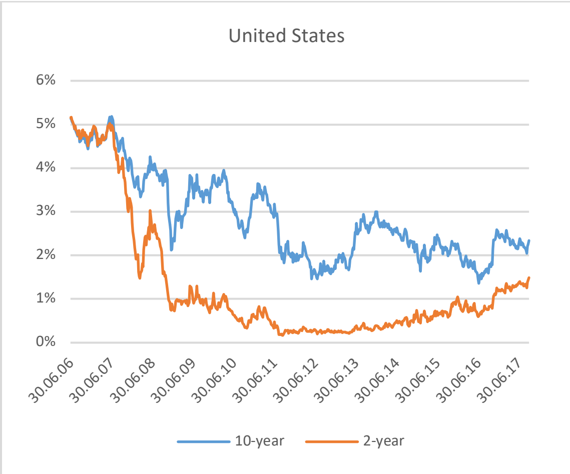

Figure 3: United States Sovereign Yields

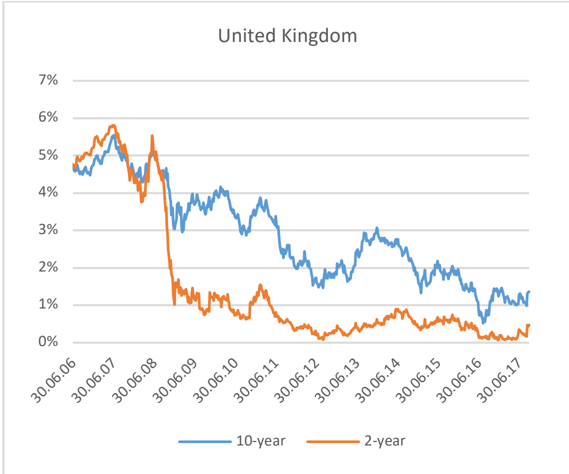

Figure 5: United Kingdom Sovereign Yields

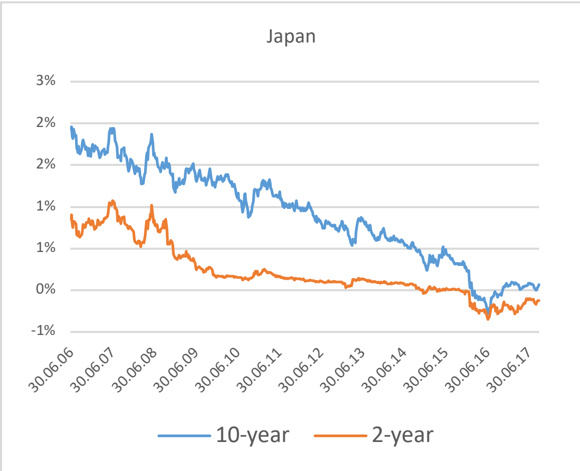

Figure 4: Japan Sovereign Yields

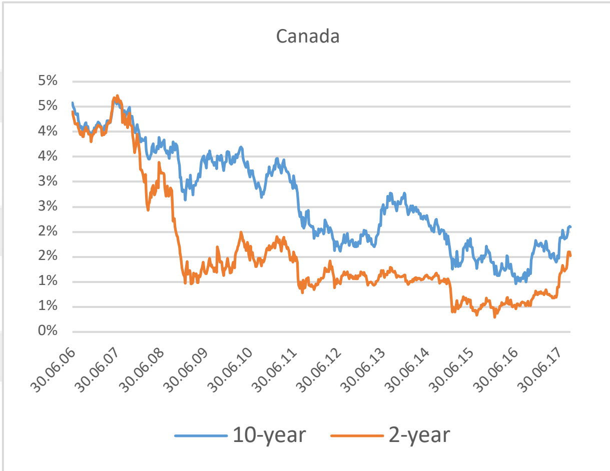

Figure 6: Canada Sovereign Yields

The graphs shows the spread between evaluation of sovereign curve of countries in question. Since, there is an expected inflation exists, the spread between short-term and long-term yields should diverge. From the eye inspection, we can see that most of the countries' 2-year – 10 year sovereign spreads are widening, especially in EM.

Figure 7: Italy Sovereign Yields

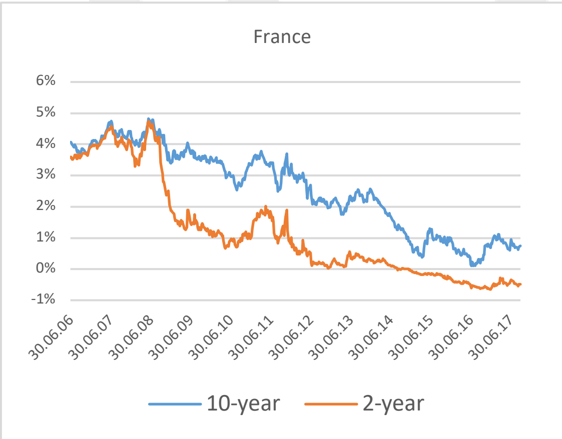

Figure 8: France Sovereign Yields

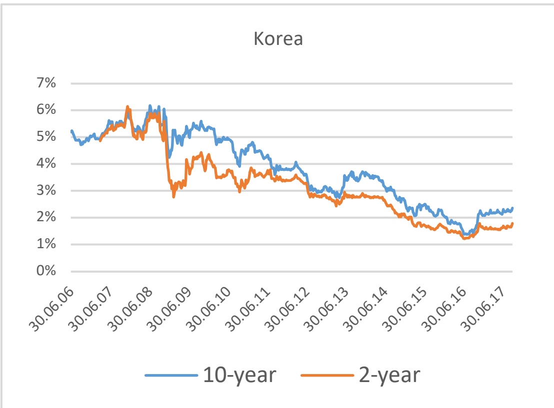

Figure 9: Korea Sovereign Yields

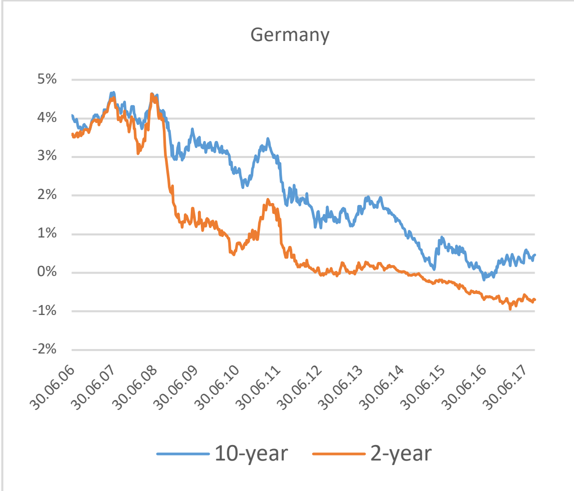

Figure 10: Germany Sovereign Yields

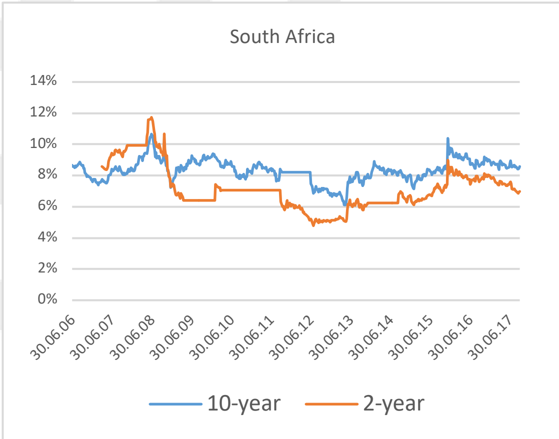

Figure 11: South Africa Sovereign Yields

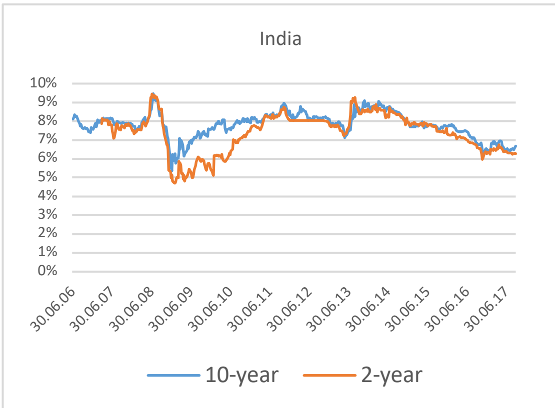

Figure 12: India Sovereign Yields

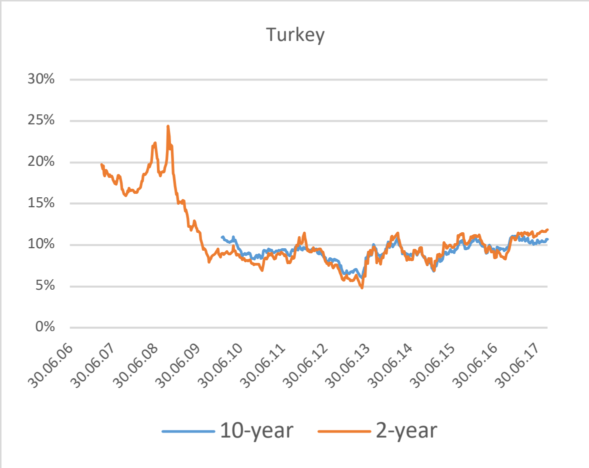

Figure 13: Turkey Sovereign Yields

Figure 14: Mexico Sovereign Yields

$$MII = \lambda * (2yrBondYield - 10yrBondYield)$$ **(1)**

As followed by Chong et al. (2008) and Ahmed et al. (2013), To measure financial contagion, a regression model in which endogenous variable is the condi- tional correlation of pairwise time-series and exogenous variables are conditional volatilities of individual series (Roy and Sinha Roy 2017). Thus, we required to obtain both conditional volatilities of individual series with univariate GARCH (p,q) models and dynamic time-varying correlations with DCC - MGARCH (p,q) models.

$$p_{ij} = \alpha + \beta_1 h_{it} + \beta_2 h_{jt} + E_t$$ **(2)**

To start with individual conditional volatilities, mean models of each series have been identified first; then, individual volatilities have been modeled. As stated above, individual volatilities have been captured by Univariate GARCH models. The model selection has been performed based on Akaike Information Criterion (AIC), and for the univariate case, generalized error distribution (ged) has been used.

Secondly, time-varying dynamic correlations were obtained from DCC - MGARCH (1,1) model. DCC-MGARCH (p,q) Models are required univariate mean model specification; thus, AIC based mean models, calculated in the previous step, defined in the model. For a multivariate case, “mvnorm distribution” (multivariate normal distribution) have been used. Error distributions are also selected based on the AIC information criterion.

Conditional volatilities obtained from univariate GARCH(p,q) models and pairwise dynamic conditional correlations obtained from DCC-MGARCH(p,q) models have been used to measure contagion the next step. A least square regression estimated, and the model’s parameters, β_i’s, have been estimated. A positive β_i indicates that during high volatility, the pairwise correlations tend to increase, i.e., there is a positive relationship with volatility and correlation, which favors financial contagion. In other words, if high volatility triggers a pairwise time-varying correlation, we can call that financial contagion has occurred. The Adjusted R^2 of the least-squares regression represents the degree of financial contagion and goodness-of-fit of the model.

Recent studies in finance show that volatility is autocorrelated and clustered. Thus, it is important to capture financial markets volatility to pricing risk and risk- based financial instruments (Engle 2004). Univariate Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model has been developed to serve this purpose (Bollerslev 1986). Volatility in any financial instruments, either intra- market or inter-market, can be measure by the GARCH(1,1) model. Although this model specification is not the best one, it is sufficient enough to capture and forecast volatility (Brunnermeier et al. 2017)

1.3.1 Volatility Term Structure (GARCH(p,q) Model)

A log return series can be stated as $r_t = \mu_t + a_t = \mu_t + \sigma_t \epsilon_t$ where ϵ_t forms a independent standard normal random error. Properties of ϵ_t is

$$\epsilon_t \tilde{} N(0,1) \quad \textbf{(3)}$$

$$\mu_t = E(r_t | F_{t-1}) \quad \textbf{(4)}$$

which implies a equation of GARCH(1,1) model as;

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_t^2 + \beta_1 \sigma_{t-1}^2 \quad \textbf{(5)}$$

The model has following properties:

1. $\alpha_1 + \beta_1 < 1$

2. $\alpha_0 > 0$

3. $\beta_1 < 0$

4. The unconditional long-term variance of return series r_t is $\sigma^2 = \frac{\alpha_0}{1-\alpha_1-\beta_1}$

Thus GARCH (1,1) model equation becomes;

$$(\sigma_t^2 - \sigma^2) - \alpha_1(a_t^2 - \sigma^2) + \beta_1(\sigma_{t-1}^2 - \sigma^2) \textbf{ (6)}$$

and quantifies squared deviations from long-term variance (Tsay, 2005).

1.3.2 Dynamic Conditional Correlation (DCC) – GARCH Model

Assume r_t is return series of N financial assets which have $NX1$ dimensions where $E(r_t) = 0$. The return series, r_t, consist of a mean vector μ_t and iid error process n_t

$$r_t = \mu_t + n_t \textbf{ (7)}$$

where $n_t = H_t^{1/2} z_t$ and $E(n_t n'_t) = I_N$. The conditional variance - covariance matrix of r_t is an NxN matrix denoted by $H_t = [h_{ijt}]$. z_t is an $Nx1$ random variable, $E(z_t) = 0$ and $Var(z_t) = E(z_t z'_t) = I_N$ assuming that r_t is conditionally heteroscedastic and given the information set INF_{t-1};

$$r_t = H_t^{1/2} z_t \textbf{ (8)}$$

Furthermore, $Var(r_t | INF_{t-1}) = H_t$ where H_t is conditional variance matrix of r_t.

