# Monetary integration and stock market cross-correlations during the interwar period: an international comparison between Belgium, France and the US*

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**Abstract**

This paper assesses the effect of monetary integration on correlations between the Belgian, French and US stock market returns during the interwar period (1919-1939) using high quality value-weighted stock price indices on monthly basis. Contrary to the common wisdom, we find that cross-correlations increased before the beginning of the international financial crisis of the 1930s.Financial linkages between stock markets tightened during the Gold Exchange Standard period, showing that monetary integration has strongly affected the co-movement of stock returns especially between the Belgian-US and the French-US stock markets.

***Keywords:***Monetary integration; Stock market linkages; Exchange rate regime; Time-varying financial market integration.

***JEL Classification:***C29, C58, G15, N22, N24.

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## 1. Introduction

Since the global financial crisis of 2007-2008 and the subsequent Euro area sovereign debt crisis of 2010-2011, there have been raising concerns about the potential exit of a Euro area member from the currency union. After Greece's dramatic monetary fate and the subsequent "Grexit" fear, attention has now shifted to a much larger economy, namely Italy. Political uncertainty surrounding the Prime Minister Renzi's referendum about a large constitutional reform, added to poor economic performances have raised fears about the country's ability to remain in the Eurozone. These concerns have materialized in increasing capital flight since 2015.[1]

The most prominent episode of a fixed exchange rate regime collapse caused by a financial crisis occurred in the 1930s. Indeed, the largest economies at that time used to devaluate in order to boost their domestic output and employment. As the recession spread internationally, these domestic policies worsened the recession in other countries. The main difference with the recent crisis is that the principal concern of economic authorities was ensuring price stability through an international monetary system based on gold parity: the Gold Standard or the Gold Exchange Standard (GES hereafter).[2] The issue with this setting is the lack of fiscal room it implies when a country wishes to boost its demand. The only way for countries to depreciate their currency was then to get out of the system and abandon their gold parity even if there were still concerns about inflation. This is what happened after the beginning of the Great Depression in the early 1930s: the UK went off gold in 1931, the US in 1933 and finally France and most of the remaining countries in 1936. Eichengreen (1992), and its famous "Golden Fetters" hypothesis, explains that countries that stayed the longest on gold were the ones for which the recovery was the slowest. Obstfeld and Taylor (2003) point out that the evolution of the global capital market is closely related to the international monetary system in place. They analyze the development of international lending under the framework of the inconsistent trinity, i.e. the impossibility for an open economy to get more than two elements out of the three following policy goals: full cross-border capital mobility; fixed exchange rate

[1]See Carmen Reinhart (2016) Fleeing from Italy, Project Syndicate, November. https://www.project-syndicate.org/commentary/capital-flight-from-italy-by-carmen-reinhart-2016-11

[2] The Gold Standard refers to the monetary system in place until 1914. For a matter of simplification, we will use GES as a standard term for the interwar gold standard since the latter had many different denominations according to slight differences in the countries it was set up (for example Gold-bullion standard, Gold-coin standard, Qualified gold standard etc.

and independent monetary policy reaching domestic objectives. According to the authors, the world capital market's evolution reflects how governments have been dealing with their objectives with respect to the trilemma. Wolf (2008) investigates the timing of going off the gold standard in the 1930s using monthly data for European countries.[3] He finds that deflationary pressure was a key factor in the decision-making process to exit the interwar gold standard, along with the occurrence of a banking crisis, the ability to defend the gold parity and the trade ties. The author stresses the importance of complementing his analysis by taking into account bilateral economic relationships as "*new evidence of the pattern of bilateral financial relations could be of considerable value"*. This is what we do in this paper. The goal is to fill this gap by investigating bilateral relationship between two members of the gold block with the US, in order to explore, in the light of high quality data, the consequences of monetary instabilities on stock exchanges.

