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DID GLOBALIZATION KILL CONTAGION?

Abstract

Does financial globalization lead to contagion? We scrutinize linkages between international stock markets in a long historical perspective (1880-2014). Our results highlight that without globalization, contagion cannot exist. However, if cross-market correlations are very high, globalization kills contagion. We show that financial contagion was absent from stock markets in both the period of deglobalization of 1918-1971 and the era of "extreme" globalization of 1972-2014 but was present in the period of "moderate" globalization of 1880-1914. Our results suggest that contagion could become a significant problem if financial markets return to a more moderate level of globalization.

JEL Classification: N20, F65, F36, G15, E44

Keywords: contagion, Globalization, Financial history, Stock market, market interdependence, economic integration

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Did Globalization Kill Contagion?

1. Introduction

Researchers in finance are concerned with the interdependence of financial markets and the diversification loss it entails. Two key concepts are used to address this interdependence: contagion and globalization. Contagion denotes a "*significant increase in cross-market linkages after a shock*" (Forbes and Rigobon, 2002). It is thus intimately linked to financial crises. By contrast, globalization is crisis–insensitive. It refers to a general increase in correlations within asset classes and across geographical areas (Berben and Jansen, 2005). Both contagion and globalization are associated with increased market interdependence, and are therefore difficult to separate econometrically (Bekaert *et al*., 2005). Moreover, the literature suggests that the evidence of contagion in stock markets turns out to be weak when globalization is accounted for (Brière *et al.*, 2012). Yet, these results are based on evidence from the modern post-1980 period only.

This paper revisits the issue of contagion during globalized periods in a long historical perspective (1880-2014). Intuitively, in a globalized world, that is, in a world with high cross-market correlations, the scope for an increase in correlations following a crisis should be more limited than in a world with limited or no globalization. Take for instance two markets exhibiting returns with a correlation of, say, 90%. The increase in correlation following a crisis is automatically capped at 10%. As a result, contagion will be difficult to identify at conventional levels of confidence. This argument is the starting point of our investigation, which compares historical periods known for their different level of worldwide economic integration.

To what extent does financial globalization affect contagion? In order to answer this question, we scrutinize the cross-market linkages that prevailed on the stock market during four historical periods with uneven degrees of globalization: the 1880-1914 gold standard period; the 1918-1940 interwar years; the 1946-1971 Bretton Woods period and the 1972-2014 post-Bretton Woods era. Both the 1880-1914 and 1972-2014 periods have been described in the literature as eras of financial globalization. By contrast, the interwar period witnessed a disintegration of global capital markets as governments reacted to the financial instability of the interwar years by adopting capital controls (Mauro *et al*., 2002; Bordo and Flandreau, 2003; Obstfeld and Taylor, 2003b; Goetzmann *et al*. 2005). As Obstfeld and Taylor (2003a, p. 125) put it, "the world economy went from globalized to almost autarkic in the pace of a few decades." The Bretton Woods period was characterized by important capital controls and financial repression (Sbrancia, 2011). The demise of the Bretton Woods system opened the way for a new period of high globalization. Whether markets were more integrated during the gold standard period or after the Bretton Woods period has been subject to debate (Bekaert and Mehl, 2019). Depending on the indicators used, scholars have contemplated all the possibilities, with financial markets being either more integrated in the gold standard period than the post-Bretton Woods period (Bordo and Murshid, 2001; Bordo and Flandreau, 2003), equally integrated (Obstfeld and Taylor, 2003a; Goetzmann *et al*., 2005), or less integrated (Bordo *et al.*, 1999). Bekaert and Mehl (2019) however show that stock market integration reached a higher level in the post-Bretton Woods era than in the pre-WW1 gold standard period. Overall, between 1880 and 2014, globalization followed a "swoosh" pattern on the stock market (Bekaert and Mehl, 2019).

To overcome the problem of disentangling globalization from contagion, we use a sequential process. First, and in line with the most recent literature, we use an international

Capital Asset Pricing Model (CAPM) to assess globalization in the equity market of 17 countries and so identify excess returns over the four identified sub-periods with respect to the international market portfolio. Next, we analyze correlations between monthly equity excess returns. We rely on the approach proposed by Brière *et al.* (2012), which is designed to capture the interdependence of financial markets over long periods including crises. This approach compares correlation matrices by using the tests proposed by Goetzmann *et al*. (2005). In sum, we allow for the possibility of globalization associated with the systematic source of return variation, and then, we consider overlying contagion.

Our main finding is that the intensity of stock market contagion varies with the degree of financial market globalization, but in a nonlinear way. More precisely, we find that the phenomenon of financial contagion – as defined by Forbes and Rigobon (2002) - was absent from global stock markets in both the period of deglobalization of 1918-1971 and the era of extreme financial globalization of 1972-2014 but was present in the period of "moderate" globalization of 1880-1914. Our results highlight that without globalization, contagion cannot exist. However, if cross-market correlations are too high, globalization can kill contagion. These findings suggest that contagion might become a significant problem for investors if financial markets return to a more moderate level of globalization in the near future as feared by many analysts.[1]

2. Long-term Globalization and Contagion

Identifying contagion has strong implications for investors. During a crisis, investors are especially looking for the benefits of diversification strategies. However, in the presence of contagion across countries, geographical diversification becomes less powerful during crises,

[1] See articles published in the press, such as "Investing in the Age of Deglobalization," in the *Financial Times*, 21 July 2019, and "The Financial Markets in an Age of Deglobalization", in *The Economist*, 15 December 2016.

which in turn makes investors with already low returns even worse off. Our analysis of cross-market correlations in stock returns relies on identifying periods with varying degrees of financial globalization within our long sample. Financial historians often divide the period running from 1880 to the present into four sub-periods according to the degree of international capital market integration: the classical gold standard era of 1880-1914, the interwar period of 1918-1940, the Bretton Woods period of 1946-1971 and the post-Bretton Woods period, characterized by floating exchange rates, of 1972-2014 (see Figure 1).

Researchers have attempted to quantify international capital market integration during these various periods and have described financial globalization as a non-linear process. More precisely, it has been shown that financial globalization was significantly more pronounced in the 1880-1914 and post-1971 eras than in the interwar and Bretton Woods periods. Figure 1 below summarizes the evolution of global stock market integration between 1880 and 2014.

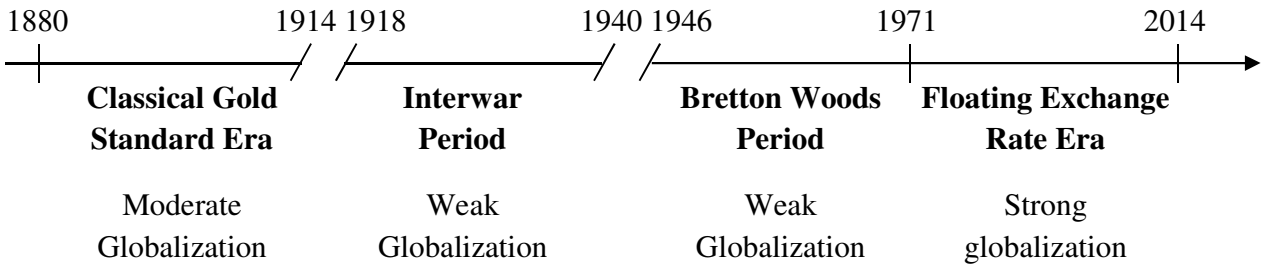


Figure 1: Global Stock Market Integration over the period 1880-2014

The so-called "first era" of globalization of 1880-1914 coincides with the heyday of the classical gold standard system (1880-1914) and was characterized by low barriers to international

financial movements and sizeable capital flows (O'Rourke and Williamson, 1999). Several authors have described the level of international financial integration in this period as similar to that observed in the most recent era of globalization (Goetzmann *et al.,* 2005). Bordo *et al.* (1998) and Obstfeld and Taylor (2003a) therefore argue that globalization followed a "U-shaped" pattern over the last two centuries. For example, net financial flows from the core countries to the periphery were, once expressed relative to GDP, higher in the period just before 1914 than at the end of the twentieth century. Bordo *et al.* (1999) however note that the sectors concerned by these flows were much narrower, with the bulk concentrated on railroad, government debts and mining. They conclude that financial integration was more pronounced in the modern period. Bekaert and Mehl (2019) concur. These authors focus more specifically on the stock market. Using a factor model of equity returns, they show that, although global integration was high in the 1880-1914 period, it was nevertheless more moderate than in the post-1990 period.

The outbreak of the First World War in 1914 resulted in the collapse of the gold standard and in severe disruptions on international financial markets. The post-war years were marked by extreme volatility on the foreign exchange market and hyperinflation episodes in Central Europe. While international capital flows revived substantially in the second half of the 1920s, coincidental with the stabilization of European currencies, the period following the stock market crash of 1929 and the beginning of the Great Depression witnessed a sudden stop (Feinstein and Watson, 1995; Accominotti and Eichengreen, 2016). Several countries resorted to capital controls in order to insulate themselves from the global financial cycle. In addition, traditional proponents of free trade, such as Britain, moved away from these policies in the 1930s (de Bromhead *et al.*, 2019).

At the end of the Second World War, most belligerent countries ended up with vast amounts of public debts and reducing the debt level required engaging in financial repression (Sbrancia, 2011; Reinhart and Sbrancia, 2015).[2] In addition, the heavy regulations of cross-border capital movements adopted in the 1930s were maintained and strengthened in the context of the Bretton Woods international monetary system, resulting in global financial disintegration. Although these controls were progressively lifted and current account convertibility was restored in 1959, it is only with the breakdown of the Bretton Woods system in 1971 that a new era of globalization opened up on financial markets (Rangvid *et al*., 2016).

Several authors have analyzed cross-market linkages over the long run. Mauro *et al*. (2002) compare the integration of sovereign-bond markets in modern times (1992-2000) with that of 1870-1913 by analyzing the spreads of emerging market bonds. They find that co-movement in spreads has been more pronounced in the modern period than in the past one and that investors are nowadays less concerned with country-specific events than their 19th century predecessors. Goetzmann *et al*. (2005) track changes in correlations across markets for a period covering 150 years in order to assess the benefits of international diversification. Their results show that correlations are unstable over time and that globalization affects diversification opportunities in two contrasting ways. On the one hand, more globalization involves a larger number of emerging markets accessible to investors. On the other hand, this comes at the cost of a higher correlation across markets.