Conditional covariance matrix can be splitted and stated as follows;

$$H_t = D_t R_t D_t \textbf{ (9)}$$

where $D_t = diag(h_{1t}^{1/2}, \ldots\ldots, h_{nt}^{1/2})$ is the conditional stardart deviation and R_t is the correlation matrix. To reduce the number of parameters and thus simplify the estimation, Bollerslev(1990) assumes that conditional correlations are constant and thus conditional covariances are proportional to the product of the corresponding conditional standart deviations. Thus the CCC-MGARCH model is defined as:

$$H_t = D_t R D_t = h_{it}^{1/2} h_{jt}^{1/2} \rho_{ijt}; i \neq j \; \textbf{(10)}$$

However, the assumption of constant correlation may seem unrealistic in many empirical applications and hence Chritsdoulakis and Satchell (2002), Engle (2002) and Tse and Tsui (2002) propose a generalization of CCC-MGARCH model by making constant correlation matrix time dependant and hence the DCC-MGARCH model develops. Then we go back to the equation number (3) and specify the conditional standart deviation and conditional correlation matrices as: $diag(h_{1t}^{1/2}, h_{2t}^{1/2}, \ldots\ldots, h_{nt}^{1/2})$ and since R_t is the conditional correlation matrix of standartized error terms $\varepsilon_{\ t}$,

$$\varepsilon_{\ t} = D_t^{-1} \eta \; N\tilde{}(0, R - t) \; \textbf{(11)}$$

Thus, the conditional correlation is the conditional covariance between the standardized disturbances. Before analyzing R_t, further, recall that H_t has to be positive definite by the definition of the covariance matrix. Since H_t is a quadratic form based on R_t, it follows from basics in linear algebra that R_t has to be positive define to ensure that H_t is positive definite. Furthermore, by the definition of the conditional correlation matrix, all the elements have to equal or less than one. To guarantee that both these requirements are met R_t is decomposed into

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1} \textbf{ (12)}$$

where Q_t is a positive definite matrix defining the structure of the dynamics and Q_t^{*-1} rescales the elements in Q_t to ensure $|Qij|$ =< 1. Then Q_t^* is the diagonal matrix consisting of the square root of diagonal elements of Q_t. Thus $Q_t^* = diag(q_{11t}^{1/2}, q_{22t}^{1/2}, \ldots\ldots, q_{nnt}^{1/2})$ Now, Q_t follows the dynamics in the form of

$$Q_t = (1 - \theta_1 - \theta_2)\overline{Q} = \theta_1 \varepsilon_t - \varepsilon_{-1}^T - 1 + \theta_2 Q_{t-1} \textbf{ (13)}$$

where $\overline{Q} = Cov(\varepsilon_t \varepsilon_t^T) = E(\varepsilon_t \varepsilon_t^T)$ is the unconditional covariance matrix of standartized errors. $\overline{Q}$ can be estimated as:

$$\overline{Q} = 1/T \sum_{t=1}^{t} \varepsilon_t \varepsilon_t^T \textbf{ (14)}$$

In equation (7), θ_1 and θ_2 are scalars and must a satisfy the following conditions:

$$\theta_1 => 0, \theta_2 => 0, and, \theta_1 = \theta_2 < 1 \textbf{ (15)}$$

For the purpose of estimation let us assume that the standartized errors ε_t are multivariate Gaussian distributed with the joint distribution function $f(z_t) = \Pi_{t=1}^{T} 1/(2\pi)^{n/2} exp| - 1/2 Z_t^T Z_t|$ where $E(Z_t) = 0$ and $E(Z_t Z_t^T) = I$. We know that $\eta = H_t^{1/2} Z_t$. Then the log-likelihood funtion becomes:

$$In(L(\theta) = -1/2 \sum_{t=1}^{T} (nln(2\pi) + ln(|H_t|) + \eta_t H_t^{-1} \eta_t^T) \quad \textbf{(16)}$$

$$= -1/2 \sum_{t=1}^{T} (nln(2\pi) + ln(|D_t R_t D_t|) + \eta_t D_t^{-1} R_t^{-1} D_t^{-1} \eta_t^{-T}) \quad \textbf{(17)}$$

$$-1/2 \sum_{t=1}^{T} (nln(2\pi) + 2ln(|D_t|) + +ln(|R_t|) + \eta_t D_t^{-1} R_t^{-1} D_t^{-1} \eta_t^{-T}) \quad \textbf{(18)}$$

where θ denotes parameters of the model. Let the parameters, θ, be divided un tow groups:$\phi, \theta = (\phi_1, \phi_2, \ldots\ldots \phi_n, \theta)$, where $\theta = \alpha_{0i,\alpha_1 i,\ldots,\alpha_{qi}}, \beta_{1i}\beta_2 i, \ldots.., \beta_{pi})$ are the parameters of univariate GARCH model for the ith asset class and $\theta = (\theta_1, \theta_2)$ are the parameters of the correlation structure or DCC parameters. DCC_MGARCH model is designed to allow for two stage estimation as the estimation of correctly specified log-likelihood is difficult. In the first stage from the univariate GARCG models ϕ_is are estimated for each asset class and then in the second stage parameters θ_1 and θ_2 are estimated. We have discussed the estimation technique of DCC-MGARCH (1,1) model. The generalized model DCC-MGARCH(p,q) can e estimated in the same manner.

1.4 Results

Financial contagion means volatility increase in a market or an asset class triggers volatility in another ones. As stated in methodology section, we regress univariate volatilities over time-varying conditional correlations. We can conclude contagion impact if estimated OLS regression parameters of univariate volatilities have positive sign and statistically significant.

he adjusted r-squared of the regression model will show power of the contagion impact.

Initially, we checked stationarity of the data via Augmented Dickey Fuller Test with 95% and 90% confidence intervals. Required differencing are shown in Table below.

Table 1: Augmented Dickey Fuller Test for 2-year and 10-year Sovereign Bonds

	ADF Statistics	p-value	Required Diff %95	Required Diff %90
United States 10-year	-2.60	0.32	1.00	1.00
United Kingdom 10-year	-3.03	0.14	1.00	1.00
Japan 10-year	-4.43	0.01	1.00	1.00
Canada 10-year	-2.43	0.40	1.00	1.00
Italy 10-year	-2.09	0.54	1.00	1.00
Germany 10-year	-3.69	0.02	1.00	1.00
France 10-year	-3.59	0.03	1.00	1.00
South Africa 10-year	-2.75	0.26	1.00	1.00
Korea 10-year	-2.86	0.22	1.00	1.00
Brazil 10-year	-2.25	0.47	0.00	1.00
India 10-year	-2.60	0.32	1.00	1.00
Turkey 10-year	-2.86	0.21	1.00	1.00
Mexico 10-year	-2.06	0.55	1.00	1.00
United States 2-year	-1.63	0.74	2.00	2.00
United Kingdom 2-year	-1.81	0.66	1.00	1.00
Japan 2-year	-2.27	0.46	1.00	1.00
Canada 2-year	-1.37	0.84	1.00	2.00
Italy 2-year	-3.08	0.12	1.00	1.00
Germany 2-year	-2.34	0.44	1.00	1.00
France 2-year	-2.11	0.53	1.00	1.00
South Africa 2-year	-1.48	0.80	1.00	1.00
Korea 2-year	-3.26	0.08	1.00	1.00
Brazil 2-year	-1.78	0.67	1.00	1.00
India 2-year	-2.22	0.49	1.00	1.00
Turkey 2-year	-1.75	0.69	1.00	1.00
Mexico 2-year	-0.80	0.96	1.00	2.00

As shown in the Table 1, all countries except United States requires first-degree integration to be stationary. Either 10 year or 2 year tenor bonds shows similar characteristics. Moreover, %95 confidence interval and %90 confidence interval points out similar results.

Descriptive Statistics of the data set is shown as below for 2-year and 10-year sovereign yields of developed and emerging country samples.

Table 2: Descriptive Statistics Developed Economies (10-year Sovereigns)

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
United States	1	588.00	0.03	0.01	0.03	0.03	0.01	0.01	0.05	0.04	0.65	-0.64	0.00
United Kingdom	2	588.00	0.03	0.01	0.03	0.03	0.01	0.01	0.06	0.05	0.25	-1.12	0.00
Japan	3	588.00	0.01	0.01	0.01	0.01	0.01	-0.00	0.02	0.02	-0.18	-1.05	0.00
Canada	4	588.00	0.03	0.01	0.02	0.03	0.01	0.01	0.05	0.04	0.23	-1.17	0.00
Italy	5	588.00	0.04	0.01	0.04	0.04	0.01	0.01	0.07	0.06	-0.37	-0.73	0.00
Germany	6	588.00	0.02	0.01	0.02	0.02	0.02	-0.00	0.05	0.05	0.08	-1.34	0.00
France	7	588.00	0.03	0.01	0.03	0.03	0.02	0.00	0.05	0.05	-0.23	-1.27	0.00

Descriptive statistics of long-end interest rates shows less volatility compared to short-end rates for developed market countries. On the other hand average return is higher in short-end. This is because inverted structure of the yield curve for those countries.

Table 3: Descriptive Statistics Developed Economies (2-year Sovereigns)

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
United States	1	588.00	0.01	0.01	0.01	0.01	0.01	0.00	0.05	0.05	1.73	1.65	0.00
United Kingdom	2	588.00	0.02	0.02	0.01	0.01	0.01	0.00	0.06	0.06	1.36	0.15	0.00
Japan	3	588.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.01	0.01	0.79	-0.29	0.00
Canada	4	588.00	0.02	0.01	0.01	0.01	0.01	0.00	0.05	0.04	1.35	0.54	0.00
Italy	5	588.00	0.02	0.02	0.02	0.02	0.02	-0.00	0.08	0.08	0.31	-0.95	0.00
Germany	6	588.00	0.01	0.02	0.00	0.01	0.01	-0.01	0.05	0.06	0.93	-0.52	0.00
France	7	588.00	0.01	0.02	0.01	0.01	0.01	-0.01	0.05	0.05	0.88	-0.58	0.00

Table 4: Descriptive Statistics Emerging Economies (2-year Sovereigns)

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
South Africa	1	549.00	0.07	0.01	0.07	0.07	0.01	0.05	0.12	0.07	0.92	0.61	0.00
Korea	2	549.00	0.03	0.01	0.03	0.03	0.01	0.01	0.06	0.05	0.48	-0.62	0.00
India	3	549.00	0.07	0.01	0.08	0.07	0.01	0.05	0.09	0.05	-0.67	-0.21	0.00
Turkey	4	549.00	0.11	0.04	0.09	0.10	0.02	0.05	0.24	0.20	1.28	0.77	0.00
Mexico	5	549.00	0.05	0.01	0.05	0.05	0.01	0.03	0.09	0.06	0.71	-0.69	0.00

For emerging economies situation is not much different compared to developed market. However, volatilities are same for long-end and short-end of the curve except Turkey. We think it is because one-off event risk priced in Turkey for recent years.

Table 5: Descriptive Statistics Emerging Economies (10-year Sovereigns)

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
South Africa	1	588.00	0.08	0.01	0.08	0.08	0.01	0.06	0.11	0.05	-0.23	0.91	0.00
Korea	2	588.00	0.04	0.01	0.04	0.04	0.02	0.01	0.06	0.05	-0.12	-1.28	0.00
India	3	587.00	0.08	0.01	0.08	0.08	0.01	0.05	0.09	0.04	-0.67	0.45	0.00
Turkey	4	401.00	0.09	0.01	0.09	0.09	0.01	0.06	0.11	0.05	-0.69	0.26	0.00
Mexico	5	588.00	0.07	0.01	0.07	0.07	0.01	0.04	0.11	0.07	0.29	-0.40	0.00

Table 6 shows contagion impact of 2-year US Treasury bond yields from United States over 2-year Developed Market bond yields, i.e, United Kingdom, Japan, Canada, Italy and France. We can infer that demand for short term US Treasuries impacted short term sovereign debt of United Kingdom, Japan, Canada, Germany and France but Italy. As stated before, the power of contagion impact is measured by adjusted R-Squared of the Ordinary Least Squares regression. Strongest contagion impact is observed between US and Canada with adjusted R-Squared of 0.87 followed by France (0.86), Germany (0.84), United Kingdom (0.80) and Japan (0.78). As it is seen from Table 6 Italy does not show clue for contagion impact for short term yields. This can be resulted from country's own idiosyncratic risk, i.e being largest European Debt holder, as CDS levels are higher and ongoing debates about the payment of the debt in the period of FED QE. In other words, due to Italy's own economic conditions, it could be least choice of investment managers due to high risk low return environment.

Contagion impact of short term bond yields are shown in Table 7. The origination country is United States and we analyzed contagiousness over developed Markets. The expanded model, in this case, includes marginal impact of inflation (MII). We do not expect this variable will have explanatory power on short term yields, as 2-year time horizon can be assumed as short term period and expected inflation is anticipated to impulse long-end of the yield curve rather than short-end. Thus, higher demand for long-term securities will be prevented due to higher expected inflation. In other words, marginal impact of inflation (MII) is not a explanatory variable for short term securities in developed markets. As seen from the model results neither univariate volatilities nor adjusted R-Squared is incrementally different from initial model.

Due to market expectation about further decrease in policy rates accompanied with demand for US Treasuries enforce the yield curves to be inverted, we expect excess demand for 10-year US Treasuries is more contagious compared to shorter terms. Table 8 shows contagion impact of US Treasury yields for longer term bonds and Table 9 shows analysis with Marginal Impact of Inflation. The results showed statistical evidence for stronger contagious impact in longer terms compared to shorter ones. MII does not have incremental impact on neither long nor short term for Developed Markets.

Among G7 countries we noticed that US is main driver of bond yield movement. Then, we analyzed how Emerging Economies reacted against this movement, we include South Africa, Korea, India, Turkey Mexico and Brazil into the analysis. Unfortunately; Turkey, Brazil and Mexico showed convergence problems in DCC-GARCH model and due to the fact excluded from the analysis. We can assume these countries do not show any clues for financial contagion.

Table 10 and Table 11 summarizes results for contagiousness of US Treasuries to Emerging Economies. For shorter tenors, statistical evidence show that South Africa and Korea shows financial contagion from United States. As stated before, MII is not expected to be a significant variable for short rates, and proven by model for EM yields. Moreover, Table 12 and Table 13 states results for longer yields, 10-year bond yields, and we could not find statistical evidence for financial contagion from US to Emerging Economies for longer yields. MII also does not have explanatory power for this countries in question.

This leads us another problem that United States is not main domain for bond yield movement for EM. Thus, what drives EM bond yields? We know that United Kingdom is the financial center for CEEMEA region. Although banks has financial subsidiaries and HQ in Middle East United Kingdom could be one of the trigger for G7 and EM bond yields. Table 14 and Table 15 indicates level of financial contagion from United Kingdom to G7 economies with and without MII for 2-year generic bond yields. As seen from Table 14; Japan, Germany and France show evidence for financial contagion with degree of contagion 0.77, 0.82 and 0.86. We can conclude that France has experienced highest exposure for UK bond yields for short term. Similar to US case, MII is found as irrelevant for short term yields in developed economies.