We analyze the relationships between three stock markets: New-York, Paris and Brussels. As it will be discussed further, New-York and Paris, in addition to London, were the heart of international finance during the interwar period and that was all the more the case starting from the late 1920s. In fact, whereas the US kept its gold parity during World War I (WWI hereafter) and until 1933, France, Belgium and most of the belligerent countries abandoned gold in order to finance the war.[4] During the early 1920s, those countries managed to stabilize their currency and restore their gold convertibility. France and Belgium are particularly interesting as the timing of their monetary decisions was very similar. In addition, these two continental European countries had close commercial and financial links[5] and they were both members of the "Gold Block", a group of countries that were still committed to the GES after US' exit in 1933. We are particularly interested in this feature since the currency war at that time caused large capital movements with asset allocation driven most strongly by stable monetary environment prospects. The use of Belgian data allows for robustness checks of the phenomena observed between France and the US. Moreover, as stated by Bussière (1992), Brussels becomes a much more international financial place starting in 1927 when Europe receives large capital inflows.

[3]The author tests multiple hypotheses stemming from the modern theoretical literature on currency crises (from the 1st to the 3rd generation) in order to predict the timing of European countries' departure from gold.

[4]Actually, US gold exports was restricted by the Fed from September 1917 to June 1919, but gold kept on circulating domestically (Friedman and Schwartz 1963).

[5] See Bussière (1992) for a detailed study of the Belgian-French relationship during the interwar.

The intuition here is that the switch from a floating to a fixed exchange rate regime for most of the advanced countries tightened up stock market linkages. Therefore, the movements of stock prices are more interconnected and they should respond to a change in the monetary policy elsewhere. In a context of a worldwide depression, the closer links between financial places might have also worsened the global decrease in stock prices. To check our conjecture(s), we rely on both statistical and econometrical analyses. More specifically, the econometrical analysis is conducted over different sub-periods as well as on rolling windows. Our approach—inspired partly by that of Chow et al. (2011) but primarily motivated by the data— focuses on correlations between national stock market returns thus allowing pairwise contemporaneous relationship between the stock markets (i.e. the co-movements). An increase in correlation coefficients can then be interpreted as evidence of greater stock market co-movements and hence, as a tendency towards financial integration. Our methodology also provides a dynamic analysis of financial integration during the interwar on a monthly basis. It allows us to run event studies with regards to monetary policy in terms of exchange rate regime.

Our findings confirm the tightening in international financial markets when all the countries returned on gold. Interestingly, it only disappeared after the gold bloc burst in 1936. While Obstfeld and Taylor (1997) claim that the Great Depression is the main explanation for the decline in international capital mobility during the XXth century, we believe that there may be more sides to the story. Indeed, according to our results, financial integration was low following WWI, but returned to high levels in the mid/late-1920s when countries came back under the same fixed exchange rate regime. The level of integration in bilateral relationships between the US and gold bloc members such as France and Belgium remained high until both countries departed from gold. Implications are twofold. First, this finding shows that capital mobility between the mid-1920s and the mid-1930s was higher than what we usually read in the literature on the Great Depression.[6]It supports the idea that France resisted longer to the Depression than some comparable economies thanks to its ability to attract gold and capital in the early 1930s. Second, our findings also shed lights on the outcome of a departure from the Euro area for a country such as Italy, or any large northern economy in terms of capital

[6] A detailed picture can be found in Section 2.

markets integration. The experience of gold bloc countries during the interwar shows that the exit from a currency union may isolate the capital market of the departed country.

The remainder of the paper is as follows. Section 2 gives an outlook of the interwar monetary history, detailing the course of events for the studied countries and how we divide the 1919-1939 period into three distinct sub-periods based on the exchange rate regime. Section 3 introduces the data, discusses the choice of the series and shows the evolution of cross linkages through a correlation analysis. Section 4 presents the methodology used to analyze the bilateral co-movements between our three markets and depicts our results. Finally, Section 5 concludes.

## 2. Financial integration during the interwar: background and related literature

Financial integration may be defined as the situation in which market participants face the same set of rules, have equal access and are treated equally (Baele., 2004). Financial integration is a complex phenomenon which is defined and measured in different ways in the literature depending on the topic that is tackled. As such, there exist two measures to appraise it, either *de jure* or *de facto* ones.