The link between long-term correlations and financial crises has also received substantial attention. A recent paper by Devereux and Yu (2019) develops a general-equilibrium approach to

[2] According to Reinhart and Sbrancia (2015, p. 291), "financial repression includes directed lending to government by captive domestic audiences (such as pension funds), explicit or implicit caps on interest rates, regulation of cross-border capital movements, and (generally) a tighter connection between government and banks".

assess how the level of financial market integration affects the probability and severity of financial crises as well as the probability that they propagate internationally. The authors test their predictions on the 1970-2014 period and find that banking crises are more "contagious" when financial markets are more integrated.[3] Devereux and Yu (2019) show that financial market liberalization increases the risk of contagion - defined as the cross-country correlation of crises - because it leads investors to be more levered and take more risks. Longin and Solnick (1995) analyze international equity returns over a period of 40 years and report an increase in correlations following crises. They rely on extreme value theory to show that correlations tend to increase in bear markets but not during bullish episodes (Longin and Solnick, 1995). To what extent does this increase in correlations indicate the presence of contagion? During crises, an increase in correlations between markets does not always imply contagion. The increase in correlation might just be mechanical, reflecting existing cross-market linkages with no particular implications for international diversification. By contrast, Forbes and Rigobon (2002) define contagion as an increase in correlations following a shock that cannot be explained by market interdependence. Defined in this way, the presence of contagion on international financial markets reduces the benefits of portfolio diversification.

Following the seminal contribution of Forbes and Rigobon (2002), the literature defines contagion as any increase in cross-market linkages that exceeds what fundamentals explain (Karolyi, 2004; Dungey *et al*., 2005; Bekaert *et al*., 2014). Accordingly, the empirical analyses addressing the challenge of disentangling globalization and contagion identify those "fundamentals" before testing for contagion. Fundamentals consist of geographical and industrial

[3] Devereux and Yu (2019) rely on the loist of banking crises identified by Laeven and Valencia (2013).

factors, which are usually based on returns on market indices. Therefore, testing for contagion first requires estimating a factor model for returns (Fama and French, 1993).

The number and type of factors needed to account for globalization depend on the market and period under investigation. Bekaert and Harvey (1997) rely on a model with a single, global factor to scrutinize equity market volatility of 20 emerging countries between 1976 and 1992. Corsetti *et al*. (2005) apply the same one-factor model to identify contagion during the Hong Kong stock market crash of 1997. The authors uncover significant contagion from Hong Kong to the stock markets of five countries, including France, Italy, the Philippines, Singapore, and the U.K.. Ng (2000) uses a two-factor model in which market integration results from exposure to a global and a regional factor. A similar two-factor model is used by Baele and Inghelbrecht (2010) and by Bekaert and Mehl (2019). Baele and Inghelbrecht (2010) show that the identification of contagion depends on factor specification. More precisely, they find no contagion when using a general specification with time-varying market exposure and an array of control variables accounting for economic and financial integration, while a more restrictive specification with constant market exposure leads them to find significant contagion. Bekaert and Mehl (2019) use a similar model to assess the level of financial market integration from 1885 to 2014. Bekaert *et al*. (2014) rely on an international three-factor model accounting for the U.S. economy, the global financial sector, and country-and-sector-specific equity portfolios during the 2007-2009 financial crisis. Overall, the number of factors used in related studies ranges from one to three depending on the type of data to be analyzed and on the availability of relevant time series. When it comes to choosing a factor model, the current state of the art offers no clear-cut rule guiding the identification of fundamentals.

Once globalization is accounted for, we can test for contagion by comparing cross-market excess-return correlations in quiet and crisis periods to identify significant changes not explained by fundamentals (King and Wadhwani, 1990; Bordo and Murshid, 2001; Forbes and Rigobon, 2002). To do so, several methods coexist. A first approach is to study cross-market correlations. Forbes and Rigobon (2002) compare correlations between markets during calm and crisis periods adjusting for the heterogeneity of volatility across markets. A second approach consists in formally testing causality. Gebka and Serwa (2006) use a threshold VAR framework to estimate shock transmission parameters for calm and volatile periods focusing on the 1997 Asian crisis. Sander and Kleimeier (2003) study the same period and use a Granger-causality method with an Error Correction Model (ECM) to investigate changes in causality patterns following a shock. Finally, a third approach relies on multivariate GARCH models. Bollerslev (1990) develops the Constant Conditional Correlation (CCC-GARCH) model assuming constant correlation across time to evaluate the impact of the creation of the European Monetary System (EMS) on five nominal European U.S. dollar exchange rates. Engle (2002) uses a Dynamic Conditional Correlation (DCC-GARCH) model to study the correlation between stock market indices, stocks and bonds markets, and exchange rates. This model allows relaxing the assumption of constant correlation as it includes time-varying conditional correlations to capture the changes in investors' behavior in response to shocks.

In this paper we follow the method proposed by Goetzmann *et al*. (2005), which has the merit of being agnostic about the underlying structure of dynamic correlations. Goetzmann *et al*. (2005) build on the Jennrich (1970) test to determine whether the correlation matrices in quiet and crisis periods are significantly different from each other. Over the period 1872-2002, Goetzmann *et al.* (2005) identify two significant peaks in correlations: following the 1929 stock

market crash, and in the most recent period. Brière *et al*. (2012) apply the same methodology to four asset classes to test for the presence of globalization and contagion between the U.S., the Eurozone, Japan and the U.K., from 1978 to 2010. They find a high level of globalization but no evidence of contagion. This paper revisits the evidence by breaking down the sample 1880-2014 into the four periods featured in Figure 1, which are known for their different levels of globalization. This breakdown allows assessing whether the data confirm our hypothesis that a certain level of globalization is a necessary condition for contagion, but that too much of it kills contagion.

The next section introduces the dataset and details our methodology, which combines CAPM-based estimations for the fundamentals in the spirit of the Bekaert *et al*. (2014), with the test approach proposed by Goetzmann *et al*. (2005) for assessing the presence of contagion in international stock markets.

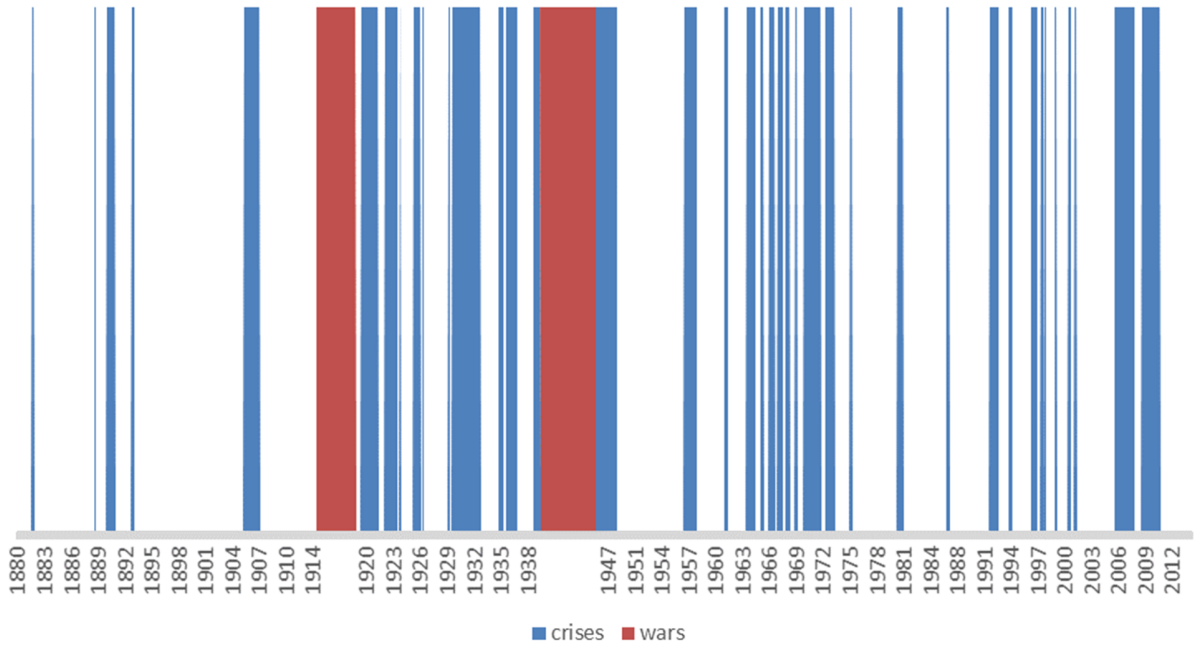
3. Data and Methods

3.1. Data

We retrieved from the Global Financial Data (GFD) the monthly returns of 17 stock market indices from Australia, Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, South Africa, Spain, Sweden, Switzerland, the U.K., and the U.S., over the period stretching from 1880 to 2014. GFD provides ex-dividend returns computed in domestic currency. Next, for each country in our sample we combined two sources of data to build series of annual nominal GDP. We used the database provided by Klasing and Milionis (2014) for the

period 1880-1950, and the Penn World Table of UCDavis[4] for the period 1950-2014. For the latter, the nominal GDP in USD was obtained from the series of real GDP denominated in USD and of GDP deflators to compute the nominal GDP in USD.

Figure 2: Crisis Periods (1880-2014)



To test for the stability of the correlation matrices during our four periods of interest (see Section 2) we need to delineate the crisis periods. To identify the start and end dates of these episodes, we rely on the secondary literature (see details in Appendix A). Overall, we identify 8 major banking crises (excluding twin crises), 15 crises triggered by an equity or bond crash, 24 currency crises (including twin crises), three major corporate bankruptcies, and four sovereign debt crises. Table A1 in Appendix A gives the start and end dates of all crises. Figure 2 plots the crisis periods from 1880 to 2014. The prevalence and type of crises evolved over time. While currency crises are the most frequent in all sub-periods, major corporate bankruptcies and

[4] http://cid.econ.ucdavis.edu/pwt.html. The updated version 9.0 of the series was provided by the University of Groningen up to 2014.

sovereign defaults gained likelihood in the post-1972 era, consistently with the findings of Mauro *et al*. (2002). By contrast, banking crises appeared in the 1880-1914 and 1918-1940 periods more frequently than in the modern era. During the 1946-1971 Bretton Woods period, the emergence of public institutions among sovereign debt owners led to a lower frequency of default (Oosterlinck, 2013). The Bretton Woods period was also characterized by fewer banking crises and more numerous currency crises.

3.2. Methods

In line with the recent empirical literature on contagion, our methodological approach proceeds in two steps. First, we determine excess returns with respect to economic fundamentals. We use a one-factor model based on an international market portfolio (Corsetti *et al*., 2005). The one-factor model mimics the CAPM, which has the merit of being grounded in financial theory. Additional factors run the risk of arbitrariness. During our 134-year study period, the stock market saw inevitably several major structural changes, which would affect the relevance of any fixed set of factors going beyond CAPM's single factor. In addition, working with periods of pre-identified levels of globalization reduces the need for controlling for economic and financial integration. Once the returns have been filtered with the CAPM regression model, we use the resulting excess returns to test for contagion by comparing correlations matrices obtained for quiet versus crisis periods.