To compare long and short side of yield curve, we check contagiousness of longer tenors from UK to G7 economies. Table 16 and Table 17 stated model results. Long Term yields show similar results with short-term yields, Japan, Germany and France shows statistical evidence for contagious impact. We believe that due to geographical distance between Canada and UK, bond markets behave independently from each other.

As stated in previous section, we could not find enough evidence for financial contagion between United States and Emerging Market Economies. As mentioned before, to understand nature of reaction EM bond yields against developed market movements, we test contagiousness of UK 2-year Bond yields to EM economies. Table 18 and Table 19 summarizes model results. South Africa and Korea show contagion impact with degree of 0.52 and 0.59 respectively. Then, we added MII into the model however explanatory power of model is worsen in this case.

Table 20 and Table 21 states level of financial contagion from UK through EM economies for 10-year UK bond yields. We could not find any statistical evidence for contagious impact. Moreover, MII also insignificant in this model.

1.5 Conclusion

In this paper, we aimed to find empirical evidence on the contagiousness of safe asset shortages. We used the DCC-GARCH model to quantify conditional correlations. Moreover, we used univariate GARCH models to obtain univariate volatilities.

We find long term safe assets bear more demand compared to shorter ones. Our empirical analysis shows that 10-year US Treasuries showed higher contagion impact than 2-year yields over developed markets. Moreover, Emerging Markets bond yields react against US Treasuries neither short nor long term tenors.

We found the Marginal Impact of Inflation (MII) statistically and economically insignificant for longer and shorter tenors for developed markets.

Once we found no evidence for the United States through Emerging Market contagiousness, we analyzed that the United Kingdom originated contagiousness over the developed market and emerging market economies. Empirical results showed that the United Kingdom Bond market is more contagious over developed European markets than the United States. MII is still insignificant for long and short term yields.

Our empirical results show that emerging market economies do not show any evidence for contagiousness from the United States and the United Kingdom. These results are showed that the secular stagnation hypothesis is valid for developed economies, not for emerging economies.

Table 6 : 2-year US-G7 Contagion Impact

	UK	Japan	Canada	Italy	Germany	France
US 2-year Volatility	229.89	179.72	24.85	299.76	243.97	302.38
Country's 2-year Volatility	280.39	279.36	587.29	-37.76	310.17	162.84
Adj. R-Squared	0.80	0.79	0.87	0.73	0.84	0.86

Table 7 : 2-year US - G7 Contagion Impact with Inflation

	UK	Japan	Canada	Italy	Germany	France
US 2-year Volatility	629.87	77.72	201.97	345.40	355.73	344.44
Country's 2-year Volatility	-247.99	359.43	322.28	-28.77	-22.25	2.32
Marginal Inflation Volatility	-26.55	-39.82	-17.85	5.58	-25.98	-17.03
Adj. R-Squared	0.89	0.86	0.88	0.68	0.90	0.91

Table 8 : 10-year US - G7 Contagion Impact

	UK	Japan	Canada	Italy	Germany	France
US 10-year Volatility	26.62	264.86	-267.44	554.58	363.32	409.14
Country's 10-year Volatility	622.28	480.41	1246.28	-302.46	300.65	157.14
Adj. R-Squared	0.95	0.96	0.99	0.67	0.96	0.96

Table 9 : 10-year US - G7 Contagion Impact with Inflation

	UK	Japan	Canada	Italy	Germany	France
US 10-year Volatility	46.97	319.11	-220.08	776.57	371.93	594.76
Country's 10-year Volatility	622.03	583.47	1239.91	-283.01	361.23	51.20
Marginal Inflation Volatility	3.58	44.87	6.92	28.92	8.42	14.28
Adj. R-Squared	0.94	0.95	0.99	0.75	0.96	0.95

Table 10 : 2- year US-EM Contagion Impact

	South Africa	Korea	India
US 2-year Volatility	43.73	166.83	35.04
Country's 2-year Volatility	30.32	87.48	-21.28
Adj. R-Squared	0.29	0.61	0.04

Table 11 : 2-year US-EM Contagion Impact Contagion Impact with Inflation

	South Africa	Korea	India
US 2-year Volatility	23.47	224.03	62.43
Country's 2-year Volatility	12.85	-71.58	-35.81
Marginal Inflation Volatility	-0.08	-19.48	-2.03
Adj. R-Squared	0.19	0.64	0.08

Table 12 : 10-year US - EM Contagion Impact

	South Africa	Korea	India
US 10-year Volatility	114.96	564.31	18.64
Country's 10-year Volatility	-12.90	-309.53	9.51
Adj. R-Squared	0.39	0.86	0.79

Table 13 : 10-year US-EM Contagion Impact Contagion Impact with Inflation

	South Africa	Korea	India
US 10-year Volatility	56.58	607.65	26.60
Country's 10-year Volatility	-9.81	-303.16	0.12
Marginal Inflation Volatility	-5.58	10.06	0.05
Adj. R-Squared	0.11	0.85	0.13

Table 14 : 2-year UK-G7 Contagion Impact Contagion Impact

	Japan	Canada	Italy	Germany	France
UK 2-year Volatility	91.81	-25.11	256.13	273.77	299.90
Country's 2-year Volatility	333.01	540.03	-66.96	234.01	117.78
Adj. R-Squared	0.80	0.87	0.67	0.82	0.86

Table 15 : 2-year UK-G7 Contagion Impact Contagion Impact

	Japan	Canada	Italy	Germany	France
UK 2-year Volatility	48.08	-41.58	304.72	234.51	280.76
Country's 2-year Volatility	356.60	475.77	-53.71	126.21	60.07
Marginal Inflation Volatility	-21.73	-12.72	8.42	-19.59	-10.84
Adj. R-Squared	0.81	0.87	0.61	0.87	0.89

Table 16 : 10-year UK-G7 Contagion Impact Contagion Impact

	Japan	Canada	Italy	Germany	France
UK 10-year Volatility	269.15	-355.11	719.71	498.53	520.33
Country's 10-year Volatility	419.28	1263.22	-399.22	212.69	95.15
Adj. R-Squared	0.97	0.99	0.64	0.96	0.96

Table 17 : 10-year UK-G7 Contagion Impact Contagion Impact with Inflation

	Japan	Canada	Italy	Germany	France
UK 10-year Volatility	259.42	-330.65	960.39	489.26	672.44
Country's 10-year Volatility	475.90	1322.32	-360.89	303.45	52.23
Marginal Inflation Volatility	1.48	10.99	32.53	10.66	15.91
Adj. R-Squared	0.95	0.99	0.75	0.96	0.96

Table 18 :2-year UK - EM Contagion Impact

	South Africa	Korea	India
UK 2-year Volatility	46.85	51.22	9.42
Country's 2-year Volatility	1.04	28.18	-22.14
Adj. R-Squared	0.52	0.59	0.05

Table 19 : 2-year UK - EM Contagion Impact with Inflation

	South Africa	Korea	India
UK 2-year Volatility	60.17	31.53	50.40
Country's 2-year Volatility	6.58	35.38	-38.46
Marginal Inflation Volatility	2.09	-2.14	2.45
Adj. R-Squared	0.25	0.33	0.05

Table 20 : 10-year UK - EM Contagion Impact

	South Africa	Korea	India
UK 10-year Volatility	74.37	514.93	59.22
Country's 10-year Volatility	-2.25	-294.70	-8.63
Adj. R-Squared	0.93	0.91	0.97

Table 21 : 10 -year UK - EM Contagion Impact with Inflation

	South Africa	Korea	India
UK 10-year Volatility	87.51	597.03	25.06
Country's 10-year Volatility	-23.79	-347.75	8.44
Marginal Inflation Volatility	-3.20	8.40	-0.21
Adj. R-Squared	0.13	0.86	0.16

1.6 Concluding Remarks

There can be two forms of secular stagnation: the strong- and weak-form versions. The strong-form version is one where an economy is unable to reach full employment even with zero interest rates. Japan is a good example. The weak-form version is one where the economy can achieve full employment but only in the presence of low positive interest rates. In many respects, weak-form secular stagnation is better for equities than the normal state of affairs where the economy is at full employment and interest rates are near their historic average. This is because weak-form secular stagnation allows equity investors to have their cake and eat it too – to enjoy full employment and high corporate profits, all with the persistent tailwind of very low rates.

Our baseline view on the US envisions a goldilocks scenario of sorts: An economy that is hot enough to keep deflationary forces at bay, but not so hot that the Fed has to intervene to raise rates. While there are risks on both sides of this view, they are fairly modest. US households are sitting on nearly $2.5 trillion in excess savings, which should support consumption over the next few years.

1.6.1 US and FED Perspective

How seriously should we take the secular stagnation hypothesis? On the one hand, it is becoming increasingly clear that the zero bound constraint is a major problem. The standard response to the suggestion that the Fed ought to raise its inflation target is that the financial crisis was likely a once-in-a-lifetime event.

As Fred Mishkin has argued, *"If shocks of this magnitude are rare, then the benefits to a higher inflation target will not be very large because the benefits will only be available infrequently".* However, Ball estimates that the zero bound constraint would have been binding for the majority of U.S. recessions since 1960 if the Fed had systematically targeted a 2% inflation rate during this period. For example, while the nominal fed funds rate fell to only 4.6% during the 1973-75 recession, in real terms, it declined to -5.8%. If, on top of this, the secular stagnation hypothesis is true and a lower equilibrium real interest rate is now necessary to ensure full employment, then the zero bound constraint is likely to become an even greater headache for central banks if they continue to target an inflation rate of 2%.

That said, it is one thing to argue that the zero bound will remain a constraint to monetary policy during future recessions, but quite another that a short-term nominal interest rate of zero will still be necessary once the forces that caused the recession have dissipated. Crucially, it is the latter argument that is at the heart of the secular stagnation thesis.

And when it comes to that particular argument, we remain rather skeptical, at least as far as the U.S. is concerned. Firstly, there are clear reasons why U.S. growth has been weak over the past few years, forcing the Fed to keep short-term rates near zero. These include falling home prices, household and financial sector deleveraging, worries about a euro area break up, and an ill-timed tightening of fiscal policy. With time, these headwinds will pass.

Secondly, one does not need to rely on a secular stagnation story to explain why inflation has declined over the past thirty years, any more than one needs to rely on a "secular boom" story to explain why inflation increased in the 1970s. A more plausible explanation is that starting in the early 1980s, central banks were successful in anchoring inflation expectations at progressively lower levels. This was most apparent in the late 1990s, when the unemployment rate fell below 4%, but inflation nevertheless continued to trend lower. In other words, the Phillips curve shifted down over this period.

Thirdly, there are self-correcting economic forces that will tend to push aggregate demand back towards the economy's full potential. In particular, a lack of new investment will reduce the capital stock, leading to a lower capital-to-output ratio. This, in turn, will boost the rate of return on capital, making new investment more appealing. The fact that the U.S. private-sector capital stock, adjusted for population growth and inflation, is lower now than it was before the financial crisis suggests that there is plenty of pent-up demand for everything ranging from new homes to consumer durable goods to business equipment

1.6.2 Euro Area Perspective

Ironically, while most of the recent discussion of secular stagnation has focused on the U.S., the likelihood that such an outcome will unfold is much greater in the euro area. Compared with the U.S., euro area banks are less well capitalized, home prices in several key euro area economies such as France have just begun to fall, and the demographic outlook is less favorable. We continue to find it implausible that the ECB[7] will start raising rates only shortly after the Fed, as the market is currently expecting. In fact, it is far from clear that the ECB will be in any position to raise rates before the end of the decade.

Such an extended period of ultra-low rates may not please Germany, but this is precisely what is needed to rebalance demand within the euro area without subjecting the periphery to deflation. In any case, the only alternative to higher inflation in Germany may be a breakup of the common currency. Since such an outcome would bankrupt most German banks and many of its exporters (who would now have to pay their workers in expensive deutschmarks), this is

not something Germany will ever accept. German inflation increased to over 6% in the early 1990s, as the economy overheated during the reunification construction boom. That was the price Germany paid to forge a new union. Higher inflation will be the price Germany pays once again to keep the euro area together.

[7] The ECB will be allowing its Pandemic Emergency Purchase Program, or PEPP, to expire at the end of March 2022. Beyond that, the ECB has announced that the pace of buying in the existing pre-pandemic Asset Purchase Program (APP) will be upsized from €20bn per month to between €30-40bn until at least the third quarter of 2022. This represents a meaningful slowing of the pace of ECB bond purchases, which were nearly €90bn per month under PEPP. Nonetheless, unlike most other developed economy central banks that are ending pandemic-era quantitative easing (QE) programs, the ECB will still be buying bonds on a net basis and expanding its balance sheet in 2022 (Chart 15). The central bank has taken great care in signaling that no rate hikes should be expected in 2022, likely to avoid any unwanted surges in Peripheral European bond yields or the euro. A continuation of asset purchases reinforces that message, leaving us comfortable in maintaining an overweight recommendation on Italian and Spanish government bonds for 2022.

One might think that bund yields would rise if inflation in Germany increased, but to a first approximation, the 10-year bund yield is determined by the expected path of short-term rates that the ECB sets over the next decade. If the market is ultimately forced to price in a much later ECB rate hike, the yield spread between bunds and Treasurys could actually widen from here.

1.6.3 Financial Market Implications

There is much truth to the secular stagnation story. Yet, this is one story for which degrees really matter. Consider the example of equities. If it is really the case that growth will continue to disappoint, as Larry Summers fears, then this is clearly bad news for stocks. In contrast, suppose that the forces leading to slower demand growth - deleveraging, population aging, the global savings glut, etc. - cause the equilibrium real interest rate (the rate consistent with full employment) to fall, but not so far that the zero bound constraint continues to be binding.

To use a numerical example, suppose we end up in a situation where the fed funds rate returns to 3%, inflation stays around 2%, and as a result, real short-term rates end up being 1%. In that case, the Fed will be able to fully offset the various headwinds to growth that underpin the secular stagnation story by keeping interest rates lower than normal, ensuring that the economy (and corporate profits) continue to grow at the same rate that would have prevailed if none of these headwinds existed. The only difference is that real short-term rates would now be 1%, rather than the historic average of 2%.