Chinn and Ito (2006, 2008) computed a *de jure* indicator which is frequently cited in the literature. It focuses on the degree of financial openness with respect to capital account transactions. More precisely, the capital account openness index (KAOPEN) is calculated as the first component of four International Monetary Fund (IMF) binary variables reported in the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) that translate restrictions on cross-border financial transactions. The idea here is to compare regulatory restrictions on capital account transactions among countries.[7] To the best of our knowledge, the IMF has been the first institution to build such indicators; due to data availability, we cannot replicate this methodology for our period of interest.

The other way to assess financial integration consists in using *de facto* measures. In the literature, we can find *de facto* indicators that are either price-based or quantity-based.

[7] For a survey, see Kose et al. (2006) who offer a nice outlook of the methods used in the literature.

The European Central Bank (ECB hereafter) outlines the complexity of the financial integration phenomenon[8]on the basis that many markets are involved, ie. money, banking, debt and equity markets. ECB's FINTECs (Financial Integration Composite) indices are *de facto* measures based on the aggregation of four indicators, one for each market segment, i.e. money, banking, bonds and equity markets.[9] The ECB proposes both types of *de facto* indicators mentioned above.[10] With regards to the quantity-based measures, Edison and Warnock (2003) constructed a measure of capital controls based on restrictions on foreign ownership of equities. Such a measure requires data on Initial Public Offerings (IPOs) for several countries which are difficult to gather for the interwar period, especially on a monthly basis, as it is done by the authors. Obstfeld and Taylor (2003) proposed an alternative method which consists in using gross stock of foreign capital divided by the size of the world economy, the level of output in current prices and in a common currency unit. It is alsodifficult to gather these data for the late nineteenth and first half of the twentieth century. In any cases, the French national statistic institution did not collect such data.

When adopting price-based measures to assess the extent of market integration, one has in mind that capital market integration should be reflected in the prices of similar financial assets across national frontiers (Kose*et al.*, 2006). This approach is limited when it comes to comparing a large number of heterogeneous countries because price differentials could potentially reflect, for example, the lack of liquidity in an emerging market with respect to advanced economies. However, this limitation does not arise for our group of countries since none of them suffered from liquidity concerns during the interwar. In their study on the long-term evolution of international capital mobility, Obstfeld and Taylor (2003) offered three price-based indicators to assess the development of financial integration. First, the authors focus on long-term real interest rates using monthly series of seven-year or more government bonds yields. They state that these long-term rates are "*closely linked to the cost of long-lived capital, because the slow mean reversion in real exchange rates makes it difficult to discern expected exchange rate changes in short-term data, and because risk premia can be reduced*

[8]The ECB defines financial integration as "*a situation whereby there are no frictions that discriminate between economic agents in their access to –and their investment of- capital, particularly on the basis of their location*", hence when market access is equal for all. Speech of Benoît Coeuré, member of the executive board of the ECB, in Madrid (12/03/13).
[9]ECB (2015).*Financial Integration in Europe*. European Central Bank report, April.
[10] Price-based measures aim at capturing discrepancies in asset prices across different national markets while quantity-based measures aim at quantifying the change in demand for and supply of securities with respect to market frictions (Baltzer *et al.*, 2008).

*over long horizons if long-run purchasing power parity holds*." The purpose of the study is to test if real interest rates for developed countries diverge over the long term. Stationary and cointegration tests outline the presence of a long-run relationship among real interest rates, meaning that although there might be short-run deviations, they converge towards the same level in the long-run. Their results support the idea that bond markets are integrated.

Anyways, the computation of the indicators discussed above is not easily feasible for earlier periods, mainly because of data availability.[11]