The CAPM proposed by Sharpe (1964) and Lintner (1965) is a one-factor model in which the fundamental part of each asset return is defined with respect to its contribution to market risk. We use country indices as individual assets. The global market factor corresponds to the mean

return of all country indices (weighted by GDP). Alternatively, in a robustness check addressing the concern of endogeneity, we use a country-specific global factor excluding the country whose stock index return is being explained. We estimate the following CAPM-type model:

$$R_t^k = \alpha_{k,i} + \beta_{k,i} R_t^M + \varepsilon_t^k \qquad t = T_{i-1}, \dots, T_i;\ i = 1, \dots, 4\ (T_0 = 1) \qquad (1)$$

where R_t^k is the monthly return of the stock index in country k $(k = 1, \dots 17)$ at time t, R_t^M is the global factor at time t. We estimate Equation (1) separately for each country and on each of the four sub-periods of interest $(i = 1, \dots, 4)$.

The residuals $\left(\varepsilon_t^k\right)$ in equation (1) can be interpreted as the idiosyncratic components of country-k's stock market return. We retrieve these residuals for each sub-period i and use them to test for contagion. More precisely, we compare the residuals' correlations matrices during crisis and quiet times. We compare correlation matrices using the test proposed by Goetzmann *et al.* (2005) (GLR), which generalizes the Jennrich (1970) test based on the chi-square distance between two correlation matrices. The GLR approach is superior since it relaxes the normality requirement.

Let vector μ_k and matrix Σ_k denote the first and second centralized moments of $\left(\varepsilon_t^k\right)_{k=1,\dots,17}$, respectively. The i-th sample period is split into two sub-periods: crises (n_1 observations) and quiet periods (n_2 observations). The true and sample correlation matrices for sub-period j $(j = 1,2)$ are denoted by P_j and $\hat{P}_j$, respectively. Under the assumption that the observation vectors are independently and identically distributed, there exist matrices Ω_1 and Ω_2 such that:

$$\sqrt{n_j}\ vec\left(\hat{P}_j - P_j\right) \xrightarrow{d} \mathcal{N}\left(0, \Omega_j\right), \quad j = 1,2 \qquad (2)$$

The GLR test checks whether the correlation matrices are significantly different during crisis and quiet periods. Under the null of equal correlation matrices during crisis and quiet periods, we have:[5]

$$vec\left(\hat{P}_1 - \hat{P}_2\right) \xrightarrow{d} \mathcal{N}\left[0, \left(\frac{1}{n_1} + \frac{1}{n_2}\right)\Omega\right] \tag{3}$$

The chi-square test statistic used in the GLR test is given by:

$$\left[vec\left(\hat{P}_1 - \hat{P}_2\right)\right]^T \left[0, \left(\frac{1}{n_1} + \frac{1}{n_2}\right)\Omega\right]^{-1} \left[vec\left(\hat{P}_1 - \hat{P}_2\right)\right] \xrightarrow{d} \chi^2[rk(\Omega)] \tag{4}$$

The GLR approach is currently the most effective way of testing equality of correlation matrices with p-variate distributions ($p > 2$). Heteroskedasticity does not harm the test since correlations are scale-free. Correlation matrices can, therefore, be computed from normalized series.

4. Empirical Results

4.1. Descriptive Statistics

Table 1 provides descriptive statistics for the (global) market index during each sub-period. The annual mean return generally increased between 1880 and 1971. Volatility exhibits a different pattern with a peak during the interwar period and the floating exchange rate era. This is hardly surprising. The high volatility observed during the interwar period reflects increased uncertainty following the 1929 stock market crash. As for the modern period, changes in regulation may have had an impact on volatility.

[5] See GLR for the explicit expression of matrix Ω

Table 1 : Descriptive Statistics, Market Index (1880-2014)
This table shows the descriptive statistics of the market index for each sub-period. The composition of the market index varies across periods.

	Classical Gold Standard Era 1880-1914	Interwar Period 1918-1940	Bretton Woods Period 1946-1971	Floating Exchange Rate Era 1972-2014
Mean	0.13%	0.52%	0.69%	0.62%
Ann. Mean	1.57%	6.29%	8.27%	7.47%
Median	0.15%	0.54%	0.83%	0.97%
Stdv	1.96%	4.09%	2.67%	3.93%
Volatility	6.77%	14.18%	9.26%	13.62%
Skewness	-0.24	0.36	-0.35	-0.92
Kurtosis	3.33	7.18	3.41	5.81
Max	0.05	0.20	0.09	0.13
Min	-0.07	-0.13	-0.08	-0.20
N	413	256	305	516

Appendix B provides the descriptive statistics for each country index per sub-period. Observations are in line with expectations. Australia (5.20% and 6.06%), the U.S. (1.97% and 6.09%) and Germany (1.37% and 7.91%) display the highest annual mean returns between 1880 and 1940 in addition to France with 6.34% for the interwar period. Four countries in our sample, i.e. Denmark (-3.75%), the Netherlands (-3.03%), Norway (-1.55%), and Sweden (-0.89%) exhibit negative returns for the interwar period. This might reflect the difficulties linked to the post-WWI era,[6] the consequences of the Great Depression or, in the case of Sweden, the bankruptcy of Kreuger and Toll crash in 1932. During the Bretton Woods period, the highest mean returns are observed for five European countries, i.e. Germany (14.55%), Italy (11.44%), Austria (9.11%), France (9.04%), and Spain (8.78%) in addition to Japan (22.19%). The floating exchange rate era is unique with a market index annual mean return of 7.47%, slightly lower than

[6] The Netherlands suffered from the bad situation in Germany, one of its main trading partners.

during the Bretton Woods period (8.27%) while all countries in our sample display a positive and large annual mean return above 6% after 1971.

Volatility reached a maximum of 14.18% between 1918 and 1940 with a volatility higher than 20% in Germany (45.69%), the U.S. (28.46%), Belgium (25.65%), and France (20.35%). The second highest volatility score (13.62%) characterizes the floating exchange rate era. However, this period is more homogenous with volatility ranging from 15.27% (the U.S.) to 23.60% (Italy). Volatility was lower during the Bretton Woods period (9.26%) with a range similar to that observed during the interwar years (from 6.80% for Denmark to 36.07% for Germany). Finally, the classical gold standard era of 1880-1914 was the period of lowest volatility both at the market level (6.77%) and at the country level with a maximum value of 11.14% for the U.S..

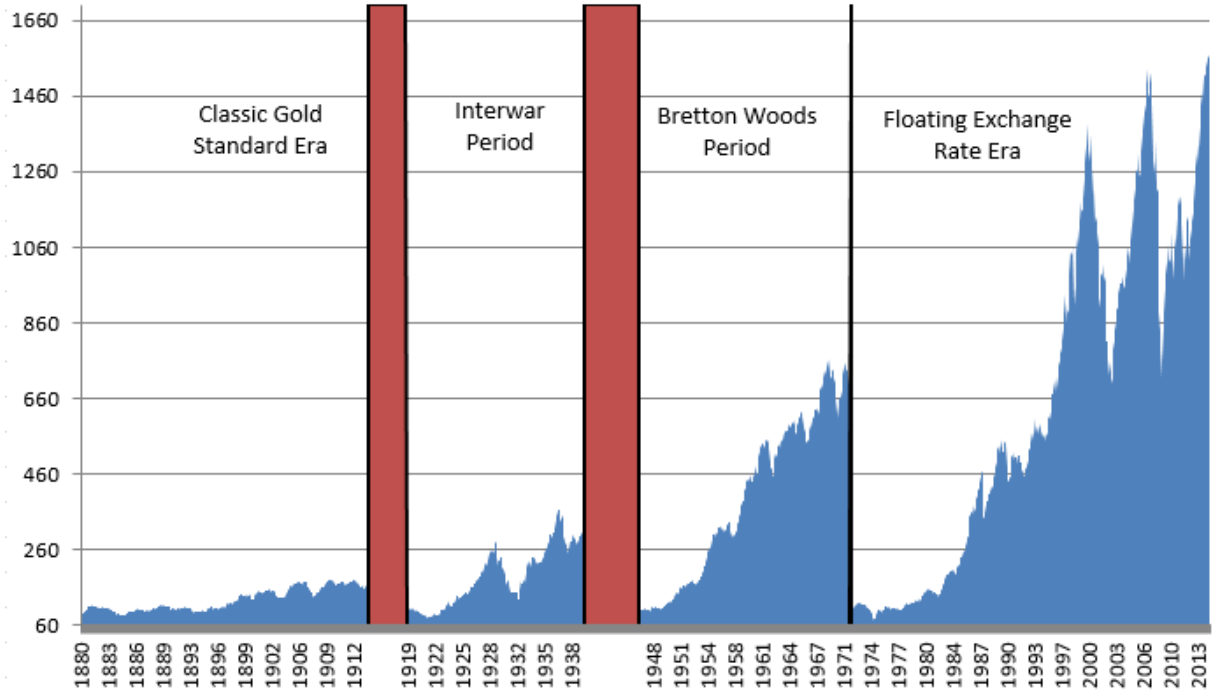
These descriptive statistics seem to indicate that countries were more homogenous during both the classical gold standard era and the floating exchange rate era highlighting the higher level of financial globalization. However, discrepancies across countries were larger during the interwar and Bretton Woods periods.

These conclusions are in line with Figure 3 which shows the evolution of the market index returns over the full period under study (rebased at 100 at the beginning of each sub-period). We observe a small increase in market returns with low volatility during the classical gold standard era. Between 1918 and 1940, the increase in returns is stronger and the volatility is higher with two sudden drops in returns due to equity crashes from 1929 to 1932 and from 1937 to 1938. The increase in returns is larger during the Bretton Woods period with a lower volatility than before 1946. Finally, we observe the largest increase in returns between 1972 and 2014, with a slow start

until the 1980s. This increase in returns is accompanied with very high volatility mainly related to two crashes, i.e. the bursts of the Dotcom and Subprime bubbles. The large decrease in returns during the two crises may explain why the annual mean return of the market index is lower during this period than during the Bretton Woods period.

Figure 3: Market Index (1880-2014)

This figure shows the evolution of the market index over each studied period. Since the composition of the index varies across periods, its initial value is set to 100 at each period starting point.



The correlation matrices, displayed in Appendix C, provide additional insights into the linkages between the different markets. The average correlation for each period is computed by taking into account only the countries for which information was available for the period under the study. As a result, we average on a different number of countries for each period. The modern period is the most globalized one with an average correlation across markets of 32.76%. This

result is consistent with the observations made by GLR who conclude that the current period is near a historical high, with levels of correlation close to the ones experienced during the Great Depression. In terms of correlations, this most recent period is followed by the gold standard period for which the correlation is equal to 18.68%. The interwar and the Bretton Woods periods follow with correlations of, respectively, 15.30% and 14.80%.