The difference between 1% and 2% may not seem like a lot, but for securities valuation, it matters quite a bit. Suppose, for the sake of argument, that the real fed funds rate stays at the current level of -2% for the next two years, and then begins to increase, reaching 1% in 2017. Also, suppose it remains at that level for another twenty years, before finally increasing to 2% in 2037. By how much would this raise the present value of expected cash flows compared with a scenario in which real rates were fixed at their pre-crisis average of 2% throughout this entire period? A simple back-of-the-envelope calculation suggests that the answer is about 30%. The point is that if the forces underpinning the secular stagnation story turn out to be modest and manageable in nature, this may actually end up being good for stocks!

The probability that such a "goldilocks" outcome will unfold in the U.S. is quite high. In Europe, however, the risk of secular stagnation is greater. That said, we ultimately expect the ECB to pursue a loose monetary policy for much longer than the market is currently expecting, thus helping to reflate the euro area economy. And with euro area stocks trading at a Shiller P/E of only 13 (compared with 25 in the U.S.), the risk of much slower growth in the region has already been discounted. On balance, we continue to remain modestly overweight global equities, while favoring relatively cheap markets such as Europe and China.

CHAPTER 2 FINANCIAL DISTANCE AND HEDGE EFFICIENCY OF GLOBAL FIXED INCOME PORTFOLIOS

ABSTRACT

The Law of universal gravitation states that particles in the universe with a positively correlated force correlate with masses' product and negatively correlated with the square of the distance between them. Newton's theory of gravitation has been used for a long time in social sciences and is considered especially useful for analyzing bilateral trade flows. The simplest form of gravity is used to model international trade. The volume of trade between any two trading partners increases their national income and decreases distance function. However, this form cannot measure financial gravity for financial markets for a couple of reasons. Firstly, the relationship between economic indicators and financial indicators are no longer exists. Secondly, due to technological enhancements and the expansion of electronic trading venues, geographical distance expires its economic meaning. To apply Newton's gravity model to financial markets, we created a new index called "Financial Distance." The financial Distance Index has a direct relationship with Credit Default Swap (CDS) Spreads and an inverse relationship with the Foreign Exchange (FX) Rate of countries in question. We used Financial Distance Index to obtain an optimal hedge ratio for global fixed income portfolios. The current practice in fixed income trading is using β of the yield. Our findings support using Financial Distance instead of β of the yield; lowers portfolio return volatility and higher risk adjusted return.

Keywords: Efficieny, Financial Distance, Fixed Income, Optimization, Gravity

2.1 Introduction

In the past several decades, the interdependence of financial markets is a pretty exciting subject in financial economics. A common strategy used to study this phenomenon is non-linear time series models such as dynamic conditional correlation models or Markow Switching (Regime Switching) models. Since the modernization of global financial markets, fixed income securities have a vital share in traded risk among other products. Fixed Income (FI) Securities are the main debt instrument of governments and a significant indicator of sovereign credit risk. Hedging FI portfolios are among the most exciting subjects in the field, and various quantitative models have been developed after introducing the modern portfolio selection theory by Harry Markowitz. (Markowitz, 1952)

Immunization (hedging) is a commonly-used notion in fixed-income trading. Yet, it is difficult to define precisely since hedging technique varies depending on risk category, i.e., Interest Rate Risk, Credit Risk, or Liquidity Risk. A well- known example of hedging interest rate risk is the execution of interest rate swaps (IRS), where the swap payer converts its fixed interest receiver position into a floater. However, IRS locks credit spread of related fixed-income instruments and depreciation of credit risk in security still requires attention. Credit Default Swaps need to be executed to hedge the credit risk of the underlying security; however, liquidity is the main bottleneck in this case. Research on the subject has been mostly restricted to limited comparisons of theoretical models with limited applicability in financial markets. In other words, modeling dynamic behavior without practical aspects would be an excellent theoretical study but nothing else.

A well-known problem with the theoretical approach is that it does not take into account the fact that

- relationship between economic indicators and financial indicators is weakend,
- electronic trading venues enable traders to execute transactions in multiple markets at the same time without any transaction cost imposed. Thus, modeling financial variables concerning an economic variable are senseless today.

Our research aims to find a solution for this challenging problem and provide a solid theoretical framework with the applicability of financial markets. The main achievements, including contributions to the field, can be summarized as

- Based on current econometric models; we created a new index to measure the financial distance of countries derived from Newton's Gravity Model, which brings all information about liquidity, credit risk, and interest rate risk of a fixed income portfolio.
- Provides applicable hedging framework to traders.

In particular, no study, to our knowledge, has considered practical aspects of the subject in question.

2.2 Literature Review

Historically, 'Newton's gravity model' has been used to generate policy measures for trade economics. This methodology is frequently employed to measure trade flows, trade value, and trade efficiency of countries. One specific example of usage area is the selection of trade counterpart, which has a trade potential. Trade potential is a concept where theoretical value is greater than actual market value (Leng et al., 2020). Previous studies primarily defined trade efficiency as actual value divided by theoretical value and utilization level of trade potential in percent. (Nilsson, 2000)

One of the components of the gravity model is 'distance.' In the literature, the term used to refer to physical distance, communication distance, road distance, distance in time, psychological distance road distance (Bialynicka-Birula, 2015) The model is also used for the microanalysis of industries such as water trade, art trade, air freight market.

Duarte, Pinila, Serrano studied water trade on the basis of several factors in the agriculture industry. They found statistical evidence that physical, economic, and institutional factors are primary drivers of virtual water trade flows (Duarte et al., 2019). In a similar case, the model also analyzes the impact of foreign trade agreements such as AIFTA, SAFTA, NAFTA (Jagdambe and Kannan, 2020). Moreover, analysis of factors for a specific region and product group can be done via model. (Nasrullah et al., 2020) Furthermore, the same logic is applied to the aviation industry, where augmented gravity models have been used to determine direct flight routes' potential. (Li et al., 2020)

Universal Law of Gravity has been applied to social sciences in different econometric approaches. One of the techniques is The Poisson gravity model along with pseudo maximum likelihood (ML). Although several benefits to using this methodology, the model is built based on the solid assumption that trade flows are independent. However, this is not the case in practice and causes biased parameter estimation and wrong economic inference and policy implications. (Krisztin and Fischer, 2015)

Another significant area in economics is the contagiousness of financial crises. The gravity model also used to model the role of psychic distance in financial crises and found that psychic distance is an essential factor accompanied by common language, development level, and available joint memberships (Zhu and Yang, 2008)

2.3 Data & Methodology

2.3.1 Generalized Gravity Model

In 1962 and 1963, Tinbergen and Pöyhönen popularized the term 'Gravity Model for International Trade' to describe bilateral trade flows via following form below. (Pöyhönen, 1963)

$$EX_{ijt} = \frac{A(Y_{it}Yjt)}{DIST_{jt}} \quad \textbf{(19)}$$

where EX_{ijt} refers to trade flow $country_i$ to $country_j$ in $year_t$. Y_{it} ıs the gross domestic product (GDP) of $country_i$, Y_{it} is the gross domestic product of the $country_j$.

Moreover, $DIST_{jt}$ is the geographical location of two countries generally expressed by physical distance between economic centers.

In some cases, by taking natural logarithm of two sides of the equation, gravity model can be rephrased to

$$lnEX_{ijt} = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnYjt + \beta_3 lnDIST_{jt} + u_{jt} \textbf{ (20)}$$

where, ln is the natural logarithm, β's are regression parameters and u_{jt} is the random error of the model. Since international trade is popular subject among economists, each research brought new variables and/or econometric approach to the field.

2.3.2 Gravity Model as Measure of Financial Distance

Financial Shocks initially trigger the Foreign Exchange Rate and Credit Default swap Spread of the country[8]. In the case of sudden financial turmoil, traders liquidate their local currency positions from bonds and stocks, sell the local currency outright or unwind the FX or cross-currency swap, and convert the position into reserve currency, leading to depreciation in FX rate. Secondly, due to deterioration in local currency, uncertainty on the repayment ability of FX debt will increase. Thus, the premium on credit default swap spread will be widened.

Based on the fact that these two variables are the key indicators of financial markets, inspired from the universal law of gravitation, we created a new metric to measure the financial distance

[8] Considering the plunge in the currency, should investors remain short and underweight on financial assets? General rule of trading suggest Currency traders who have been shorting the lira should take profits on this position due to tactical considerations; Medium- and long-term investors should remain underweight on equities and local currency bonds relative to their respective benchmarks; Dedicated credit investors should stay neutral on the nation's US dollar sovereign credit if is there any.

of countries where a financial distance is directly related to Credit Default Swap (CDS) Spreads and an inversely related with the Foreign Exchange (FX) Rate.

To prevent concern of liquidity or convertibility, we should define financial distance comparative to developed financial markets. These concerns can be widely observed in emerging economies, i.e., Turkey, Brazil, Poland. To illustrate the issue briefly, we can look at the example of the TRY FX Swap Market. To convert EUR into TRY requires the execution of EURTRY FX Swap. However, these currency pair does not have an actively traded market, instead priced via USD. Thus, execution of this trade, we need two separate transactions. The first one is TRY payer - USD receiver swap and USD payer - EUR receiver swap.

$$Transaction_1: +Pay_{TRY} - RecieveUSD \quad \textbf{(21)}$$

$$Transaction_2: +Pay_{USD} - Recieve_{EUR} \quad \textbf{(22)}$$

$$Transaction_{combined}: +Pay_{TRY} - Recieve_{EUR} \textbf{(23)}$$

As explained above, the combination of those swaps is TRY payer, EUR Receiver swap position. In other words, there is no real quotation on the EURTRY market; instead, USDTRY and EURUSD instruments are quoted and traded. Thus, our financial distance metric requires an intermediary unit to convert credit and FX risk into a single metric to compare all countries relatively. We chose the United States as a reference country because US Dollars (USD) are the main reserve currency in the global economy. Evidence from recent COVID-19 crises, in the period of a global liquidity squeeze, USD demand always increases. In March 2020, the markets' initial reaction to virus spread to developed economies, EURUSD, JPYUSD, and XAUUSD spreads were widened, and USD liquidity became scarce. Thus, the best way to measure the financial distance of two countries is converting both credit risk and FX risk into USD terms.

In the light of this information, Financial Distance Index can be calculated as

$$FDI = \frac{\frac{1}{FXRate_i * FXRate_r}}{\frac{1}{CreditDefaultSpread_i - CreditDefaultSpread_r}} \quad \textbf{(24)}$$

Where $CreditDefaultSpread_i$ refers to Credit Default Swap Spread in USD, $FXRate_i$ refers to Foreign Exchange rate of $country_i$ against USD, and $FXRate_r$ refers to the foreign exchange rate of reference country against USD.

We define credit risk, not in local currency but reference currency because central banks have the right to print money to pay the local debt. This situation leads probability of default in local currency is zero. Then, equation of financial distance turns into

$$FDI = \frac{CreditDefaultSpread_i}{FXRate_i} \quad \textbf{(25)}$$

where reference country is the United States, FX Rate is equal to 1, and default probability is equal to 0.

2.3.3 Obtaining Optimal Hedge Ratio

In general, government treasuries raise FX liquidity via issuing sovereign bonds. Thus, the majority of fixed-income securities are sovereign bonds. Whereas I-spread of a bond refers to the return of the risky asset after full elimination of interest rate risk, Credit Default Swap Spread refers to the issuer's credit risk. Since both terms are referring to the same type of risks, I-Spread and CDS are highly correlated.

To prevent any arbitrage, a bond's interest rate spread (I-Spread) needs to move in line with CDS, otherwise buying the bond and selling the CDS will result in risk-free arbitrage. The wider spread in CDS or I-Spread indicates higher credit risk.

Immunization, in broader terms, is achieved by adding uncorrelated assets into a portfolio. The main question here is the quantification of optimal hedge ratio in which risk-adjusted return is maximum, and the diversion from mean is minimum.

Market practice, ordinary least squares method is used to obtain optimal hedge ratio, β of the regression model is the hedge coefficient where

$$\beta = \frac{\sum_{i=1}^{n}(y_i - \bar{y})(x_i - \bar{x})}{(x_i - \bar{x})^2} = \frac{Cov(x,y)}{Var(x)} \quad \textbf{(26)}$$

and return of hedged portfolio can be defined as $R_p = R_i - \beta * R_h$. We suggest using financial distance index instead of bond yields to obtain optimal hedge ratio.

$$\beta_{FDI} = \frac{Cov(FDI_i, FDI_r)}{Var(FDI_i)} \textbf{(27)}$$

2.3.4 Data

We retrieved Credit Default Swap Spreads and FX rates for 74 countries from 2010 to 2021 from Bloomberg. Historical time series of the Financial Distance Index of these countries can be found in the appendix.

The Geographical Breakdown of Reserves are stated in graph below.

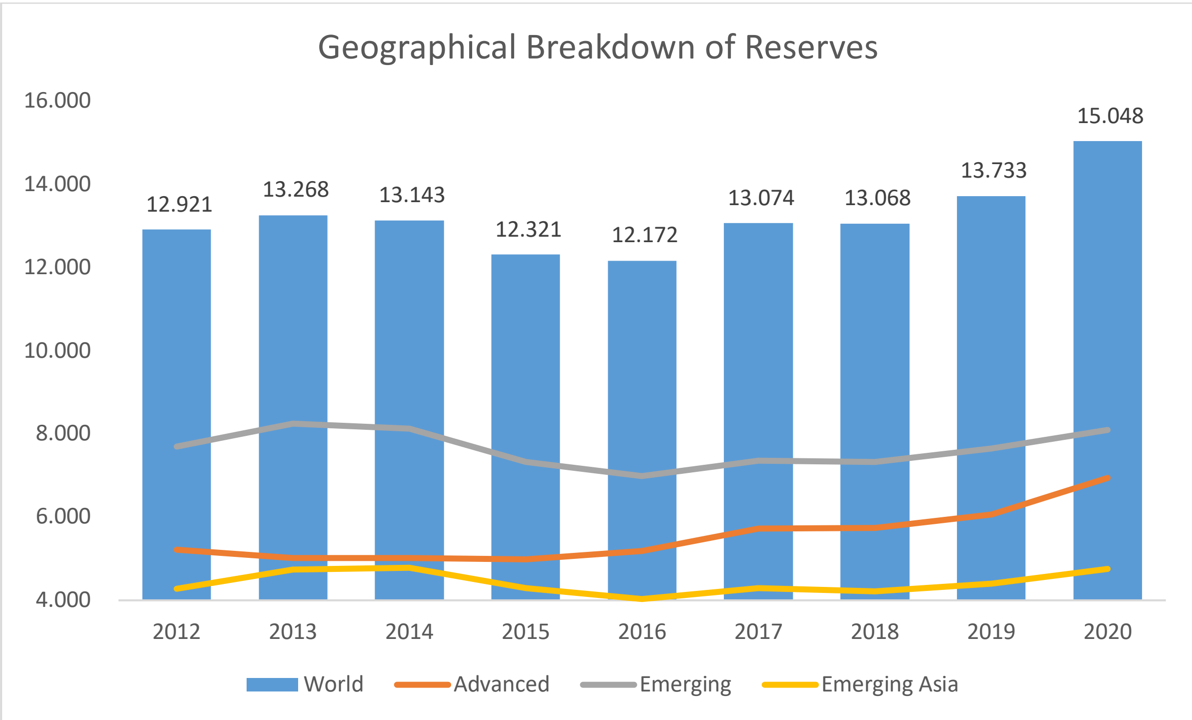

Figure 15: Geographical Break Down of Global Reserves

The evolution of related variables used in analysis are stated below for Turkey, Brazil, Mexico, Germany and France.