The second price-based indicator proposed by Obstfeld and Taylor (2003) is based on the covered nominal interest rate parity theory. The idea is the following: if capital mobility between Paris and New York's financial places is free, an investor in Paris should be able to alternatively buy a loan issued in francs, or invest the same amount in New York while simultaneously covering the exchange risk by forward selling of dollars. If the covered interest parity holds, the investor's net gain from borrowing in Paris and investing in New-York is zero. In other words, if there are no gains for investors to arbitrate between the two markets, one can assume that the two countries are financially integrated. Obstfeld and Taylor (2003) do the exercise for London, New York and Berlin. According to their results over the very long-run (1870-2000), differentials in interest rates were small and stable before 1914 during the Gold Standard era. They became quite large in the early 1920s but decreased around the end of the decade (once currencies are stabilized) before expanding during the 1930s and the Depression. According to their results, it seems that the exchange rate regime played a significant role in interest rates differentials. Once again, such analysis requires scarce data for our period of interest. Indeed, it requires in the first place finding the same type of bonds with identical yield and maturity in each market. It is fairly straightforward for large financial places such as New York, Paris or Brussels. Nonetheless, it should not be too much of a long-term interest rate because one investor has to cover itself thanks to forward contracts on the foreign exchange market. During the interwar, forward rate of exchange are quoted in Paris for the Sterling pound and the US dollar for 1, 2 and 3 months' maturity. As one cannot hedge any investment for more than a three-month time span, it is then impossible to run tests on covered nominal interest parity for any loan with a longer maturity. Usually,

[11] For example, the money market price-based indicator used by the ECB is the cross-country standard deviation of average unsecured interbank rates (at three different maturities: overnight, one month and twelve month), while the quantity-based indicator for this market relies on trading volumes. To the best of our knowledge, neither interbank rates nor trading volumes are available for Belgium, France and the US during the interwar.

the test will consist in using treasury bonds since they are both short-term securities and rather liquid. Yet, such bonds are not listed in Paris anymore after 1926, corresponding to the foundation of a special fund, the *Caisse Autonomme d'Amortissement*, which deals with the government debt.[12] The purpose of those operations was to prevent a massive demand of reimbursement from the public on short term bonds, especially after the crisis of the franc during the 1924-26 period. Consequently, it is not easy to find a listed short-term bond in Paris during the interwar after 1926, which makes it difficult to run tests on covered nominal interest parity.

Finally, financial integration may also be reflected in the interactions between equity markets across national borders. Nowadays it is quite clear that when a crash happens in one large financial center, most of the other ones will be affected. But does this phenomenon hold when it comes to earlier periods? The third *de facto* indicator proposed by Obstfeld and Taylor (2003) serves to check whether global capital market integration follows a U-shape over the long-run. To this end, they gather a sample of up to twenty-two country stock price indices on a yearly basis since 1880.[13] The question addressed concerns the extent to which stock returns' time series correlations changed over time. Rolling correlations on a ten years' window show that capital markets were highly active from 1900 to 1914 and after the 1960's, but also during most of the interwar period. This result contrasts with the authors' hypothesis of a U-shape financial integration between 1880 and 2000. According to the authors, the rationale for the high correlations observed during the interwar stems from the high volatility of stock prices, especially in the US, and the common shocks associated with large economies going on and off gold. We can also mention other studies that aimed at comparing the performances and correlations between international stock markets. Goetzmann and Jorion (1999) draw a picture of long term history of capital markets starting in the 1920s. Using data on a set of 39 countries, they compare the performances of different stock markets over time and conclude that apart from the US, real capital appreciation returns were low because of either financial crises, wars or political turbulences. The authors outline that their estimates are subject to survivorship bias, which is not the case for a shorter period such as the interwar solely. They also note that monthly data create more precise estimates and allow to perform

[12] This institution, created when Raymond Poincaré came back as the prime minister in 1926, aimed at resolving the floating debt, especially by lengthening maturities of short-term government bonds. The *Caisse Autonome d'Amortissement* also dealt with the payment of the *Bons de la Défense Nationale*, issued between 1915 and 1918 in order to finance the war.

[13] However the number of countries included in their sample decreases to a dozen during the interwar.

event studies. Goetzmann et al. (2005) address the question of diversification and study the correlation structure of the world equity markets over a 150 years' time span. Their exercise shows that periods of poor market performance are mostly associated with high correlations rather than low correlations, notably during the Great Depression. According to the authors, the Great Crash of 1929 represents a turning point in the volatility of the world stock markets and in average international correlations. The latter reached a peak in the 1930s that had not been equaled until the modern era. This result confirms the U-shape hypothesis of Obstefld and Taylor (2003). Nonetheless, the previous studies mentioned rely on average correlations among many different countries in terms of size and all of those financial places were not equally internationalized.