4.2. Country Betas

Table 2 presents the betas of each country's stock market with respect to the market index, for each of the sub-periods. The distribution of betas exhibits sharp changes over time. The standard deviation of betas is the highest for the gold standard period, with Australia exhibiting a very low beta of 0.005 (although the country has negligible weight in the global index). This higher dispersion might be due to the fact that sample is substantially smaller during the 1880-1914 period than the other periods. Another striking element is the distance of betas from unity. In the first three periods, only a few countries exhibit a beta over 1. By contrast, countries whose beta is higher than 1 represent the majority in the 1972-2014 period, while the other countries' betas are slightly below 1. The floating exchange rate period is thus characterized by betas clustered around 1. Meanwhile, the world beta seems to be driven by a few countries: Germany, Canada and the U.S. for the Bretton Woods period, and the U.S. only for the previous periods.

Table 2: Period-Wise-Estimated Country Betas

The table shows the betas of each country's stock market with respect to the market index obtained as a GDP-weighted average of country indices. The composition of the market index varies across periods and the betas are estimated period by period (see Eq. (1)).

	Classical Gold Standard Era 1880-1914	Interwar Period 1918-1940	Bretton Woods Period 1946-1971	Floating Exchange Rate Era 1972-2014
Type of period	Moderate globalization	Weak globalization	Weak globalization	Strong globalization
Panel A: Europe				
Austria	-	-	0.123	0.734
Belgium	-	0.416	0.349	0.801
Denmark	-	0.201	0.144	-
France	-	0.560	0.666	1.114
Germany	0.542	0.979	1.219	1.036
Italy	-	0.490	0.815	1.103
Netherlands	-	0.531	0.873	1.056
Norway	-	0.208	0.243	1.040
Spain	-	-	0.179	1.004
Sweden	-	0.549	0.487	1.007
Switzerland	-	0.464	0.848	0.875
U.K.	0.413	0.258	0.663	1.049
Panel B: America				
Canada	-	0.907	1.001	0.891
U.S.	1.565	1.739	1.243	1.003
Panel C: Others				
Australia	0.005	0.118	0.380	0.845
Japan	-	0.159	0.556	0.952
South Africa	-	0.179	0.279	0.796
Beta: std dev	**0.663**	**0.426**	**0.364**	**0.118**

4.3.Differences Between Crisis and Non-Crisis Correlations

To give a sense of the extent of contagion affecting each country in each period, Tables 3 to 6 provide the differences in correlations between quiet and crisis periods for respectively the classical gold standard, the interwar, the Bretton Woods and the floating exchange rate periods. Intuitively, the higher the correlation, the more likely the asset prices in the corresponding

country were subject to contagion during the period under consideration. The tables can thus be viewed as the descriptive statistics driving the GLR tests developed in the next section.

Table 3: Differences Between Crisis and Non-Crisis Correlations: Classical Gold Standard Era 1880-1914

The table shows the differences between the correlation matrix of the $(\varepsilon_t^k)'s$ in Eq. (1) computed over the observations from the crisis periods of the classical gold standard era and its counterpart obtained for the non-crisis (or quiet) periods.

	Germany	U.K.	U.S.
Germany			
U.K.	-0.11		
U.S.	-0.09	0.26	
Australia	-0.38	0.03	0.34

During the classical gold standard period (see Table 3), large differences are observed between the quiet and crisis periods. Except for Germany, correlations are higher during crises, which indicates the presence of contagion. The specific result for Germany might be related to the country's more limited integration with the other markets, which had closer links with the London financial center. Both London and New York had their own listing requirements and the two places shared a common-law background. By contrast, Berlin was ruled by a civil-law system and brokers needed government approval to list foreign securities (Davis *et al*., 2003). These facts suggest that the level of financial integration between London and Berlin was lower than between London and New York.

Results for the interwar period (see Table 4) are heterogenous, probably because the number of countries in the sample increases from 4 to 15. In general, crisis periods are characterized by higher correlations than quiet periods, even though the reverse can be observed for correlations involving the stock markets of Germany, Norway, and Australia. The countries hosting the four main leading financial centers (Berlin, London, New York, and Paris) exhibit different features.

For all the countries, the correlation with the U.S. market increases in times of crises. This may reflect the rise of New York as an international financial center[7] combined with the fact that about half of the crisis periods during the interwar are associated with shocks originating in the United States. The U.K. market shows similar features, with crisis-related increases in correlation in most instances. Despite the turmoil created by World War I and by the discussions surrounding the return to the gold standard, the London stock exchange remained a dominant market. After 1931, and the sterling crisis, the U.K. stopped foreign lending, an embargo which was relaxed for members of the Commonwealth in 1933 (Stewart, 1938). The fall of sterling prompted the U.K. to adopt a more inward looking approach regarding its financial markets. The fact that the period under consideration (1918-1940) straddles periods preceeding and following the fall of the sterling can explain why we observe unclear evidence regarding the contagion potentially driven by the London stock index.

[7] The dollar replaced the sterling as the dominant reserve currency in the 1920s (Eichengreen and Flandreau, 2009)

Table 4: Difference Between Crisis and Non-Crisis Correlations: Interwar Period 1918-1940

The table shows the difference between the correlation matrix of the $(\varepsilon_t^k)'s$ in Eq. (1) computed over the observations from the crisis periods of the interwar period and its counterpart obtained for the non-crisis (or quiet) periods.

	Belgium	Denmark	France	Germany	Italy	Netherlands	Norway	Sweden	Switzerland	U.K.	Canada	U.S.	Australia	Japan
Belgium														
Denmark	0.07													
France	0.26	0.02												
Germany	-0.05	-0.09	-0.05											
Italy	0.04	0.14	-0.06	-0.07										
Netherlands	0.17	0.20	-0.15	-0.10	0.11									
Norway	0.22	-0.03	-0.12	-0.15	0.02	0.12								
Sweden	0.05	0.18	-0.01	0.04	0.12	-0.08	0.13							
Switzerland	0.21	0.28	-0.01	-0.19	0.04	0.25	-0.05	0.02						
U.K.	0.26	0.21	-0.08	-0.12	0.17	0.12	0.08	0.14	0.37					
Canada	0.12	0.12	-0.18	0.00	0.02	-0.12	-0.07	-0.08	0.03	-0.07				
U.S.	0.07	0.33	0.30	0.22	0.32	0.50	0.32	0.35	0.47	0.54	0.34			
Australia	-0.01	0.09	-0.11	0.07	0.05	-0.03	-0.12	-0.08	-0.08	-0.14	-0.35	-0.03		
Japan	0.01	0.11	0.02	-0.15	0.05	-0.25	0.06	0.03	0.06	0.10	-0.10	0.23	-0.26	
South Africa	0.18	-0.04	-0.05	-0.01	-0.08	-0.01	-0.04	-0.10	-0.13	-0.04	-0.01	0.18	0.02	-0.13

Table 5: Differences Between Crisis and Non-Crisis Correlations: Bretton Woods Period 1946-1971

The table shows the differences between the correlation matrix of the $(\varepsilon_t^k)'s$ in Eq. (1) computed over the observations from the crisis periods of the Bretton Woods period and its counterpart obtained for the non-crisis (or quiet) periods.

	Austria	Belgium	Denmark	France	Germany	Italy	Netherlands	Norway	Spain	Sweden	Switzerland	U.K.	Canada	U.S.	Australia	Japan
Austria																
Belgium	-0.20															
Denmark	-0.05	-0.03														
France	-0.12	-0.06	-0.23													
Germany	-0.37	-0.18	0.11	0.00												
Italy	0.01	-0.27	-0.16	-0.19	-0.02											
Netherlands	0.02	-0.04	-0.18	0.19	-0.13	-0.04										
Norway	-0.20	-0.03	-0.36	-0.14	-0.31	-0.09	-0.01									
Spain	0.02	-0.02	-0.11	-0.02	0.08	0.28	-0.02	0.03								
Sweden	-0.01	-0.13	-0.17	-0.06	-0.09	0.01	-0.04	-0.15	0.01							
Switzerland	-0.06	0.03	-0.11	0.38	-0.30	-0.09	-0.09	-0.14	0.27	0.04						
U.K.	-0.06	-0.13	-0.09	-0.16	-0.01	0.05	0.05	-0.14	0.08	-0.06	0.07					
Canada	0.12	-0.15	-0.32	0.05	-0.38	0.05	0.00	0.15	-0.40	-0.08	0.14	0.00				
U.S.	0.41	0.18	0.16	0.14	-0.24	0.11	0.06	0.40	0.03	0.13	0.15	0.12	0.39			
Australia	0.04	-0.09	-0.14	-0.01	-0.11	-0.03	0.08	-0.10	-0.04	-0.11	0.08	-0.04	-0.01	0.11		
Japan	-0.24	0.24	0.00	0.07	0.36	-0.33	0.27	0.04	-0.22	0.04	-0.04	0.06	-0.01	-0.07	0.07	
South Africa	0.03	-0.09	-0.07	0.02	-0.13	-0.05	0.18	-0.05	-0.22	-0.15	0.27	-0.24	0.00	0.06	0.07	0.26

During the interwar period, correlations generally increased in crisis times between France's and other countries' stock markets. Unsurprisingly, Germany was characterized by a decline in correlations with other countries during crises. The German immediate afterwar period was marked by hyperinflation. Later, the Dawes loan of October 1924 contributed to stabilize the currency and Germany borrowed extensively from abroad. The 1929 stock market crash, and most importantly the 1931 banking crisis, forced the German Government to suspend the Reichsmark convertibility (Schnabel, 2004). This first move was followed by a German sovereign default in 1933. Germany negotiated separate settlements with holders of its sovereign bonds leading to a de facto segmentation of the international market for German bonds (Accominotti *et al*., 2017). This disconnection of the German economy from the rest of the world may explain why the correlations of its stock market with other markets tended to be lower during crises.

The Bretton Wood period (see Table 5) was characterized by multiple capital controls in Europe (Dooley *et al*., 2004), preventing the convergence of interest rates until 1958 (Bordo, 1993). By contrast, the U.S. markets for capital and goods remained almost free of control as during the interwar period. It is therefore unsurprising that the differences in correlations involving the U.S. market are similar to those prevailing during the previous period.

The results are however less clear-cut for the U.K. The British economic position stands out during the Bretton Woods period, mainly because the pound sterling was regularly under attack, especially at the end of both the 1940s and the 1960s. These speculative attacks may have contributed to create large swings between periods of U.K. insulation from other markets and periods of U.K. centrality in the international monetary system. Bordo *et al*. (2019) suggest that contagion between reserve currencies, such as the pound sterling, explains the failure of the Gold

Pool, the central bank cooperation mechanism intended to preserve the effectiveness of the Bretton Woods system.