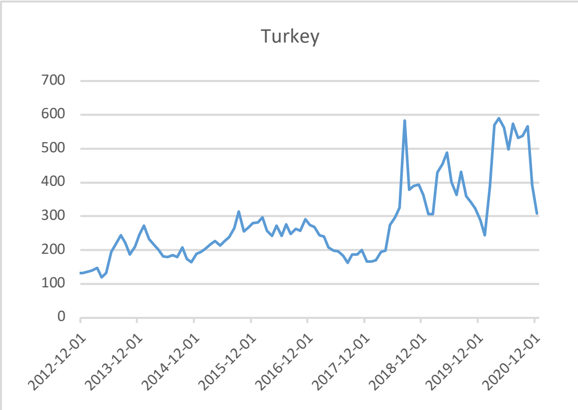

Figure 16: Turkey Credit Default Spread (bps)

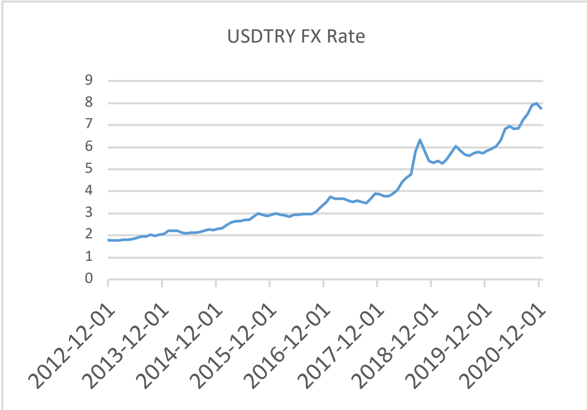

Figure 19: USDTRY Foreign Exchange Rate

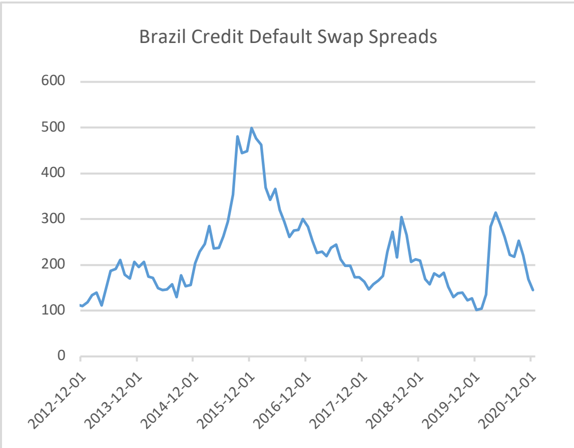

Figure 17: Brazil Credit Default Swap Spreads (bps)

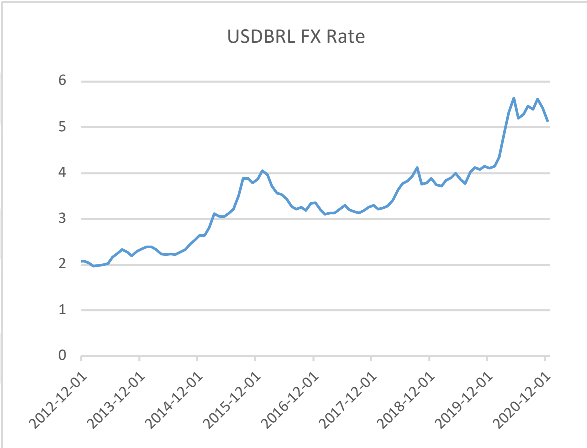

Figure 20: USDBRL Foreign Exchange Rate

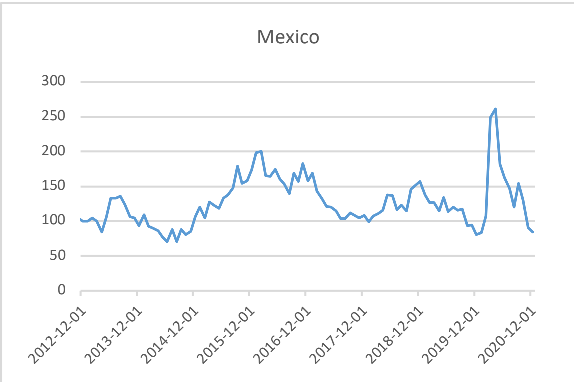

Figure 18: Mexico Credit Default Swap Spread (bps)

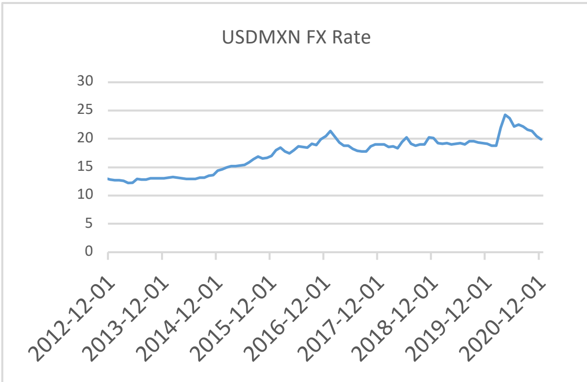

Figure 21: Mexico Foreign Exchange Rate

For Eurozone we stated only USDEUR FX rate however, we represented each country's CDS levels.

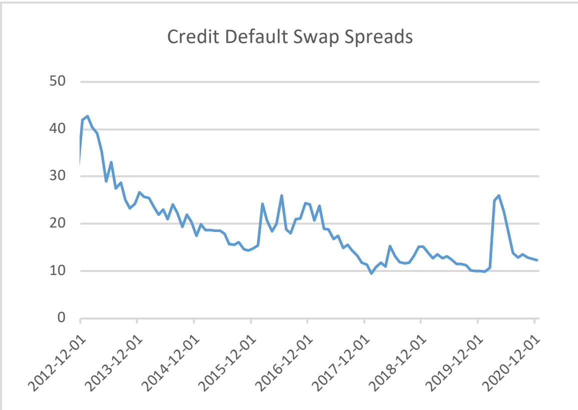

Figure 22: Germany Credit Default Swap Spread (bps)

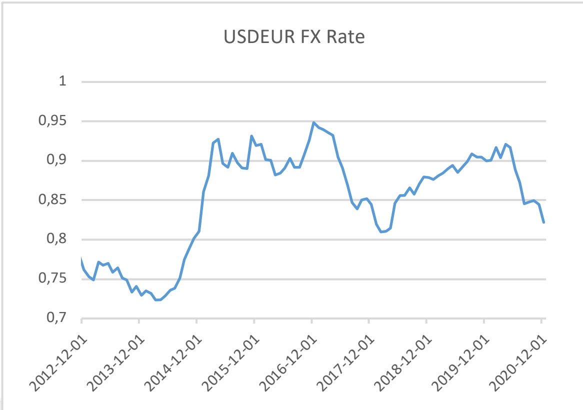

Figure 24: USDEUR Foreign Exchange Rate

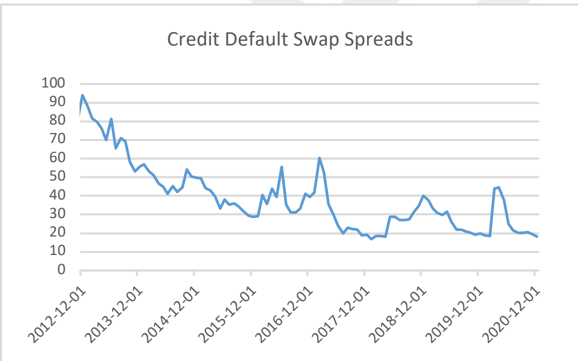

Figure 23: France Credit Default Swap Spreads(bps)

2.4 Results and Discussion

To measure the performance of the proposed methodology, we have created sample portfolios with Germany, France, Turkey, Brazil, and Mexico and formed a pairwise basket in which a sovereign bond of a country hedged with another one. We compared unhedged, OLS-hedged, and FD-Hedged portfolios, as employed by Buyukkara et al., in terms of mean returns, standard deviations, and risk- adjusted returns. (Buyukkara et al., 2021)

Table 22: Turkey vs Brazil Sovereign Optimal Hedge Ratio

	Turkey	
	Sovereign Yield	Financial Distance
	OLS	*OLS*
	(1)	(2)
Brazil Sovereign Yield	1.309*** (0.029)	
Brazil Financial Distance		0.878*** (0.031)
Observations	279	279
R^2	0.877	0.739
Adjusted R^2	0.876	0.738
Residual Std. Error (df = 278)	1.927	3.133
F Statistic (df = 1; 278)	1,977.829***	785.861***
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 17 compares the results obtained from the preliminary analysis of Turkish and Brazilian Sovereign Yields. Coefficients of the model represent optimal hedge ratio, Adj. R2 represents the hedge effectiveness of the trade. According to results, the classical OLS approach suggests 1.309 on the other hand, new financial distance index methodology suggests 0.8777 as an optimal hedge ratio. Moreover, the hedge effectiveness of the standard approach is higher than the FD methodology.

Table 23: Turkey vs Mexico Sovereign Optimal Hedge Ratio

	Turkey	
	Sovereign Yield	Financial Distance
	OLS	*OLS*
	(1)	(2)
Mexico Sovereign Yield	1.763*** (0.027)	
Mexico Financial Distance		0.315*** (0.006)
Observations	279	279
R^2	0.939	0.921
Adjusted R^2	0.939	0.920
Residual Std. Error (df = 278)	1.356	1.725
F Statistic (df = 1; 278)	4,281.256***	3,231.385***
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 18 represents the hedge ratio of Turkish and Mexican Sovereign Yields. In this case, Adj. R2 almost not changed. However, ordinary OLS suggest an incrementally higher hedge ratio with slightly higher hedge efficiency.

Table 24: France vs Germany Sovereign Optimal Hedge Ratio

	France	
	Sovereign Yield	Financial Distance
	OLS	*OLS*
	(1)	(2)
Germany Sovereign Yield	0.615*** (0.020)	
Germany Financial Distance		1.903*** (0.023)
Observations	279	279
R^2	0.781	0.962
Adjusted R^2	0.780	0.962
Residual Std. Error (df = 278)	0.153	0.047
F Statistic (df = 1; 278)	989.749***	7,054.728***
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 19 compares the results for Germany and France. Compared to emerging economy examples, Adj. R2 is much higher in this example. Moreover, ordinary OLS suggest a relatively under-hedged portfolio as an optimal level. However, in contrast to earlier findings, no evidence of lower hedge efficiency is detected in the FD hedge portfolio.

Table 25: Risk-Return Profiles of Fixed income Portfolios

	Mean	Std. Dev.	Risk Adj. Return
Turkey vs Brazil			
Unhedge	5.3337	1.2621	4.2260
OLS Beta	0.3597	1.8934	0.1900
OLS Financial Distance	1.9985	1.6048	1.2453
Turkey vs Mexico			
Unhedge	5.3337	1.2621	4.2260
OLS Beta	0.1691	1.3451	0.1257
OLS Financial Distance	4.4115	1.1858	3.7202
Brazil vs Mexico			
Unhedge	3.7999	0.9659	3.9340
OLS Beta	0.0894	0.8977	0.0996
OLS Financial Distance	2.9261	0.8720	3.3558
France vs Germany			
Unhedge	-0.1977	0.2606	-0.7586
OLS Beta	0.0530	0.1438	0.3689
OLS Financial Distance	0.5778	0.2342	2.4669

How do we decide whether ordinary OLS or Financial Distance OLS represent better results? For pairwise portfolios, we investigated portfolio characteristics and compared not-hedged, OLS hedged, and FD Hedged portfolios.

As it is shown in Table 20, FD Hedge portfolios generate higher mean returns compared to standard OLS hedges.

However, the mean returns will not provide clear insight into the performance alone. For instance, the portfolios that are not hedged provides the highest returns, except the ones traded in a negative interest rate environment. Thus, to track the performance of the constructed hedge portfolios, we need to measure risk-adjusted return in which return is represented in terms of per unit risk. In other words, risk-adjusted return is calculated by the ratio of mean return to its standard deviation of return. The findings show that in all cases, FD hedges provide higher risk-adjusted returns compared to OLS hedges.