## 3. Stylized facts

### *3.1. Data*

A key issue when dealing with historical data for comparative research concerns the lack of consistency and comparability across time and space, due to changing meanings, various interpretations of the same historical situations or processes, changing classifications, etc. Sources and computation of indices vary widely across studies that examine the long-run evolution of stock prices. In this section, we describe our data choice and the reason why we restrict our analysis to the US, French and Belgian stock markets.

Indeed, stock market data for other countries would have been interesting in order to compare them, especially for UK, but also for Gold bloc members such as Switzerland, Netherlands or Italy. Although such data exist,[14] we do not think it is appropriate to compare indices since they are computed in very different ways.

Although London was the main international financial center up to WWII, data on stock prices suffer from a major caveat for our period of interest. The whole nineteenth century is covered with high quality indices,[15] while the London Share Price Database contains all the available data for the period after 1955. However, the qualitative gap is massive if we focus on the interwar period. To the best of our knowledge, the only available composite share price index for the interwar is the one stemming from the *Banker's*

[14] Series for each of those countries are available on Global Financial Data (GFD).
[15] See Acheson *et al*. (2009) for the period 1825-1870 and Grossman (2002) for 1870-1913.

*Magazine*.[16] The latter came out very early, at the end of the 1880s, but was revised several times in its sector composition. While the composition remained stable from 1921 to 1957, it is not clear how it was computed: the original series were calculated using market capitalization, but the continuous series have been converted into indices by scaling capitalization by the par value in order to get comparable numbers between series with different sectorial compositions.

We could also look for the dynamics of stock prices in other Gold block members such as Italy, Switzerland or Netherlands. Concerning Italy, the only index that is available on a monthly basis during the interwar consists in the combination of two indices: one spanning from 1905 to 1930 including 173 stocks, and the other from 1931 to 1939 including 74 stocks.[17] Moreover, data from 1922 to 1924 are yearly, which generates noise in the series. Finally, the methodology used to calculate these indices is not reported. The Switzerland case is similar in the sense that the Swiss National Bank calculated an index using 21 stocks from 1910 to 1925 when a broader sample of stocks was introduced, however the methodology used in not detailed. Finally, data for Amsterdam consist in an arithmetic average of weighted indices for 50 stocks representing all sectors. It was calculated by the Central Bureau of Statistics.[18] The selection criteria for the included stocks are not reported, so it is difficult to assess the representativeness of the index since there are no mentions of market capitalizations.

This is why our analysis is conducted considering only the Belgian, French and US stock market returns as the series for these three countries have been collected recently with a high degree of transparency with respect to the primary sources and computation methodologies.[19] Therefore, these data computed using high quality value-weighted stock price indices ensure a better consistency of our results.

For the US stock market, we use the S&P 500 index, which is a market capitalization-weighted index. During our sample period, series come from the Cowles/Standard and Poors' composite index, which includes on average 90 stocks.[20] Data are monthly and correspond to

[16] The Financial Time also published a share price index: the FT-30, but only starting in 1935.
[17] Source: GFD.
[18] Source: GFD.
[19] It is not true for the S&P, but the Cowles' commission documented their work and it is available for researchers.
[20] This index is available through the Global Financial Database (GFD).

end-of-the-month prices. The French stock index, the "Indice Général CAC", comes from Le Bris and Hautcoeur (2010). It is also a market value-weighted index, which includes the forty top capitalizations listed at the Paris Bourse at the beginning of each year. Finally, Belgian data stem from the SCOB database, which gathers stock prices for all stocks listed at the Brussels' stock exchange[21]. Here, the Belgium index has been computed especially for this study in order to include only companies whose main activity is both national and international, thus allowing us to account for international difficulties. It includes the top forty stocks by their market capitalizations at the beginning of each year.