France and Germany are characterized by lower correlations with other markets during crisis periods than in quiet times. The increase in Germany's balance-of-payments surplus prompted the government to act against capital inflows. Markets might have expected Germany to tighten controls over financial markets even more when other countries were facing an adverse shock. In the aftermath of the May-1968 riots in France, both France and Germany faced a foreign-exchange crisis. French monetary authorities responded to the crisis with expansionary monetary policy and capital controls. Germany was hit just after due to a significant cash inflow from France. This destabilizating inflow pushed the German government to restrict foreign-owned deposits (Bordo, 1993). Hence, the 1968 currency crisis contributed to isolate the French and German financial markets from the rest of the world.

Last, during the 1972-2014 floating exchange rate era, we observe that cross-market correlations generally increased in crisis times with the notable exceptions of Japan and the U.S. Correlations between European markets were influenced by European integration and the creation of Eurozone in January 1999, whereby 11 European countries decided to adopt a single currency. Later, the Eurozone was progressively enlarged, and since 2015 it consists of 19 countries. The picture is less clear for the other markets. Formal tests for contagion are therefore needed to make sense of the correlation tables.

Table 6: Differences Between Crisis and Non-Crisis Correlations: Floating Exchange Rate Era 1972-2014

The table shows the differences between the correlation matrix of the $(\varepsilon_t^k)'s$ in Eq. (1) computed over the observations from the crisis periods of the floating exchange rate era and its counterpart obtained for the non-crisis (or quiet) periods.

	Austria	Belgium	France	Germany	Italy	Netherlands	Norway	Spain	Sweden	Switzerland	U.K.	Canada	U.S.	Australia	Japan
Austria															
Belgium	0.24														
France	0.21	0.27													
Germany	0.09	-0.05	0.04												
Italy	0.13	0.18	0.05	0.14											
Netherlands	0.33	-0.01	0.13	0.07	-0.05										
Norway	0.09	0.15	0.24	-0.14	0.24	-0.14									
Spain	0.07	-0.03	0.14	-0.02	-0.08	0.00	0.04								
Sweden	0.21	0.12	0.04	0.10	-0.07	-0.01	0.13	-0.13							
Switzerland	0.11	0.12	0.15	0.13	0.14	0.14	-0.14	0.04	-0.04						
U.K.	0.22	0.25	0.10	0.10	0.19	-0.01	0.28	0.06	0.02	0.15					
Canada	-0.13	0.05	-0.21	0.06	0.02	-0.04	-0.08	0.17	-0.01	-0.18	-0.04				
U.S.	-0.12	-0.08	0.05	-0.06	0.04	-0.12	-0.13	0.08	-0.05	-0.11	-0.02	-0.05			
Australia	-0.04	0.04	-0.08	0.11	0.01	0.12	-0.22	-0.07	0.01	0.12	0.07	-0.14	-0.13		
Japan	-0.22	-0.15	-0.17	-0.13	-0.31	0.06	-0.04	-0.24	-0.04	-0.04	-0.10	0.15	0.18	0.22	
South Africa	-0.04	-0.13	0.20	0.07	0.10	0.14	-0.02	0.01	-0.07	-0.13	0.07	-0.33	-0.11	-0.12	0.04

4.4.Tests for Contagion

Tables 3 to 6 provide preliminary observations about the evolution of correlations in crisis versus quiet periods. We now run formal tests of contagion. The results of the GLR tests for contagion in Table 7 help assessing the effect of globalization on contagion. The table shows the results of the GLR tests for each period separately, considering all the countries together. In all periods except the 1880-1914 classical gold standard era, we reject the presence of contagion at the 10% level.

Table 7: GLR Tests for Contagion

	Period	GLR stat	Proba
Classical Gold Standard Era	1880-1914	12.01	0.06
Interwar Period	1918-1940	97.50	0.69
Bretton Woods Period	1946-1971	148.85	0.21
Floating Exchange Rate Era	1972-2014	138.38	0.12

Rangvid *et al*. (2016) and Bekaert and Mehl (2019) argue that the capital market integration was low during the interwar and the Bretton Wood periods. Market segmentation during these two periods may explain the absence of contagion. However, although the 1880-1914 and 1972-2014 periods were both marked by strong capital market integration, contagion was only present in the former period.

For contagion to occur, markets have to be somewhat integrated. When connexions between markets are minimal, contagion cannot appear as for instance during the interwar and the Bretton Woods period. Thus, short of globalization, contagion is impossible because it requires some permability between financial markets located in different countries. Once markets are

more integrated, contagion becomes plausible during crises. During the classical gold standard era, globalization was reasonably high and the GLR test in Table 7 concludes to the presence of contagion. With peaking levels of globalization, however, contagion is doomed to disappear because when correlation values during quiet times are very high, there is no more room for any increase following a shock. This situation is consistent with the correlation matrix obtained for the floating-exchange rate period (see Table C4 in Appendix C). It also rationalizes the negative results derived for contagion during that last period of our sample, suggesting that strong globalization "kills" contagion. Overall, contagion is more likely to occur when with globalization levels are in the middle range. Our findings are thus consistent with an inverted u-shaped relationship between contagion and globalization.

4.5.Robustness Check

In our baseline analysis, we estimate a one-factor model for each country and use the CAPM to regress the country's return on a global factor. By definition, this global factor is built from the returns of all the coutries in the sample. The country's index is therefore present in both sides of the equation, which might generate spurious correlations and raise endogeneity concerns (Bekaert and Mehl, 2019). To address this issue in a robustness test, we reformulate the one-factor model to include a specific global factor for each CAPM regression. The specific factor is obtained by excluding the country whose stock index return is on the left hand side, resulting in a different global factor for every CAPM regression.[8] Next, we test for contagion in the same way as in our baseline study. Table 8 shows the results of the GLR tests for contagion, suggesting that the presence of contagion is significant for the classical gold standard era while it is not significant for the three other periods. These findings support the conclusions of our baseline analysis.

[8] The CAPM estimation results are available upon request.

Table 8: GLR Tests for Contagion, Robustness Check

	Period	GLR stat	Proba
Classical Gold Standard Era	1880-1914	10.93	0.09
Interwar Period	1918-1940	93.17	0.79
Bretton Woods Period	1946-1971	148.15	0.22
Floating Exchange Rate Era	1972-2014	127.40	0.30

5. Conclusion

The aim of this paper is to investigate how the risk of international contagion varies with the level of global financial market integration. As such, we run our empirical estimation on a long period of time between 1880 and 2014 in order to consider different levels of market integration. Following Forbes and Rigobon (2002), we define contagion as any increase in correlations between stock market excess returns during crises, which is not explained by fundamentals, i.e the international globalization of financial markets.

Our results suggest that globalization can reduce contagion drastically. In crisis times, contagion might therefore be less of a concern in highly globalized financial markets, like those of nowadays. According to many observers, including the IMF and the World Economic Forum,[9] markets may currently show the first signs of deglobalization. According to a report from McKinsey (Lund *et al.*, 2013), cross-border capital flows have decreased by 60% since their peak in 2007. In addition McCauley *et al*. (2019) show that, since 2016, the European banking sector has increased its home bias by deleveraging foreign risk exposure. By definition, deglobalization entails more segmented markets, leading to an increase in idiosyncratic risks and in transaction costs. Our results suggest that the movement towards deglobalization, if confirmed, might be

[9] See https://www.weforum.org/agenda/2018/11/globalization-4-what-does-it-mean-how-it-will-benefit-everyone/ ; https://www.weforum.org/agenda/2015/01/de-globalized-world/, and https://www.imf.org/external/pubs/ft/fandd/2016/12/mallaby.htm

accompanied with enhanced contagion. Heightened contagion in a less globalized financial system would in turn make the effets of crises even more dramatic for investors.

One contribution of this paper is the exhaustive list of crises we provide for the 1880-2014 period. We have used the wide previous literature to identify the start and end dates of all historical crisis episodes, considering not only financial institutions crises but also market crashes, currency/twin crises, corporate brankruptcies, and sovereign debt turmoils. An interesting development of this paper could be to test whether contagion is crisis-specific. Devereux and Yu (2019) highlight the presence of contagion when focusing on banking crises between 1970 and 2014. Although these authors do not use the same definition of contagion, we may wonder whether the difference in results could also be due to the type of crises considered. This would in turn suggest that, in strongly globalized markets, contagion may occur more often during banking crises than during other crises, such as currency crises, sovereign debt crises, equity crashes and major corporate bankruptcies. This explanation is however to be taken with caution as different types of crises often overlap.

Moreover, considering the period under study (1880-2014), we have selected our sample of countries taking into account the importance of their financial markets all along the time frame. However, one may wonder whether this sample is still relevant for the more recent period (1972-2014) as some emerging countries have started to play a major role in the globalized markets. According to the World Bank, the stock market of China has become more open and significant for the last 30 years amounting for 11% of the total market value of the world stock market, being ranked second in 2017. As such, enlarging the sample of countries for the more recent period would provide additional insights on the dynamics surrounding the co-movements of stock markets (Wang and Guo, 2020).

If the the high level of globalization during the recent period has prevented contagion from taking place, we should expect that contagion appeared after the end of the Bretton Woods period when markets started integrating, then peaked, and later sunsetted. The evolution of the contagion literature might reflect this trend. Empirical studies of the 1990s typically found contagion in equity markets (De Santis and Gérard, 1997; Lin *et al*., 1994) whereas the influential article by Forbes and Rigobon (2002) was one of the first to question the actual occurrence of contagion and to point out the relevance of globalization, referred to as "interdependence". Should this mean that contagion is a problem of the past and that it is buried forever? Certainly not, as history shows, globalization is reversible and it should never be taken for granted.

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Appendix A: List of Crises (1880-2014)

Table A1: Start and End Dates of Crises

This table gives the start and end dates of all the crises between 1880 and 2014. Below the table, we provide a precise description of all crisis episodes. For crises dated between 1976 and 2007, we refer to the definitions provided by Brière *et al.* (2012).