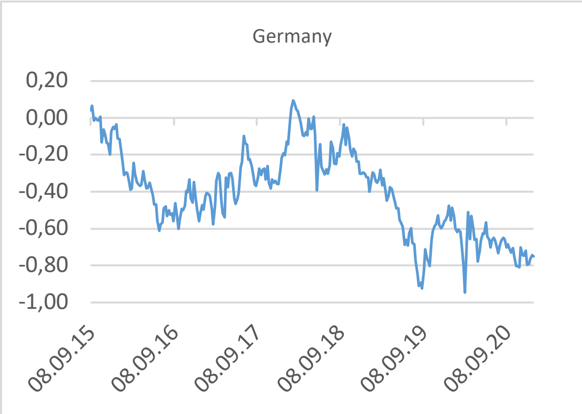

Figure 25: Germany Generic Sovereign Yield

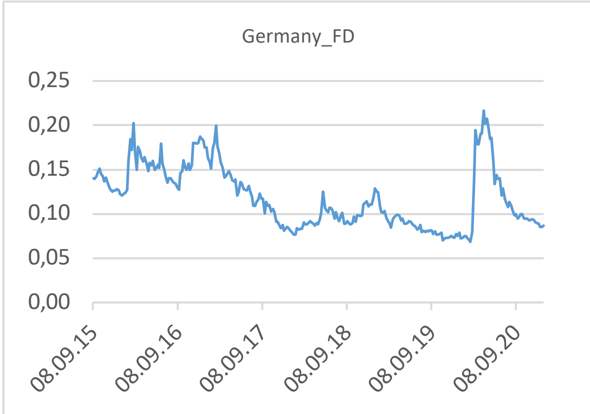

Figure 27: Germany Financial Distance Index

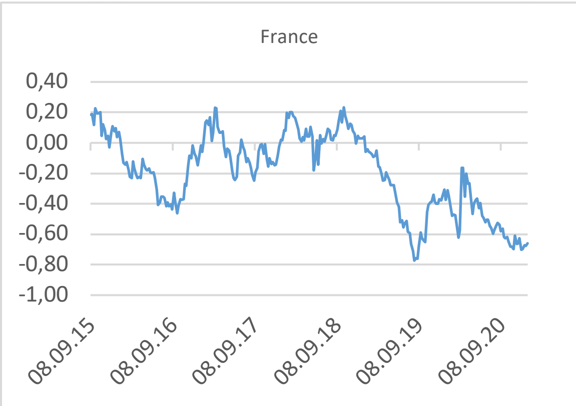

Figure 26: France Sovereign Yield

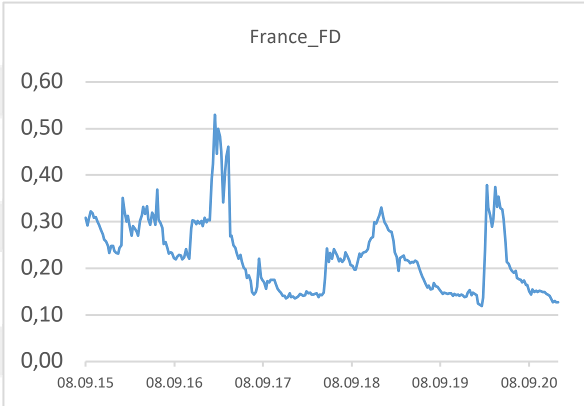

Figure 28: France Financial Distance Index

Altough sovereign yield shape resembles financial distance index, we believe financial distance is more appropriate way to measure hedge effectiveness.

Figure 29: Turkey Generic Sovereign Yield

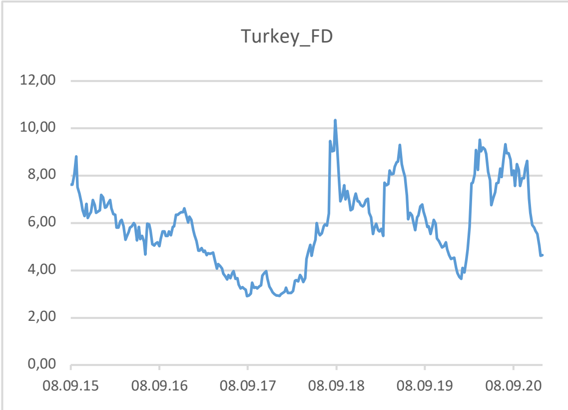

Figure 32: Turkey Financial Distance Index

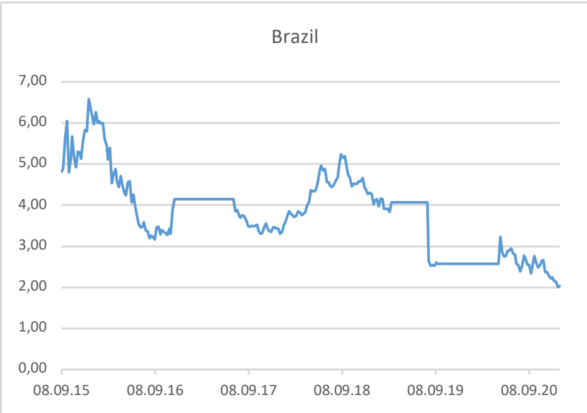

Figure 30: Brazil Generic Sovereign Yield

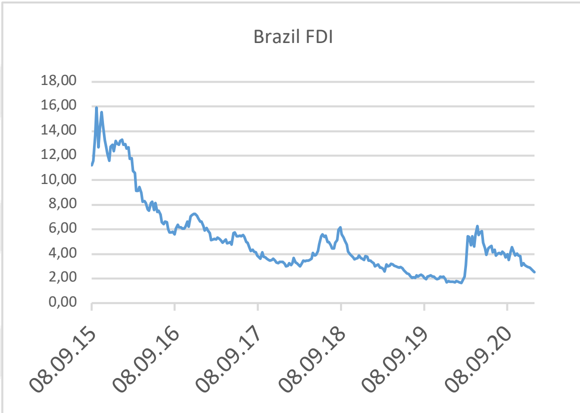

Figure 33: Brazil Financial Distance Index

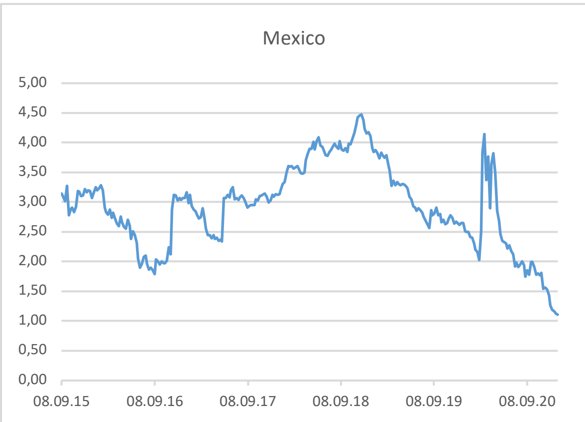

Figure 31: Mexico Generic Sovereign Yield

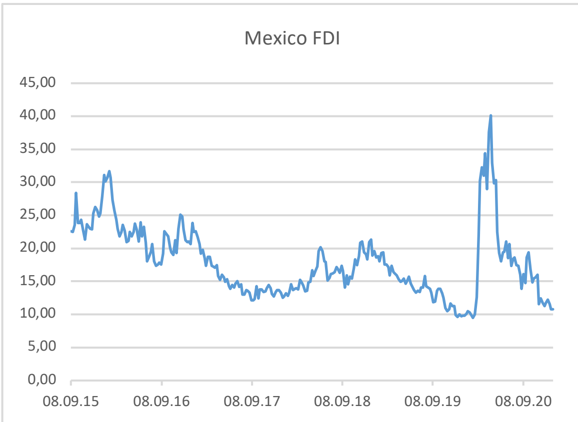

Figure 34: Mexico Financial Distance Index

Our model applied to the same currency sovereign bonds, as the initial focus is on hedging sovereign credit risk. As it is stated before, different currency issuance will yield a different probability of defaults and different credit risk profiles. Hedging a USD-denominated asset with EUR denominated instrument leads to an open FX Position in the trader book, which cannot happen in practice. A typical trading book needs to be cash neutral, i.e., cannot carry an open cash position in any currency. In this case, hedging in different currencies requires an additional cash instrument to fill the gap in open cash FX position. In the real world, traders hedge their positions via FX Swaps, and return analysis needs to be cover P&L impact for those derivatives too. On the other hand, standard approaches also ignore this fact, and β of bond yields in different currencies are used for hedge proxy, which completely wrong.

In some cases, X-denominated issuance is converted into Y via a hypothetical cross-currency swap to find yield levels and hedge accordingly. However, the issuer's credit risk is not the same in currency X and currency Y. It is not a proper methodology to use as a hypothetical conversion to find an optimal hedge ratio. In this case, the optimal solution is calculating hypothetical Quanto-CDS in which dual currency default probability is included in the spread.

2.5 Conclusion

How to manage EM currency exposure when investing in EM local currency debt and equities has been a frequently asked question of practitioners on managing developed market (DM) currency exposure when investing in DM equities and government bonds.

According to the BIS Triennial Central Bank Survey, EM currency exchange markets have evolved rapidly since 2001. The daily turnover reached 1.65 trillion dollars in April 2019, which is about 25% of the global currency daily turnover.4 While it is becoming increasingly easy to trade EM currencies, compared with DM currencies it is still more costly and operationally more challenging to hedge EM currency exposure, especially the currencies with non-deliverable forwards (NDFs) that require collateral management.

In this paper, inspired by Sir Isaac Newton's gravitation law, we provide a state-of-the-art new methodology to quantify optimal hedge ratios for the Fixed-Income Sovereign bond market. We adopted universal gravitation law to financial markets and created a new metric that is called Financial Distance Index. FDI is a comprehensive metric that includes credit and FX risk of a country in which FDI is positively correlated with Credit Default Spread and negatively correlated with FX rate. We calculated Financial Distance for 74 countries from the years 2010 to 2021.

Although our new index can be applied in any field of financial economics, we decided to apply it to quantify the optimal hedge ratio for pairwise portfolio allocations in global fixed income markets. Our findings reveal that the Financial distance index is a better hedge proxy than sovereign yield β in terms of adjusted mean return.

Our findings provide a solid evidence base for the inaccuracy of optimal hedge ratios with current methodologies. This study should, therefore, be of value to practitioners wishing to eliminate inappropriate hedging transactions

CHAPTER 3 WINDS OF TAPERING, FINANCIAL GRAVITY AND COVID-19

ABSTRACT

Real interest rates have fallen dramatically since the early 1980s. Economic theory states that lower real rates discourage savings while promoting spending. However, today, in the world economy, we face a global saving glut problem in which, even in negative real rates, economic agents keep saving. This situation leads to excess demand for safe assets (US Treasuries), lowering bond yields, and peaking equity valuations. Thus, the world economy becomes more dependent on major economies, especially the United States. In this research, we aim to provide a new framework called financial gravity to understand the nature of dependency on US monetary policy and its results. Our new theoretical framework suggests not using macroeconomic variables to model financial asset dynamics since macro variables are lagged, less frequent, and have different demand functions than financial assets. Our empirical findings support that financial gravity is positively related to international reserves, negatively related to Credit Default Swap Spreads (CDS) and Foreign Exchange Rate. We also analyzed the COVID-19 period and found that pandemics contributed to world reserve accumulation positively due to economic lock-down measures, fiscal stimulus packages (unemployment benefits), and decreased global spending.

Keywords: Financial Gravity, Financial Distance, Tapering, COVID-19

3.1 Introduction

The last decade was an exciting period for financial markets since sub-prime mortgage crises in the United States, 2011-2012, the European Crises, 2020 announcement of a pandemic due to corona virus widespread worldwide led financial turmoil and unorthodox policy actions took by Central Bankers. In statistical terms, Turmoil means an unexpected shock to the financial system, leading to structural breaks and distortions to the economic system. There is a wide range of literature on the topic of what triggers financial crises, and results include but are not limited to credit growth, asset bubbles, inappropriate macro-prudential policies, and current account deficits.(Kiley, 2021)

The estimated sensitivity of the global liquidity components, i.e., international capital flows, peaked in 2013 when former Fed Chairman Bernanke announced that Fed would slow down the asset purchases that triggered foreign exchange rate volatility in emerging countries, especially in the Asia region (Avdjiev et al., 2020). This period called “Taper Tantrum” led to sharp spikes in foreign exchange rates, brought panic and volatility to the markets, and forced central bankers to be cautious about future monetary policy messages of the United States (Jiao, 2021). Similar reactions have been observed for Europe in 2015, “Bund Tantrum” concentration of bond ownership and market illiquidity undermines market microstructure and damage transmission channels for market shocks and indirectly real economy (Boermans et al., 2016)

The first time introduced by Lord (2013), "Taper Tantrum" brought a new concept called "Fragile Five" which is referring the countries hit by the event whose currencies are deteriorated and sovereign yields and credit default spreads are widened most. If we would add Russia to the "Fragile Five," the new group is known as "Sorry Six" (Amstad et al., 2016)

Since international financial markets are linked and influenced by significant policymakers, i.e., FED or European Central Bank, we thought we could understand the nature of linkage by the financial gravity model. Our research aims to contribute to the existing literature by providing theoretical and empirical evidence for the gravity of financial markets. There is limited coverage of financial gravity, mainly driven by physical distance, trade, and minor financial variables. (Zhu and Yang, 2008) Sophistication in econometric measurement advanced daily; however, full-scope financial gravity has not been reached yet. Thus, we estimate the gravity model with stand-alone financial variables.

Recent academic work on the economics of gravity is widely applied to analyze and understand bilateral trade flows between countries. However, the usage of the gravity model should not be limited to geographical economics. We thought the model is also a good instrument for analyzing international investment flows. Then the question becomes why financial gravity should be different from existing gravity literature? Why should we not use macroeconomic fundamentals for modeling financial assets?

Previous studies investigated the linkage between tangible assets and financial assets due to the economic crises of 2008 since the housing bubble triggers it. Regime switching models, volatility spill-over analysis, and inter-market dependence have been measured by various researchers (Chan et al., 2011). However, the existence of linkage or inter-dependence does not mean we can use these variables interchangeably.

First of all, as a macroeconomic phenomenon, trade is a physical transaction where an asset needs to be transported cross-border. However, financial assets are different from physical assets by nature. If we take an example of financial security, i.e., sovereign bond, an investor in any region in the world can buy or sell a sovereign bond in seconds without any transaction cost.

Since transactions are executed electronically, and delivery is being made electronically, the physical distance is irrelevant. Moreover, settlement of the transaction being made by a clearinghouse, there is no insurance required for delivery of the security; the only risk is the price risk until settlement which is called delivery-versus-payment (DVP). Thus, physical distance as an input for the gravity model is not applicable for financial assets.

Secondly, macroeconomic variables are lagged, and their drivers are different from the financial assets. Macroeconomic data is less frequent, quarterly or monthly; on the other hand, financial data can be measured by seconds, minutes, or hours. Moreover, financial data is subject to speculation if the market is not liquid or efficient so that extended time intervals can lead to information loss for modeling.

Third, except for gold, physical assets are not high-quality liquid assets (HQLA), which is a fundamental input for the Liquidity Coverage Ratio of the Basel III accord. Gold is an exceptional case where it is a part of international reserves and a buffer for external shocks for an economy. Thus, demand function cannot be the same for financial and physical assets, which is the main argument for Secular Stagnation Hypothesis, the reason for excess demand for Safe Assets, US Treasury Bills, and the birth of the concept of Global Saving Glut (GSG) Countries.