These three indices measure common stocks and do not include dividends, so that the rate of return of stocks only corresponds to capital gains. As indices for Paris and New-York correspond to raw data,[22] the rate of return over the period t-1 to t is the percentage change in the raw index: $R_{it} = \frac{I_{t-1} - I_t}{I_{t-1}}$ with I the raw index. For the Brussels' index, data already correspond to capital gains. For the sake of comparability, the three indices are expressed on the same base of 1919=100. The following figure shows their evolution from 1919 to 1939.[23]

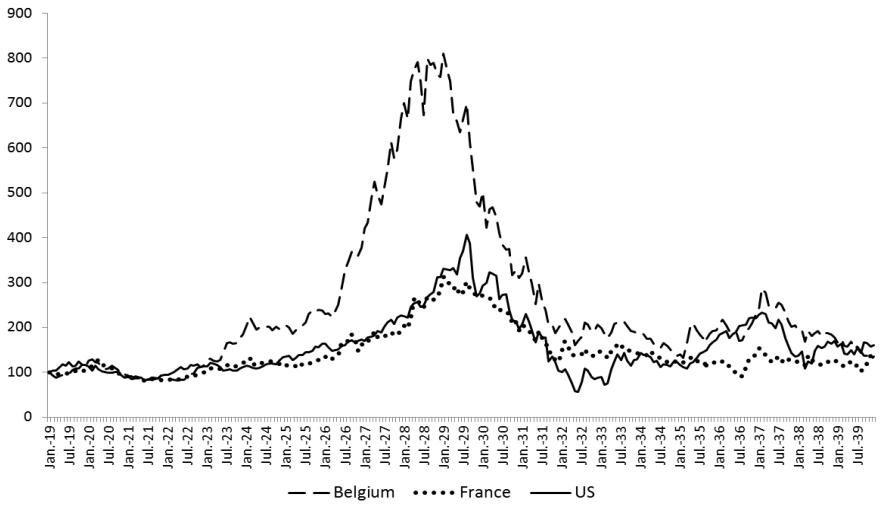


Figure 1 — Indices in nominal terms (1919=100)

[21] They also have data for both Antwerp and Liège stock exchanges, but here we only focus on stocks listed in Brussels. A precise description of the data is given in Annaert *et al.* (2015).

[22]Expressed in domestic currencies and nominal terms.

[23] We also transformed our nominal series in real terms by using the associated consumer price index for each series. Figure B1 (reported in Appendix B) plots the real series. Differences are visible among nominal and real terms especially for France and Belgium who suffered from inflation during the 1920's while the US remained on gold up to 1933, except for a short period between late 1917 and mid-1919.

Figure 1 shows rather clearly the different cycles of stock prices during the interwar. The common upward trend in the three series during the 1920s corresponds to the economic boom from 1926 to 1929. It is interesting to note here that for both France and Belgium, this upward trend starts when the currency was stabilized *de facto* (in mid-1925 for Belgium and late 1926 for France). For the three indices, maxima are reached in 1929, yet earlier for France and Belgium. The NYSE was then the center of international speculation and prices kept rising until the crash of October. The depression is then clearly identified in the series with a huge drop for all markets (particularly for the US) and it is interesting to note when the cycle finally reversed. For each series, prices continued to decrease until governments departed from gold: early 1933 for the US; mid-1935 for Belgium and late 1936 for France.

## *3.2. Cross-correlations between stock market*

In order to get first glimpses on the relationship between the Belgian, French and US stocks markets —and so to adopt an empirical approach consistent with the observations, we proceed to some preliminary analyses. More specifically, we compute pairwise correlations between the Belgian, French, and US stock market returns over three succeeding sub-periods defined according countries' exchange rate regime. The sub-periods examined are i) period I: from January 1919 to October 1926, period during which the two European currencies floated not only towards the US dollar but also against each other; ii) Period II: covering the gold exchange standard until US and Belgium's departure from gold respectively in June 1933 and March 1935; and iii) Period III from the end of period II to December 1939 when all countries devalued their currencies and adopted a regime of managed floats.

The results of the correlations are set out in Table 1.

Table 1 — Correlations between the stock market returns

| | **Period I** | | | **Period II** | | | **Period III** | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***BEL*** | ***FR*** | ***US*** | ***BEL*** | ***FR*** | ***US*** | ***BEL*** | ***FR*** | ***US*** |
| ***BEL*** | 1.000 | | | 1.000 | | | 1.000 | | |
| ***FR*** | 0.486 | 1.000 | | 0.631 | 1.000 | | 0.498 | 1.000 | |
| ***US*** | 0.096 | 0.196 | 1.000 | 0.626 | 0.482 | 1.000 | 0.453 | 0.299 | 1.000 |

Notes: The period I corresponds to observations before October 1926. Period II corresponds to observations between October 1926 and June 1933 for the correlation between the US and France and the US and Belgium; for the correlation between France and Belgium, period II corresponds to observations between October 1926 and march 1935. Period III correspond to the rest of the observations.