Countries/Firms	Start date	End date	Type
France	30/11/1881	28/02/1882	Equity crash
France	28/02/1889	31/03/1889	Banking crises
U.S.	30/06/1890	30/06/1891	Currency crises
Argentina	30/06/1890	31/07/1890	Sovereign debt crises
U.K.	31/07/1890	31/12/1890	Banking crises
U.S.	31/05/1893	31/08/1893	Banking crises
U.S.	30/04/1906	31/01/1908	Banking crises
U.S.	31/01/1907	31/12/1907	Equity crash
U.S.	30/09/1919	31/08/1921	Equity crash
Germany	30/06/1922	30/11/1923	Currency crises
France	28/02/1924	31/03/1924	Equity crash
France	30/09/1925	31/07/1926	Currency crises
France	31/10/1926	30/11/1926	Equity crash
U.S., France, U.K.	30/09/1929	30/11/1929	Equity crash
U.S., France, U.K.	31/03/1930	31/05/1932	Equity crash
Germany, Eastern Europe, Latin America	31/03/1931	28/02/1934	Sovereign debt crises
Austria, Germany, Hungary	30/04/1931	31/10/1931	Currency crises
U.S.	30/04/1931	31/08/1931	Banking crises
U.K.	30/06/1931	31/12/1931	Currency crises
U.S.	30/09/1931	31/10/1931	Banking crises
U.S., World	29/02/1932	31/05/1932	Corporate Bankruptcies
U.S.	31/01/1933	28/02/1934	Currency crises
U.S.	28/02/1933	31/03/1933	Banking crises
France, Netherlands, Switzerland	30/04/1936	31/10/1936	Currency crises
France	28/02/1937	31/05/1938	Currency crises
U.S.	30/09/1937	31/12/1937	Equity crash
France	30/04/1945	31/10/1949	Currency crises
Germany	30/04/1945	30/11/1948	Currency crises
U.S.	30/08/1946	31/10/1946	Equity crash
U.K.	30/06/1947	31/08/1947	Currency crises
U.K.	31/03/1949	31/10/1949	Currency crises
France	31/07/1957	31/12/1958	Currency crises
U.S.	31/03/1962	31/07/1962	Equity crash
U.K.	30/09/1964	31/05/1965	Currency crises
U.K.	30/06/1965	30/09/1965	Currency crises

U.K.	31/05/1966	31/08/1966	Currency crises
U.K.	30/04/1967	31/12/1967	Currency crises
France	30/04/1968	30/11/1968	Currency crises
France	31/03/1969	31/08/1969	Currency crises
U.S.	30/04/1970	31/07/1970	Equity crash
U.S.	30/04/1971	31/03/1973	Currency crises
U.S., U.K.	31/10/1973	31/10/1974	Equity crash
U.K.	30/11/1973	31/03/1975	Banking crises
Mexico	31/08/1976	31/10/1976	Currency crises
Mexico	31/01/1982	30/09/1982	Currency crises
Chile	31/05/1982	31/08/1982	Currency crises
Equity crash	30/09/1987	31/12/1987	Equity crash
EMS	31/08/1992	31/08/1993	Currency crises
Mexico	30/11/1994	31/03/1995	Currency crises
Asia	30/06/1997	31/01/1998	Currency crises
Russia & LTCM	31/07/1998	31/10/1998	Sovereign debt crisis + corpo bankruptcies
Brazil	31/12/1998	31/01/1999	Currency crises
Equity crash	28/02/2000	30/04/2000	Equity crash
11-9	31/08/2001	30/09/2001	Equity crash
Argentina	31/10/2001	31/12/2001	Sovereign debt crises
Enron	31/10/2001	31/12/2001	Corporate Bankruptcies
WorldCom	31/05/2002	31/07/2002	Corporate Bankruptcies
Subprime crisis	31/01/2007	31/03/2009	Equity crash
Euro crisis	28/02/2010	31/03/2012	Currency crises

A.1. Currency Crises (Including Twin Crises)

- **United States, 07/1890-06/1891**

Following the Baring crisis in the U.K. and passage of the Sherman Silver Purchase Act in July 1890, which increased silver monetization, there were fears of a switch from the gold to the silver standard in the U.S. (Hallwood et al., 2012, p. 74). The U.S. Treasury endured substantial gold losses between December 1890 and June 1891. The gold losses were halted in July 1891 following an exceptional grain crop (Lauck, 1907, p. 80).

- **Germany (hyperinflation), 07/1922-11/1923**

The German mark's depreciation and hyperinflation intensify in July 1922 and are most severe from January to November 1923, during the French occupation of the Ruhr (Sargent, 1982). In

October 1923, a monetary reform introduces a new currency, the Rentenmark. The mark stops depreciating at the end of November 1923 and prices stabilize (Sargent, 1982; Eichengreen, 1992).

- **France, 10/1925-07/1926**

In October 1925, the French franc enters a period of depreciation. Uncertainty regarding the French government's fiscal policy and the fear of a capital levy contribute to currency instability (Eichengreen, 1992, p. 178-180). The crisis is halted in July 1926 when Raymond Poincaré, an opponent to a capital levy, returns to power. The French franc starts appreciating against the U.S. dollar and pound sterling and eventually stabilizes in December 1926. France restores the gold convertibility of its currency in June 1928.

- **Austria, Germany, and Hungary, 05-10/1931**

In May 1931, the failure of the Austrian bank *Creditanstalt* triggers a banking and currency crisis in Austria (Schubert, 1991). The Austrian National Bank loses large amounts of gold and foreign exchange reserves until it introduces capital controls in October. The run on the *Creditanstalt* is also followed by a run of the Hungarian National Bank's gold and foreign exchange reserves. The Hungarian government reacts imposes exchange restrictions in July 1931 in order to avoid currency depreciation. In Germany, the collapse of the large *Darmstädter und National Bank* in July triggers a run on the large German banks and on the mark (Schnabel, 2004). The German government introduces capital controls on 15 July 1931.

- **United Kingdom, 07-12/1931**

Starting July 1931, a run on the Bank of England's gold reserve puts the gold convertibility of the pound sterling under pressure. The speculative attack on the pound intensifies in August, despite financial assistance by the Bank of France and Federal Reserve Bank of New York. The U.K. suspends the gold standard on 21 September 1931. After several months of depreciation, the pound stabilizes against gold in January 1932. Denmark, Sweden, Norway and Portugal follow the U.K. off the gold standard in October-December 1931.

- **United States, 02/1933-02/1934**

In February 1933, U.S. banks endure heavy deposit withdrawals while Federal Reserve Banks lose substantial gold reserves. On 5 March 1933, the newly-inaugurated President Franklin

Delano Roosevelt declares a nationwide Bank Holiday. When the banks reopen four days later, a new legislation (the *Emergency Banking Act*) allows the U.S. President to regulate any transaction in foreign exchange and gold (Silber, 2009, p. 24). Roosevelt suspends the gold convertibility of the U.S. dollar on 19 April 1933 (Eichengreen, 1992, p. 332). The dollar depreciates (against gold) until its stabilization in March 1934 at a rate close to 35 U.S. dollars per ounce of gold. Several Latin American countries also follow the U.S. dollar off gold in 1933 (Eichengreen, 1992, p. 188-189).

- **France, Netherlands, and Switzerland, 05-10/1936**

After the U.S. dollar's devaluation of 1933, only a handful of countries remain on the gold standard: France, Belgium, the Netherlands, Switzerland, Italy, Poland and Czechoslovakia. These countries' governments reaffirmed their adherence to the gold standard and created the gold bloc at the World Economic Conference in 1933 (Eichengreen, 1992). However, the gold bloc progressively collapses in the following years. In March 1935, the devaluation of the Belgian Franc opens a first period of stress for gold bloc countries. France, the Netherlands and Switzerland endure large gold withdrawals in March-June. In May 1935, the victory of the left coalition (the *Popular Front*) at the French general election triggers a new run on the Bank of France's gold reserves. France devalues its currency in September 1936. Switzerland and the Netherlands immediately follow suit.

- **France, 03/1937-05/1938**

The French franc, Swiss Franc and Netherlands guilder stabilize against the pound sterling and U.S. dollar in October 1936. However, while this stabilization is durable in the cases of the Swiss franc and Netherlands guilder, the French franc starts depreciating again between March 1937 and May 1938 (Eichengreen, 1992).

- **United Kingdom, 07-08/1947**

After a period of capital controls initiated during the Second World War, the U.K. restored current account convertibility on 15 July 1947. This decision was immediately followed by a run on the British gold and dollar reserves forcing Britain to suspend convertibility on 20 August. See Newton (1984), Eichengreen (2008, p. 101) and Schenk (2010, p. 60-62).

- **United Kingdom, 04-10/1949**

Starting April 1949, a run on the British Exchange Equalisation Account's gold and dollars reserves put the pound sterling under pressure. The run was only halted with the pound's devaluation of September 1949. See Cairncross and Eichengreen (1983), Schenk (2010) and Naef (2016).

- **France, 05/1945-10/1949**

Following the end of the Second World War, France suffered from a series of inflation and currency crises. The French franc was devalued in 26 January 1948, 17 October 1948, 27 April 1949 and 20 September 1949. See Merigot and Coulbois (1950, p. 262 and 265).

- **Germany, 05/1945-11/1948**

Between 1945 and 1948, Western Germany experienced a long period of monetary instability. In order to counteract the effect of the rise of the German monetary stock on inflation, the Allies imposed a system of price control. This gave rise to the use of various commodities as money - especially cigarettes (Bignon, 2009). More than 300 monetary reforms were proposed between 1945 and 1948 (Dornbusch and Wolf, 1990, p. 39). The monetary reform was finally implemented between June and October 1948 (Klopstock, 1949; Dornbusch and Wolf, 1990).

- **France, 08/1957-12/1958**

France entered a period of currency instability in 1957 and the French franc was devalued twice on 11 August 1957 and 29 December 1958 (Bordo, 1993; Blancheton and Bordes, 2007).

- **United Kingdom, 10/1964-05/1965; 07/1965-09/1965; 06/1966-08/1966; 05/1967-12/1967**

In 1964-1967, the U.K. experienced a series of currency crises and speculative pressure was particularly acute in certain months. The pound sterling was eventually devalued in November 1967. See Bordo et al. (2009).

- **France, 05-11/1968; 04-08/1969**

Following the French riots of May 1968, pressure on the French franc intensifies and culminates in November 1968. The French government eventually resists devaluation and decides to implement a series of fiscal reforms and a tightening of foreign exchange restrictions. Speculative pressure on the franc eases at the end of 1968 but returns following the resignation of French

president de Gaulle. The franc is eventually devalued in August 1969. See Blancheton and Bordes (2007).

- **United States, and end of Bretton Woods, 05/1971-03/1973**

The persistent U.S. current account deficits in the second half of the 1960s put pressure on the dollar's gold convertibility. In May 1971, the German mark starts floating against the U.S. dollar. In August, U.S. President Richard Nixon announces the suspension of the dollar's gold convertibility. Several attempts are made over the following months to restore a fixed exchange rate system and the U.S. dollar is devalued twice (relative to gold). In March 1973 however, the Bretton Woods system definitively collapses and is replaced by a floating exchange rate system. See Garber (1993, p. 465-466).

A.2 Banking Crises (excluding twin crises)

- **France, 02-03/1889**

The crisis may be traced back to the failed attempt by Pierre-Eugène Secrétan, the head of the Comptoir d'Escompte, to corner the copper market. This scheme had forced the Comptoir d'Escompte to sustain the price of copper, endangering its financial stability. When the price of copper further fell in February 1889, the bank registered large losses. The Comptoir was deemed as too large to fail which led the Banque de France to intervene in order to guarantee an orderly liquidation (Hautcoeur *et al.*, 2014).