For the reasons listed above, existing gravity models cannot be applied to financial markets. For this reason, based on the existing theoretical framework, we convert macroeconomic variables into financial variables to obtain a proper financial gravity model.

3.2 Theoretical Framework & Data

Theoretical Framework. We used a modified version of Coeurdacier and Martin to derive a gravity equation for financial markets. Their gravity model is a simplified version of Martin and Rey, used to model international trade in assets with transaction costs. (Coeurdacier and Martin, 2009).

$$log(Asset_{ij}) = logL_i y_i + logn_j - (\epsilon - 1)log\tau_{ij} + (\epsilon - 1)logQi \quad \textbf{(28)}$$

In their model, the first independent variable is the gross domestic product of the country j representing the size of the country. The second term is the number of assets which is a proxy for financial sophistication. As stated in Martin and Rey, the volume and variety of assets issued by a country is a vital sign for financial openness, positively related to income, represents the country's richness, and sign for being a financial center. (Martin and Rey, 2006) The third term is the transaction cost of bilateral trade of two countries, inversely related asset holdings of the country in question. Lastly, the final term is the price index of the country.

As it is seen from the variables above, the model produced by Coeurdacier and Martin includes macroeconomic and financial market variables; however, their specification is not sufficient to prescribe full financial markets gravity since macroeconomic variables are lagged variables. Based on the fact that financial variables are traded in a more dynamic environment, we are now ready to produce our financial markets gravity model states as below:

The first step in our analysis is to estimate a standard gravity model with financial variables:

$$log(x_j) = \alpha + \beta_j + \gamma_j(\frac{FXReserves_j}{FXReserves_{world}}) - \Phi log(Z_j) + \epsilon_j \quad \textbf{(29)}$$

X_j is the dependent variable, the logarithm of US investors' holdings of foreign bonds in 2011 to 2020 for country j.

The term, FX Reserves, is a hybrid variety that connects financial markets to economic fundamentals. Reserves are an essential tool for a country to sustain economic and financial stability.

From Bretton Woods till today, pioneered by emerging economies, oil exporters, global saving glut (GSG) countries, international reserves as the portion of a gross domestic product exponentially grew due to financial globalization and financial openness. From 1970 to 2010, international reserves have a 15% annual growth rate mainly driven by emerging economies. (Steiner, 2013) Widening float exchange rate regimes and increased capital flows led central bankers to built international reserves to defend the domestic currency. (Obstfeld et al., 2010)

International reserves (FX Reserves) are considered an emergency exit for economic turbulence and essential for keeping financial markets stable. It is used for cooling down the currency and adequately intervene in the market by central banks. In addition, substantial FX Reserves provide shelter for structural economic problems. For example, in most Emerging Economies, there is a currency mismatch on savings and investments, in which investments take place in local currency, savings are in foreign currency. As a result of that, the bank's balance sheet consists of FX Deposits against domestic currency loans, making banks' balance-sheet fragile and leading central banks to keep more reserves. Since Central Banks, as a lender of last resort, needs to fund the short position of bank's local currency liquidity, the FX Swap facilities will be placed to retrieve FX deposits from banks and provide local currency funding to the market.

Thus, the variable $\frac{FXReserves_j}{FXReserves_{world}}$ is a market share proxy that belongs to the country j to represent a bridge to economic variables to financial markets.

Z_j is the financial Market determinants where

$$Z_j = FXRate_j \Phi_1 + CDS_j \Phi_2 \quad \textbf{(30)}$$

$FXRate_j$ is the Foreign exchange rate of the country *j* per USD, CDS_j is the credit default swap spread of the country *j*. An increase in FX rate means the devaluation of the currency, increase in Credit Default Swap Spreads an increase in credit risk in USD; both variables represent the distance from the domain country, i.e., the United States. Therefore, both variables are expected to have a negative sign.

Our primary motivation to select these variables for our gravity model is in adverse economic conditions; the initial hit will get into the local currency bond market, then sell-off government bonds followed by sell-off local currency against reserve currency. These actions allow traders to liquidate their risky position into a risk-free position, i.e., cash that bears overnight interest in the reserve currency, EURO, or US Dollar. On the other hand, shorting local currency leads to deterioration in local currency and increases uncertainty to repay FX debt of the institutions, bringing sell-off in the sovereign bond market and credit default swap (CDS) market, respectively. CDS is the insurance of bond issuer, and interest rate swap spread and credit default spread has long-term equilibrium.

β_j is the corona dummy to control how gravity changes after the official announcement of pandemics all around the world in march 2020. Therefore, we expect the sign of the corona dummy will be positive.

We apply panel data regression to estimate the equations stated above. Prior to the estimation, we check the stationarity of panel data. We use the panel unit root test of Levin-Lin-Chu, in which the test assumes that the series under scrutiny are cross-sectionally independent. (Kleiber and Lupi, 2011)

We run panel data regressions (fixed/random effects model) and applied the Hausman test for model misspecification. (Hsiao, 2003). The nature of the variables is the primary driver of the model selection. Before testing model specification statistically, the following properties of random and fixed effect models should be kept in mind (Allison, 2009):

1. If there are no omitted variables or omitted variables are not statistically correlated with independent variables in the model, then the random effects model should be specified.
2. To prevent omitted variable bias, if omitted variables correlate with independent variables, the fixed effects model is the appropriate model.
3. If within groups variability is not changing over time, or there is little change fixed effect model is not suitable for this case because of their standard errors.
4. The random-effects model has minor standard errors; however, their estimated coefficients are biased in general.

The model structure for Fixed Effect and Random Effect Model can be structured as below;

$$y_{it} = \mu + \beta_{1W}(x_{it} - \overline{x}_i) + \beta_{2B}\overline{x}_i + \beta_3 z_i + \upsilon_{i0} + \upsilon_{i1}(x_{it} - \overline{x}_i) + \epsilon_{it0} \quad \textbf{(31)}$$

In equation 31, as regular ordinary least squares regression, y_{it} is the dependent variable, x_{it} is the time varying independent variable, z_i is a time-invariant independent variable. Moreover, β_{1W} is representing within effect whilst β_{2B} is standing for between effects for x_{it}. Random Effect has two components inside the model, first one is υ_{i0} is for intercept, υ_{i1} is for slope that allows heterogeneity in the within-effect of x_{it} The parameters are assumed to distributed normally.

A simplified parameterisation of model can be stated as follows:

$$y_{it} = \beta_0 + \beta_{1W}(x_{it} - \overline{x}_i) + \beta_{2B}\overline{x}_i + \beta_3 z_i + (\upsilon_i + \epsilon_{it}) \quad \textbf{(32)}$$

ϵ_{it} *is* homoscedastic, normally distributed error term, and υ_i is the model's homogeneous (random effect) for individuals. (Bell et al., 2019)

General simplified framework for Random Effects can be rephrased as in Equation 33, with assumption of $\beta_{1W} = \beta_{2B}$ or $\beta_{2C} = 0$ which has equivalent meaning. Estimating this equation will be more efficient compared to Equation 31, if and only if the assumption is being hold.

$$y_{it} = \beta_0 + \beta_1^{RE} x_{it} + \beta_3^{RE} z_i + (\upsilon_i + \epsilon_{it}) \quad \textbf{(33)}$$

Since the model specification depends on the assumption, the final model requires a statistical test for coefficients of within and between effects. This is what the famous Hausman test is being used often. In general, the Hausman test is used for if the specified model is accurate, i.e., Random or Fixed, via checking between and within effects are statistically different.

Depending on the research question, field, and nature of the variables, one of the most used specifications is the Fixed Effects model in which uj are specified as fixed effects and υi draws from any types of statistical distribution. Then, between effects cannot be estimated, and Equation 32 turns into

$$y_{it} = \beta_1(x_{it} - \overline{x}_i) + (\upsilon_i + \epsilon_{it}) \quad \textbf{(34)}$$

Although parameters are more efficient in this specification, exclusion of between effects from the beginning is one of the main disadvantages of the FE model.

We use US Investors' securities holdings from The Treasury International Capital (TIC) System provides country and instrument breakdown of the data, credit default swap rates from Bloomberg Fixed Income Database, International Reserves, and Foreign Exchange rates from IMF International Financial Statistics Database.

We collect data for 74 countries where we can quantify credit default spread. Later on, we removed Iraq, Kuwait, Peru due to unreliable data on financial variables. Moreover, we also removed Argentina and Greece for distortion in CDS data. Finally, our dataset consists of 71 countries with five variables.

3.3 Results and Discussion

3.3.1 Empirical Results

Before estimating equations, we check the stationarity of the panel dataset. In the case of panel data, panel unit root is more critical than individual time-series unit root. Thus, we run the Levin-Lin-Chu Panel Unit-root test to comment on the stationarity of the dataset. As shown in Table 26, test results suggest that our data is panel stationary, i.e., no further action is required before continuing the estimation.

Table 26: Levin-Lin-Chu Unit Root Test for Panel Data

Test statistic	P value	Alternative hypothesis
-13.04	3.473e-39 * * *	stationarity

Hausman Test results suggest a random-effect model rather than a fixed-effect model, as shown in Table 27

Table 27: Hausman Test for Model Specification

Test statistic	df	P value	Alternative hypothesis
4.206	4	0.3788	one model is inconsistent

We have run panel data regressions to estimate gravity equations with our new variables. We specified both Fixed-Effect and Random-Effect model, results are summarized in Table 28.

Both models suggest a statistically significant relationship for FX Reserve Market Share, CDS Level, FX Rate, and Corona Dummy.

Table 28: Panel Data Fixed Effect Model

	Securities Holdings	
	Fixed Effects Model	Random Effects Model
FX Reserves	10.298*** (1.550)	11.191*** (1.515)
log(FX Rate)	−0.063** (0.030)	−0.067** (0.028)
log(CDS)	−0.202*** (0.011)	−0.203*** (0.011)
Corona Dummy	0.281*** (0.019)	0.282*** (0.019)
Constant		10.777*** (0.247)
Observations	7,452	7,452
R^2	0.085	0.086
Adjusted R^2	0.076	0.086
F Statistic	170.906*** (df = 4; 7379)	701.521***
Note:		*p<0.1; **p<0.05; ***p<0.01

According to our empirical results, financial gravity is positively related to FX Reserves, negatively related to CDS and FX Rate as we expect in our theoretical framework. The pandemic period also has a statistically significant impact on gravity could have various reasons, which will be discussed in the next section.

3.3.2 Discussion

The recovery from the 2020 COVID recession is now well underway, and many investors are curious about when central bankers might respond by removing monetary policy accommodation and starting to lift their policy rates. Some central banks appear to move the policy rates, and the others will reduce or stop asset purchase programs. For example, the Bank of Canada and Bank of England have already started to reduce their rates of bond-buying, and the FED started to provide forward guidance about its tapering.

So, why is it crucial in our context? If we rule out country-specific unsystematic risks, financial gravity provides us insights into fragility. In financial terms, fragility meaning foreign exchange rate deterioration, Credit Default Swap spread widening, and adequate positioning in international reserves. If we know all three with their elasticities, we can infer whether a central bank can defend its currency promptly against sudden sell-off in currency or sovereign debt markets.

We have mentioned in previous sections that Central Banks of Emerging Economies already accumulating international reserves as a defense strategy from the beginning of 2000. International Reserves are diversified portfolio mainly held insecurities, especially US Treasuries, covered bonds, or gold. Thus, increasing reserves meaning increasing demand for US Treasuries and more dependence on US monetary policy. The other way around, more strength against currency attacks. As of May 2021, central bank holdings of foreign currencies Asian Emerging economies reached approximately six trillion USD; if we exclude China, international reserves of the region's central banks stood at an all-time high of roughly three trillion USD. (Jiao, 2021).

Dependency to United states monetary policy will bring fluctuations to emerging economy. Since FED already announced to end quantitative easing, Emerging Market sell-off is on the way. The figure 35 [9]shows the comparison duration adjusted spread ratio of US/EM[10].

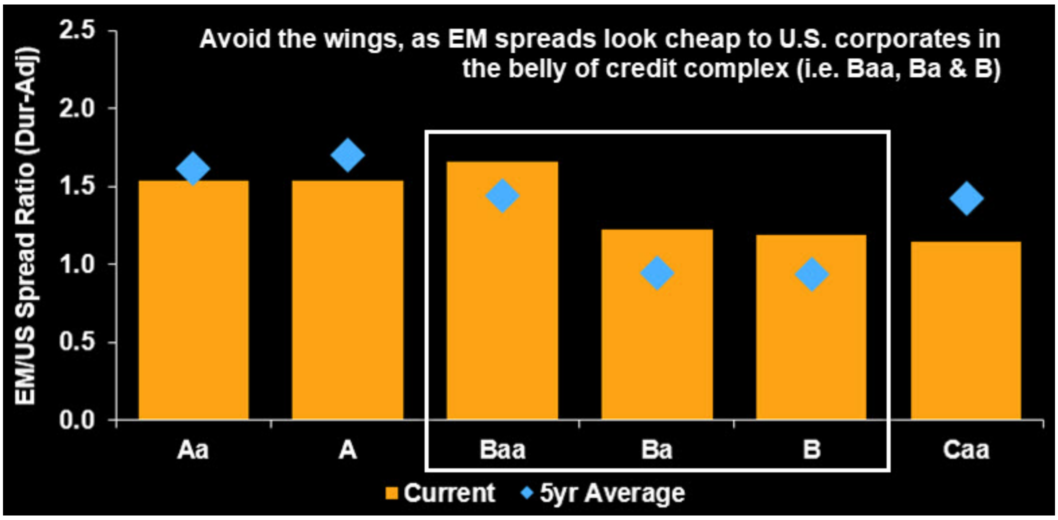

Figure 35: Duration Adjusted United States / EM Spread Ratio

[9] source: Bloomberg
[10] US/EM spread ratio used to understand overbought/oversold analysis of fixed income securities.

Since quantitative easing lowered the real yields and collapsed equity valuations, reversal of the bond market brings opposite directions. Thus, tapering will force emerging market yields as current situation is relatively higher than 5-year average.

Another aspect we analyzed in this paper is the pandemic of 2020. COVID-19 has turned the world upside down this year and severely impaired global trade. Most countries had also seen negative foreign direct investment (FDI) growth in 2020.