A first look at the stock market nominal returns shows that the correlations between the three stock markets are higher in period II compared to the other two periods. Indeed, focusing on the French and Belgian stock markets, the correlation is equal to 0.486 in period I then rises to 0.63 in period II before falling to 0.498 in period III. Looking at the US-Belgian and US-French stock market return correlations, we note an even more pronounced rise in the correlations in period II. The most striking rise is that of the correlation between the US and Belgium: in period I the correlation is around 0.1 then rises to 0.626 in period II. The correlation in period III is also important (0.453) although weaker than that in period II. These first results, showing that correlations are higher in average when countries' exchange rates regimes are pegged on gold, fits well with our intuition. At first glance, it seems therefore that there has been a tightening of the links between the three stock market returns during period II, i.e. the GES period. To go deeper into the analysis and especially to identify trends in the markets integration process, Figure 2 displays pairwise rolling correlations (50 months basis) between the different stock markets.

As can be seen, Figure 2 not only confirms our previous observations but also shed more light on the relationship between the three stock markets. Indeed, from the end of 1926, a clear upward trend can be observed in the correlation between the US and France, and between the US and Belgium. The upward correlation is more pronounced between the US and Belgium than between the US and France. In the latter case, the increase in the correlation is quite small from the end of 1926 to mid-1930 before increasing dramatically hereafter. For the correlation between France and Belgium, the picture is similar while variations in the correlations seem weaker. This confirms our previous results based on correlations computed over the three sub-periods. Another interesting outcome stemming from this time-varying analysis is that correlations between Belgium and the US, and France and the US remain high after June 1933. Indeed the coefficients only start to decrease when all countries left the monetary arrangement (March 1935 for Belgium and US, and September 1936 for France and US) and when the US consequently adopted a managed float exchange rate regime through the Exchange Stability Fund. Moreover, even after the US went off the gold exchange standard, many transactions occurred between New York and Paris precisely because the economic environment continued to be stable in the Gold Block members, while the US stock market begun to show signs of recovery after 1933. However, after late 1936, correlations decrease in every case, confirming a global reallocation process towards domestic markets.