- **United Kingdom, 07-12/1890**

At the end of the 1880s a decrease in capital inflows hit the Argentinean economy and triggered a run on the banks in July 1890 (Flores, 2010, p. 131-133; Turner, 2014, p. 154-155). The crisis in Argentina had severe repercussions in the U.K. because of one merchant bank's heavy involvement in the country: Baring Brothers & Co. In early November 1890, the house of Barings experienced severe difficulties and had to ask support from the Bank of England. Baring's failure risked causing turmoil in the London money market. In December 1890, a rescue operation was organized involving the Bank of England as well as other major London banks. The Baring crisis had severe economic repercussions in Europe as well as in other Latin American countries (Mitchener and Weidenmeier, 2008).

- **United States, 05-08/1893**

Pressure on the U.S. Treasury's gold reserves and an economic recession triggered a crash in the New York stock market and a severe banking panic in May 1893. Financial and commercial failures increased dramatically in June-August. The panic was halted at the beginning of September (Stevens, 1894) but was followed by an economic recession which lasted until June 1894 (Gorton, 1988).

- **United States, 04/1906-01/1908**

The San Francisco earthquake of April 1906 triggered a crash in the London stock and bond markets. British companies providing insurance to San Francisco homeowners were soon in troubles and had to liquidate their assets. This resulted in substantial gold outflows from London in the summer of 1906 (Odell and Weidenmeier, 2004). The Bank of England reacted by raising its discount rate from 3.5% to 6% between September and October 1906 (Bruner and Carr, 2007, p. 15). This resulted in increased credit scarcity and financial stress in the U.S., which eventually resulted in a stock market crash and banking panic in October 1907. The panic started with the failure of the New York-based Knickerbroker Trust Company, which had supported Otto Heinze's failed attempt to corner the copper market. Troubles immediately spread to other trust companies and banks and were only halted thanks to the intervention of JP Morgan. Banks had to suspend payments until January 1908 (Bruner and Carr, 2007, p. 143). The 1907 panic had severe economic repercussions in the U.S..

- **United States, 04-08/1931**

Wicker (1996, p. 66-72) dates the beginning of the second U.S. banking crisis of the Great Depression in April 1931. 563 U.S. banks failed between April and August and three quarters of them were located in the Districts of Chicago, Minneapolis, Cleveland, and Kansas City. Richardson and van Horn (2009) also show that bank distress increased in New York City in July-August 1931.

- **United States, 09-10/1931**

Britain's departure from the gold standard in September 1931 and the Federal Reserve's decision to raise its discount rate trigger a nationwide banking panic in 09-10/1931 (Wicker, 1996, p. 72-78).

- **United States, 02-03/1933**

See currency crises (twin crisis).

- **United Kingdom, 11/1973-03/1975**

Following a collapse in property prices, several British financial institutions known as "secondary banks" experienced liquidity problems in November 1973. The Bank of England coordinated a large rescue operation and the British clearing banks agreed to launch a "lifeboat" in order to provide support to institutions in difficulties. Banking troubles however intensified in March 1974 and took an international dimension (Reid, 1982; Capie, 2010, p. 524-586). The banking situation was stabilized in March 1975 (Capie, 2010, p. 556).

A.3. Sovereign Debt Crises

- **Argentina, 07/1890**

See banking crises (Baring crisis).

- **Germany, Eastern Europe, and Latin America, 04/1931-02/1934**

The 1930s witnessed an unprecedented number of sovereign defaults, with 80% of defaults happening on the NYSE clustered between 1931 and 1933 (Flandreau *et al.*, 2009). Brazil, Chile, the Dominican Republic and Peru defaulted in 1931, followed a year after by Bulgaria, Greece, Salvador and Yugoslavia. In 1933 it was the turn of Colombia, Costa-Rica, Cuba, Panama, Uruguay, the wave continued in 1934 with the defaults of Hungary (in February). On top of the defaults occurring on the NYSE sovereign defaults also occurred for bonds listed in European exchanges such was the case for example for Germany or Romania (Klug, 1993; Oosterlinck and Ureche-Rangau, 2012).

A.4. Crises Triggered by an Equity or Bond Crash

- **France, 12/1881-02/1882**

According to White (2007), the crash of 1882 "presented the Paris Bourse with its worst crisis of the nineteenth century". The crash is closely linked to the collapse of the Union Générale, an investment bank which experienced troubles at the end of 1881 and failed in February 1882. From December 1881 to end January 1882, the French stock market index lost 7.3%. The crash

was such that several brokers had to be bailed out and even required credit from the Banque de France.

- **United States, 02-12/1907**

The Crash of 1907 lasted almost the whole year with the Dow Jones losing 9.7% in March, 8.2% in August, 11.3% and 10.9% in October and November. The last decline in the stock market was closely linked to the failure of the New York based Knickerbroker Trust.

- **United States, 10/1919-08/1921**

The Dow Jones began to decline sharply in October 1919 and by August 1921 was 41.2% lower than during its October peak (Mishkin and White, 2002).

- **France, 03/1924**

According to Le Bris (2010), the month of March 1924 corresponds to one of the largest stock market crash (adjusted for volatility) occurring in France. He attributes this crash to the attack on the FF. Many operators had bet on devaluation when a loan by JP Morgan prevented the devaluation, they suffered heavy losses.

- **France, 11/1926**

Le Bris (2010) attributes the crash to monetary problems and to political instability.

- **United States, 10-11/1929 and 04/1930-05/1932; France, and the U.K. also experienced a crash during a part or the totality of this period**

In two days in October 1929 the Dow Jones fell by 24%, only to fall by a further 22% in November 1929. A short-lived recovery in early 1930 was followed by another massive decline. From peak (April 1930) to trough (May 1932) the drop in the stock market represented 81.8% (Mishkin and White, 2002). In the U.K., the stock market index fell from a value of 100 in 1929 to a low of 30.8 in 1932 (Crafts and Fearon, 2010).

- **United States, 10-12/1937**

The recession had a strong impact on the stock market, in just three months the Dow Jones lost more than 30% of its value.

- **United States, 09-10/1946**

In September 1946, the Dow Jones and S&P 500 indices lost respectively 12% and 14.7% of their values. See Mishkin and White (2002).

- **United States, 04-07/1962**

Between April and June 1962, the Dow Jones and S&P indices lost respectively 20.6% and 20.9% of their values. See Mishkin and White (2002).

- **United States, 05-07/1970**

Following the bankruptcy of Penn Central Railroad in May 1970, U.S. stock market prices declined sharply until July. See Mishkin and White (2002).

- **United States and United Kingdom, 11/1973-10/1974**

U.S. stock market prices declined without interruption from November 1973 to October 1974. This stock market decline was associated with a deterioration in the condition of U.S. banks. See Mishkin and White (2002).

A.5. Major Corporate Bankruptcies

- **United States, and world markets, Kreuger, and Toll crash, 03/1932-05/1932**

During the 1920s a huge number of investors in the U.S. acquired stocks and bonds from Kreuger & Toll, Inc., a Swedish conglomerate. High and regular dividends, as well as the claim that investing in these securities was risk free because the conglomerate enjoyed match monopolies in many countries, explains the extraordinary success enjoyed by these securities. In fact however, the owner of the company Ivar Kreuger was by and large a gigantic fraud exploiting a pyramid scheme. As a result of the Great Depression the company could no longer easily issue stocks or bonds. Realizing this Ivar Kreuger committed suicide on March 12, 1932. A few weeks later the fraud was uncovered, and auditors discovered that 250 million dollars in reported assets had never existed prompting a crash on the stocks of the company. When the company went bankrupt, it represented the largest bankruptcy on record and triggered dramatic changes in financial reporting (Flesher and Flesher, 1986).

Appendix B: Descriptive Statistics

Table B1: Classical Gold Standard Era 1880-1914

This table shows the descriptive statistics of the country indices for Germany, the U.K., the U.S., and Australia for the classical gold standard era.

	Germany	U.K.	U.S.	Australia
Mean	0.11%	0.04%	0.16%	0.43%
Ann. Mean	1.37%	0.48%	1.97%	5.20%
Median	0.22%	0.00%	0.00%	0.52%
Stdv	2.21%	1.44%	3.22%	2.29%
Volatility	7.65%	4.97%	11.14%	7.92%
Skewness	-0.36	-0.10	-0.09	0.21
Kurtosis	6.39	4.80	3.40	7.81
Max	10.21%	4.88%	9.96%	11.86%
Min	-12.03%	-6.49%	-10.87%	-10.96%
N	413	413	413	413

Table B2: Interwar Period 1918-1940

This table shows the descriptive statistics of the country indices for Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Sweden, Switzerland, the U.K., Canada, the U.S., Australia, Japan, and South Africa for the interwar period.

	Belgium	Denmark	France	Germany	Italy	Netherlands	Norway	Sweden
Mean	0.17%	-0.31%	0.53%	0.66%	0.15%	-0.25%	-0.13%	-0.07%
Ann. Mean	2.05%	-3.75%	6.34%	7.91%	1.78%	-3.03%	-1.55%	-0.89%
Median	0.00%	0.00%	0.00%	0.04%	0.00%	0.00%	-0.14%	0.00%
Stdv	7.40%	3.77%	5.87%	13.19%	5.40%	4.84%	3.11%	5.34%
Volatility	25.65%	13.06%	20.35%	45.69%	18.69%	16.77%	10.79%	18.50%
Skewness	0.98	1.25	0.74	2.44	0.51	0.37	0.61	-0.51
Kurtosis	5.64	12.22	4.79	19.32	5.94	6.46	6.90	8.39
Max	35.68%	22.75%	27.45%	99.12%	25.61%	25.24%	16.82%	20.17%
Min	-16.34%	-14.35%	-14.06%	-43.90%	-18.37%	-15.15%	-11.26%	-32.12%
N	256	256	256	256	256	256	256	256

	Switzerland	U.K.	Canada	U.S.	Australia	Japan	South Africa
Mean	0.05%	0.07%	0.35%	0.51%	0.51%	0.13%	0.41%
Ann. Mean	0.64%	0.79%	4.22%	6.09%	6.06%	1.53%	4.95%
Median	0.16%	0.17%	0.58%	0.95%	0.46%	0.10%	0.25%
Stdv	4.76%	3.24%	5.49%	8.21%	3.14%	4.88%	3.37%
Volatility	16.48%	11.22%	19.03%	28.46%	10.88%	16.89%	11.66%
Skewness	0.59	0.09	-0.53	0.66	1.08	-0.10	1.64
Kurtosis	13.89	5.10	7.93	8.87	15.19	12.08	13.25
Max	33.35%	12.40%	22.86%	42.24%	22.27%	25.73%	24.16%
Min	-20.67%	-9.80%	-28.44%	-29.97%	-12.08%	-26.50%	-7.74%
N	256	256	256	256	256	256	256

Table B3: Bretton Woods Period 1946-1971

This table shows the descriptive statistics of the country indices for Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, the U.K., Canada, the U.S., Australia, Japan, and South Africa for the Bretton Woods period.