The restrictions and semi or full lock-down measures increased household savings[11] further and accumulated more cash in the private sector and households. This led to the expansion of the already large global savings glut. US households were sitting on approximately two trillion USD in excess savings as of the end of April 2021. This is money they would not have had in the absence of the pandemic.

The composition of these savings can be defined as slightly less than half of them are stimulus checks and unemployment benefits; the rest is decreased spending during the pandemic.

Enhanced unemployment benefits will expire in September 2021, schools resume normal operations, more workers will flow back into the labor market. At the same time, some of the

[11] According to the IMF, the US is expected to see no fiscal drag in 2022 thanks to the Biden Administration's spending initiatives, while Europe and EM will see significant fiscal drag (Chart 4). However, in the case of Europe, this should not be viewed negatively as it is the result of expiring pandemic era employment and income support programs that are no longer needed after economies emerged from wholesale lockdowns. So less fiscal stimulus is a sign of a healthier European economy that is more likely to put upward pressure on global bond yields, on the margin.

bottlenecks currently gripping the global supply chain should abate, allowing for increased output. To synthesize the all information above, in line with our expectations, empirical results supported that period of COVID-19 positively impacted financial gravity, although some of the Global Saving Glut Countries' investments went through sovereign securities to stocks. The concept of a savings glut is also related to another, less well known, concept: a safe asset shortage. If the private sector earns more than it spends, it must, by definition, accumulate assets. In principle, governments can satiate the demand for safe assets by issuing more bonds. In practice, governments have often been reluctant to run persistently large budget deficits for fear that this could undermine their credibility.

3.4 Conclusion

In our study, we have introduced a full-scale financial gravity model to explain inter-linkages among financial markets. Our findings with strong empirical evidence that gravity is a direct function of international reserves, the inverse function of Credit Default Swap spreads, and foreign exchange rates. Thank to safe asset shortages and global saving glut countries, reluctant to sit on excess cash, households shifted some of their funds into the stock market.

With corporate buybacks outpacing new share issuance, stock prices had nowhere to go but up. Moreover, falling bond yields [12]further supercharged equity valuations. We can infer from our

[12] the investment outlook for 2022 is more complicated for investors to navigate than the relatively straightforward story from this time a year ago. Then, the development of COVID-19 vaccines led to optimism on reopening from 2020 lockdowns, but with no threat of the early removal of pandemic monetary and fiscal policy stimulus. The fixed income investment implications at the time were obvious, in the majority of developed countries - expect higher government bond yields, steeper yield curves, wider inflation breakevens and tighter corporate credit spreads.

findings, competition for accumulating international reserves among Emerging economies will increase and lead problem of safe asset shortages being widened.

3.4.1 Implications for EM

EM crises in 1997-98 did not occur simultaneously across all EM countries. It began in July 1997 with Thailand, then spread to Korea, Malaysia and Indonesia, and finally to the rest of Asia. By August 1998, Russian financial markets had collapsed, triggering the Long-Term Capital Management (LTCM) debacle. The last leg of the crisis appeared in Brazil and culminated in the real's devaluation in January 1999. Similarly, the US financial/credit crisis in 2007-08 commenced with the selloff in sub-prime securities in March 2007. Corporate spreads began widening, and bank share prices rolled over in June 2007. Next, the S&P 500 and EM stocks peaked in October 2007. Despite these developments, commodity prices and EM currencies continued to rally until the summer of 2008 when they finally collapsed in the second half of that year.

There was a domino effect in financial markets in both the 2015 and 2018 turbulences. Initially, the selloffs started in the weakest links while other parts were holding up. Then, the selloff spread to all without exception. For example, in 2018, US share prices and high-yield credit spreads were doing quite well until October 2018. Then, a broad-based selloff transpired in the fourth quarter of 2018.

All these events show similar characteristics in terms of contagiousness and financial asset reactions. Those reactions are repetitive where traders' funding structure and investment behavior are same. Just as chains break at their weakest links, financial market selloffs begin in the most susceptible sectors. Overpriced US stocks with little or no profits and currencies with zero or negative interest rates have been most vulnerable to rising US interest rates. That is why these segments have sold off first in response to rising US nominal and real rates.

Our hunch is that the selloff in global markets due to rising US interest rates will broaden in the coming months. This does not mean that global stocks on the verge of a major bear market, but a double-digit drop in global share prices is likely.

The last asset class standing will be commodity prices. These will likely be the last affected by rising US interest rates because many investors buy commodities as an inflation hedge. Besides, oil prices have also been supported by the geopolitical tensions around Ukraine and Iran. It might take investor concerns about the US economy and a slowdown in global manufacturing to trigger a relapse in commodity prices.

As US interest rates continue rising and China's recovery fails to transpire immediately, EM financial markets remain at risk. Therefore, we recommend a defensive stance for absolute return investors in EM equity and fixed income. We are also continuing to short a basket of EM currencies versus the US dollar.

As for global equity regional allocation, the outlook for EM performance is less certain than it was in the past 12 months. Clearly, rising US/DM interest rates herald US equity underperformance versus other DM markets, like the euro area and Japan

Whether EM outperforms or not is mainly contingent on the US dollar, rather than US bond yields. EM relative equity performance against DM has a low correlation with US bond yields. Yet, EM equities will underperform their DM peers if the USD. However, if the greenback depreciates, EM will certainly outperform the US in both equity and the fixed income space.

EM credit spreads will widen, and EM local yields will not drop as US bond yields head higher and EM exchange rates depreciate. As for local rates, we largely remain on the sidelines of this asset class.

3.4.2 Implications for DM

Financial markets are at a crossroad. On the one hand, the reflation trades have already rallied a great deal and might be at a point of exhaustion. On the other hand, gigantic monetary and fiscal support from authorities worldwide, and the US in particular, could push global share prices into a no gravity zone where major overshoots and manias are possible.

The bullish view is well-known: DM central banks' easy monetary and fiscal policies will endure. Moreover, the global economy will continue its recovery as vaccines are made accessible by mid-year to a large share of the population in advanced economies. Markets will ignore any growth disappointment stemming from the expansion and/or extension of lockdowns as they are forward-looking and expect widespread vaccine deployment to eventually allow for a reopening of the economies. We agree with these points.

The negative view is also well-recognized: investor sentiment on global equities in general and EM in particular is very elevated and reflation trades have become overbought. These are valid and correct points as well.

US inflation and the Fed’s policy remain the key headwinds to US share prices. Core consumer price inflation is substantially above the Fed’s preferred range (2-2.25%) and wage growth is accelerating. As a result, the Fed will lose credibility if it does not sound ready to hike interest rates materially. The US equity market is vulnerable to such a not-dovish stance from the Fed because it is still very expensive.

Inflation has also become a political problem. One reason Biden’s popularity has been sliding in the polls is the rapid pace of consumer price increases. Heading into the mid-term elections in the fall, the White House and the Democrats will not oppose the Fed raising interest rates to fight inflation.

High and rising trimmed-mean and median CPI measures suggest inflation is broad-based. Normalization in supply-side factors will not be enough to lower core inflation below 3%.

Importantly, the median and trimmed-mean core inflation measures strip out goods and services that post abnormal fluctuations. Their elevated readings corroborate that inflation is genuine and broad-based.

Hence, pressure on the Fed to tighten will remain substantial. This is bad news for a still overvalued US stock market.

3.4.3 Implications on COVID-19 Pandemic

On the pandemic front, the number of confirmed cases of COVID-19 has surged globally, which is likely an underestimation of the total number of infections given capacity limits on testing in many countries. Recent data shows that services PMIs fell sharply in January 2022 in several economies because of the Omicron wave, reflecting both renewed pandemic control measures in some countries as well as precautionary changes in behaviour amongst consumers in countries where widespread “non-pharmaceutical interventions” (“NPIs”) were not reintroduced. Manufacturing PMIs, on the other hand, held up quite well, even in Europe where natural gas prices remain high.

Some positive signs have emerged from the hospitalization data in advanced economies, as they appear to be pointing to a cresting wave of patients with COVID-19 both in hospitals overall and specifically in intensive care units. The evolution of the pandemic remains highly uncertain, and the development of new variants continues to remain a risk. But incoming data on hospitalizations, the rapid increase in the number of vaccine booster doses administered in many advanced economies, and the sheer speed at which the disease has recently been spreading all point to a possible imminent peak in the impact of the Omicron variant on the demand side of the economy – at least in the developed world.

However, there is no sign yet of a waning impact of the pandemic on the supply side of the economy. The rising European natural gas prices are having less of an impact on our supply-side pressure indicator, but that the indicator remains flat excluding this effect.

We noted Omicron variant posed a significant risk of more frequent or longer lockdowns in China, because of the country's zero-tolerance COVID policy and the inability of the Sinovac vaccine to provide any protection against contracting Omicron. Shipping costs between China/East Asia and the west coast of the US have started to tick higher again, suggesting that the impact of ongoing lockdowns as well as mandatory quarantines and testing in key areas such as Shenzhen, Tianjin, Ningbo, and Xi'an may already be having an effect.

From the Fed's perspective, a combination of a temporarily negative domestic demand effect and a lingering domestic labor and global supply chain effect from the Omicron variant has increased the urgency to raise interest rates. The Fed's credibility has been significantly challenged over the past year by the extent of the rise in consumer prices, which is being partially driven by demand (even if supply-chain factors are also materially boosting global goods prices).

3.4.4 Implications on Bond Market

Persistent elevated inflation readings are forcing policymakers to move up the timetable of expected cyclical interest rate increases, but without signaling any change to longer-term interest rate expectations. The result has been an upward move in bond yields led by a repricing of shorter-term yields, leading to bearish yield curve flattening pressure across the developed markets.

As the global bond bear market has intensified and broadened across countries and fixed income sectors, the amount of bonds worldwide with negative yields has been slashed by $9 trillion since December 2021. Some notable examples: the 10-year German Bund yield is now up to +0.26%, the 30-year US real TIPS[13] yield is now at +0.04% and even the 5-year Japanese government bond yield climbed to +0.02% for the first time since 2016.

Recently bond markets had to digest both a 25bp Bank of England (BoE) rate hike - that was almost a 50bp move - and a huge upside surprise in the January US employment report. However, it was the more hawkish-than-expected messaging from the European Central Bank (ECB) that really rattled fixed income markets.

[13] To follow activities in US Interest rate market US Treasury (UST) Curve needs to be used. The curve is comprised of US dollar-denominated US Treasury active securities. The 1-month, 3-month, 6-month and 1-year maturities are the most recently auctioned 4-week, 8-week, 13-week, 26-week, and 1-year US Treasury bills, The 2-year, 3-year, 5-year, 7-year, 10-year and 20-year maturities are the most recently auctioned US Treasury notes. The 30-year maturity is the most recently auctioned 30-year US Treasury bond. The curve is updated on each auction day with an effective date of the next market day.

At the February 2022 monetary policy meeting, ECB[14] President Christine Lagarde opened the door to potential ECB rate hikes this year, a notable change from the previous forward guidance that rates would stay unchanged in 2022. This not only triggered a major decline in European government bond prices, but also notable jumps in bond volatility for both longer-term and, especially, shorter-term yields. Implied volatilities for swaptions on 2-year European swap rates now sit at the highest levels since the depths of the European Debt Crisis in 2011

Overnight index swap (OIS) curves are now discounting multiple rate hikes from the Fed (+127bps), BoE (+125bps) and ECB (+46bps) this year. Tighter monetary policy is the inevitable consequence of the current combination of steady above-trend growth, tight labor markets and very high inflation in those countries. This mix will continue to put upward pressure on global bond yields through a blend of steady inflation expectations and higher real yields as pandemic era monetary stimulus is removed – a process that is already underway in the US and Europe.

Given the current starting point of high equity valuations and relatively tight corporate credit spreads in the US, financial conditions are no impediment to additional Fed rate hikes in 2022.

[14] sadas ECB Eurozone curve is a risk free par-coupon curve created for the purpose of having a consistant benchmark curve for the 12 Eurozone countries. The curve follows the methodology determined by the EFFAS-ECB Committee for Methods & Measures. The 12 countries in the Eurozone and represented by this curve are, Austria, Belgium, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, the Netherlands, Portugal, and Spain. Please refer to the European Bond Commision Website for details on curve construction methodology.

The same cannot be said in the UK, where the steady appreciation of the trade-weighted pound is tightening financial conditions, on the margin. In the euro area, financial conditions remain relatively stimulative, as the euro is undervalued on a trade-weighted basis.

One of our highest conviction bond market views to begin 2022 called for US Treasuries to underperform German Bunds. Our view was based on the likelihood that the Fed would lift the fed funds rate multiple times this year and the ECB was likely to hold off on rate hikes until the first half of 2023 at the earliest.

The shift in the ECB's tone does not change that relative call. The Fed is still under far greater pressure to hike rates than the ECB, even if there is now a greater chance that the ECB could begin to tighten by the end of 2022.

From an economic growth perspective, both central banks have good reasons to consider withdrawing monetary accommodation. The economic expectations in both the US and euro area have started to recover, according to the ZEW[15] survey of financial market professionals, with a bigger bounce seen in the latter since the trough of October 2021. The fading Omicron wave is likely playing a large role in lifting economic expectations, as the variant has proven to be less lethal than previous waves of the virus.

[15] The survey is performed monthly basis since 1991 to reveal expectations about developed economies such as Germany, Eurozone, and USA.

The ZEW survey also asks respondents about their views on future inflation and interest rate changes. The ZEW Inflation Expectations index has fallen back to pre-pandemic lows in both the US and euro area, indicating that a majority expect lower inflation in the US and Europe over the next year. Both the Fed and ECB also expect inflation to fall from current elevated levels this year. However, there is still a much stronger case for tightening in the US given the tight labor market that is pushing up wages.

Should the ECB focus more on the headline or core inflation numbers when deciding if rate hikes are necessary later this year? The answer may lie more in the breadth across countries, rather than depth across sectors, of euro area inflation pressures.

In the relatively short history of the ECB, dating back to the inception of the euro in 1998, there have been only three monetary tightening episodes that involved interest rate increases: 1999-2000, 2006-2008 and 2011. We show the percentage share of individual euro area countries that have accelerating growth momentum (measured as a leading economic indicator above the level of a year earlier), and with headline/core inflation above the ECB's 2% target. In all three of those past ECB tightening episodes, essentially all euro area countries had to see strong growth or inflation at or above the ECB target before the ECB would hike rates.

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