	Austria	Belgium	Denmark	France	Germany	Italy	Netherlands	Norway	Spain
Mean	0.76%	0.24%	0.19%	0.75%	1.21%	0.95%	0.54%	0.18%	0.73%
Ann. Mean	9.11%	2.89%	2.33%	9.04%	14.55%	11.44%	6.51%	2.14%	8.78%
Median	-0.04%	0.29%	0.00%	0.61%	0.43%	0.42%	0.46%	0.00%	0.75%
Stdv	6.27%	3.14%	1.96%	4.67%	10.41%	7.84%	4.17%	2.82%	4.06%
Volatility	21.71%	10.89%	6.80%	16.19%	36.07%	27.17%	14.45%	9.75%	14.06%
Skewness	1.50	-0.22	-0.19	0.22	4.51	2.70	-0.08	0.89	0.13
Kurtosis	11.93	4.67	3.64	3.50	102.63	19.33	3.21	8.93	4.31
Max	39.14%	10.88%	7.32%	16.08%	132.24%	58.89%	12.43%	17.69%	15.89%
Min	-21.30%	-14.43%	-6.30%	-14.15%	-89.97%	-26.48%	-11.50%	-9.92%	-11.45%
N	305	305	305	305	305	305	305	305	305

	Sweden	Switzerland	U.K.	Canada	U.S.	Australia	Japan	South Africa
Mean	0.49%	0.48%	0.57%	0.51%	0.64%	0.53%	1.85%	0.11%
Ann. Mean	5.89%	5.76%	6.79%	6.18%	7.69%	6.35%	22.19%	1.37%
Median	0.44%	0.61%	0.84%	0.79%	0.85%	0.53%	2.00%	0.20%
Stdv	3.14%	4.22%	4.02%	3.59%	3.73%	3.44%	8.83%	3.96%
Volatility	10.89%	14.62%	13.92%	12.45%	12.91%	11.92%	30.60%	13.73%
Skewness	-0.24	0.30	-0.26	-0.40	-0.31	0.27	1.84	-0.47
Kurtosis	3.69	5.69	3.43	3.64	2.94	6.81	14.07	5.96
Max	9.56%	21.14%	14.59%	11.86%	10.16%	18.20%	66.32%	14.91%
Min	-10.06%	-13.34%	-11.53%	-10.83%	-10.81%	-13.31%	-22.72%	-18.05%
N	305	305	305	305	305	305	305	305

Table B4: Floating Exchange Rate Era 1972-2014

This table shows the descriptive statistics of the country indices for Austria, Belgium, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, the U.K., Canada, the U.S., Australia, Japan, and South Africa for the floating exchange rate era.

	Austria	Belgium	France	Germany	Italy	Netherlands	Norway	Spain
Mean	0.54%	0.60%	0.70%	0.59%	0.68%	0.63%	0.79%	0.67%
Ann. Mean	6.49%	7.18%	8.41%	7.10%	8.11%	7.55%	9.44%	8.07%
Median	0.25%	0.63%	1.22%	0.76%	0.53%	1.18%	0.94%	0.78%
Stdv	5.44%	4.68%	5.59%	5.30%	6.81%	5.07%	6.42%	5.97%
Volatility	18.85%	16.20%	19.36%	18.34%	23.60%	17.56%	22.24%	20.68%
Skewness	-0.08	-0.38	-0.23	-0.61	0.40	-0.60	-0.60	-0.14
Kurtosis	7.73	6.45	4.19	5.34	4.34	5.50	5.05	4.61
Max	23.52%	22.59%	21.51%	19.02%	30.02%	19.84%	20.09%	23.51%
Min	-28.38%	-22.92%	-24.12%	-23.86%	-19.48%	-23.35%	-29.85%	-28.45%
N	516	516	516	516	516	516	516	516
	Sweden	Switzerland	U.K.	Canada	U.S.	Australia	Japan	South Africa
Mean	1.08%	0.53%	0.72%	0.63%	0.68%	0.67%	0.51%	1.33%
Ann. Mean	12.93%	6.35%	8.64%	7.57%	8.18%	8.07%	6.17%	15.92%
Median	1.07%	0.93%	1.12%	0.91%	0.96%	1.07%	0.66%	1.59%
Stdv	5.74%	4.47%	5.65%	4.60%	4.41%	5.08%	5.50%	6.16%
Volatility	19.89%	15.49%	19.58%	15.94%	15.27%	17.60%	19.04%	21.35%
Skewness	-0.13	-0.69	1.10	-0.71	-0.47	-1.26	-0.33	-0.45
Kurtosis	4.74	6.08	18.07	5.91	5.02	13.12	4.20	4.32
Max	27.51%	19.72%	52.68%	17.26%	16.30%	17.88%	20.07%	17.85%
Min	-21.53%	-24.58%	-26.60%	-22.63%	-21.76%	-42.45%	-23.83%	-29.63%
N	516	516	516	516	516	516	516	516

Appendix C: Correlation Matrices

Table C1: Classical Gold Standard Era 1880-1914

	Germany	U.K.	U.S.	Australia
Germany	1.00			
U.K.	0.32	1.00		
U.S.	0.25	0.40	1.00	
Australia	0.00	-0.07	-0.02	1.00

Table C2: Interwar Period 1918-1940

	Belgium	Denmark	France	Germany	Italy	Netherlands	Norway	Sweden	Switzerland	U.K.	Canada	U.S.	Australia	Japan	South Africa
Belgium	1.00														
Denmark	-0.02	1.00													
France	0.31	0.08	1.00												
Germany	0.02	0.22	0.05	1.00											
Italy	0.15	0.11	0.24	0.07	1.00										
Netherlands	0.32	0.28	0.37	0.17	0.31	1.00									
Norway	0.21	0.18	0.17	-0.01	0.23	0.44	1.00								
Sweden	0.14	0.20	0.26	0.10	0.29	0.32	0.26	1.00							
Switzerland	0.16	0.26	0.42	0.10	0.40	0.53	0.31	0.41	1.00						
U.K.	0.09	0.16	0.23	0.00	0.20	0.42	0.27	0.24	0.28	1.00					
Canada	0.31	0.21	0.37	0.06	0.33	0.58	0.34	0.34	0.45	0.45	1.00				
U.S.	0.18	0.19	0.29	0.02	0.29	0.39	0.28	0.45	0.40	0.29	0.61	1.00			
Australia	0.13	0.05	0.00	0.03	0.04	0.26	0.12	0.15	0.16	0.12	0.11	0.06	1.00		
Japan	0.12	0.12	0.11	-0.03	0.24	0.14	0.09	0.14	0.16	0.12	0.08	0.07	0.05	1.00	
South Africa	0.09	0.15	0.08	0.02	0.15	0.26	0.22	0.04	0.16	0.25	0.27	0.17	0.12	-0.03	1.00

Table C3: Bretton Woods Period 1946-1971

	Austria	Belgium	Denmark	France	Germany	Italy	Netherlands	Norway	Spain	Sweden	Switzerland	U.K.	Canada	U.S.	Australia	Japan	South Africa
Austria	1.00																
Belgium	0.07	1.00															
Denmark	0.06	0.15	1.00														
France	0.20	0.29	0.08	1.00													
Germany	-0.08	0.17	0.09	0.26	1.00												
Italy	0.06	0.14	0.12	0.10	0.10	1.00											
Netherlands	0.10	0.29	0.13	0.25	0.12	0.12	1.00										
Norway	0.09	0.24	0.14	0.15	0.07	0.10	0.20	1.00									
Spain	0.16	0.03	0.11	0.15	-0.08	0.08	-0.01	0.15	1.00								
Sweden	0.07	0.25	0.16	0.20	0.18	0.15	0.35	0.08	0.13	1.00							
Switzerland	0.21	0.31	0.14	0.32	0.17	0.23	0.48	0.23	0.05	0.32	1.00						
U.K.	-0.09	0.21	0.12	0.21	0.09	0.16	0.33	0.12	0.01	0.25	0.27	1.00					
Canada	0.05	0.24	0.26	0.22	0.06	0.17	0.48	0.23	0.07	0.35	0.45	0.38	1.00				
U.S.	-0.01	0.13	0.11	0.13	0.04	0.08	0.47	0.16	0.04	0.27	0.40	0.25	0.72	1.00			
Australia	0.01	0.19	0.17	0.12	0.07	0.16	0.25	0.08	0.09	0.38	0.24	0.34	0.29	0.17	1.00		
Japan	-0.10	0.13	0.02	0.03	0.09	0.11	0.12	0.06	-0.04	0.09	0.10	0.06	-0.01	-0.05	0.08	1.00	
South Africa	0.00	0.16	0.19	0.08	0.06	0.09	0.17	0.07	0.02	0.15	0.16	0.17	0.22	0.12	0.20	-0.04	1.00

Table C4 : Floating Exchange Rate Era 1972-2014

	Austria	Belgium	France	Germany	Italy	Netherlands	Norway	Spain	Sweden	Switzerland	U.K.	Canada	U.S.	Australia	Japan	South Africa
Austria	1.00															
Belgium	0.50	1.00														
France	0.48	0.65	1.00													
Germany	0.58	0.63	0.70	1.00												
Italy	0.40	0.50	0.59	0.56	1.00											
Netherlands	0.51	0.65	0.70	0.77	0.56	1.00										
Norway	0.48	0.59	0.53	0.53	0.46	0.60	1.00									
Spain	0.41	0.53	0.57	0.56	0.56	0.58	0.48	1.00								
Sweden	0.39	0.47	0.54	0.61	0.50	0.63	0.55	0.55	1.00							
Switzerland	0.49	0.61	0.66	0.71	0.51	0.75	0.52	0.52	0.57	1.00						
U.K.	0.35	0.52	0.58	0.52	0.47	0.66	0.46	0.46	0.49	0.62	1.00					
Canada	0.40	0.43	0.56	0.49	0.42	0.63	0.54	0.42	0.47	0.58	0.58	1.00				
U.S.	0.37	0.52	0.61	0.58	0.41	0.68	0.52	0.49	0.54	0.65	0.63	0.75	1.00			
Australia	0.37	0.45	0.49	0.45	0.39	0.52	0.52	0.43	0.48	0.52	0.55	0.61	0.57	1.00		
Japan	0.33	0.38	0.42	0.44	0.38	0.46	0.35	0.43	0.43	0.43	0.37	0.40	0.45	0.37	1.00	
South Africa	0.38	0.33	0.39	0.38	0.31	0.38	0.44	0.28	0.34	0.41	0.29	0.49	0.40	0.45	0.32	1.00