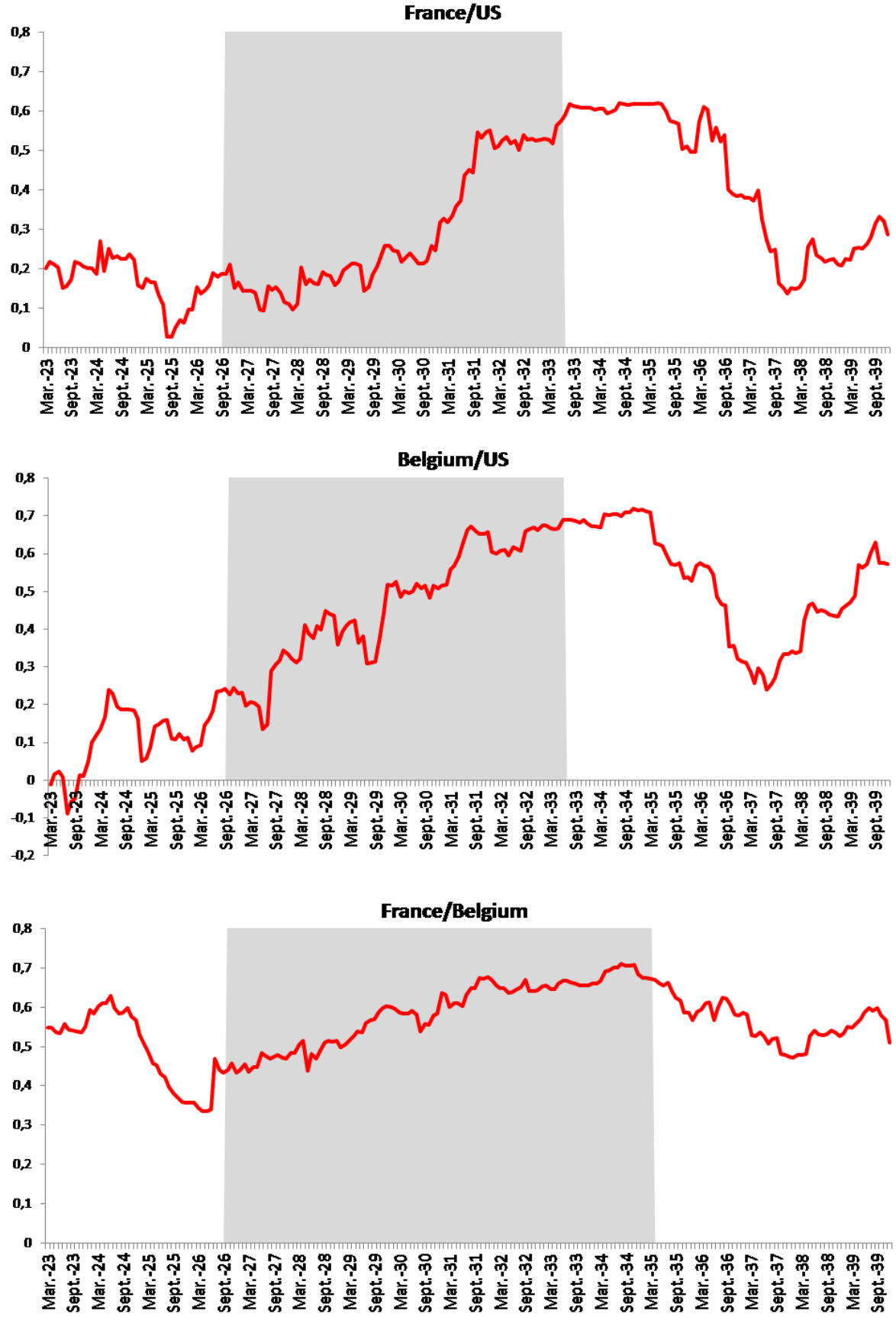


Figure 2 —Pairwise rolling correlations (50months' basis) on returns (in nominal terms)

Note: the shaded area corresponds to the period in which both countries operated under the gold exchange standard

# 4. The dynamics of stock markets integration

## *4.1. Methodology*

As we are interested in pairwise contemporaneous relationship between the stock markets (co-movements), we consider the following equation which linksthe domestic market returns with the foreign market returns — and augmented with lags:[24]

$$r_t = \alpha + \sum_{i=1}^{n} \beta_i \, r_{t-i} + \sum_{j=0}^{m} \gamma_j r^*_{t-j} + \delta \, US\,rec. + \varepsilon_t \;; \quad \varepsilon_t \sim N(0, \sigma^2_\varepsilon) \qquad (1)$$

Where$r_t$ (resp. $r^*_t$) is the domestic (resp. foreign) market return to control for unobserved global shocks we include a dummy variable $USrec$.scoring 1 if the US are in recession (0 otherwise).[25]$n$ and $m$ correspond to the number of lags selected; $\alpha$ is a constant and $\varepsilon_t$ is the error term.

Our econometric model, although simple, meshes perfectly with our goal. Indeed, in Equation (1), the coefficient associated with current foreign market returns ($\gamma_j$) captures the level of influence the foreign market has on the domestic market, and more specifically the interest of domestic investors in the foreign market. The estimated parameter therefore reflects, somehow, the nature of the domestic market agents' expectations. To get an idea on the interaction between the domestic and foreign markets, we simply run the regressions in both directions, i.e. considering alternatively the domestic and foreign markets as the dependent variable. Finally, the inclusion of lags in the specification meets the need to

[24]Vector Auto Regression (VAR)/ Vector Error Correction (VECM) models are often used to address issues similar to ours However, as we are interested in co-movements which imply a contemporaneous relationship between the variables —we consequently exclude VAR models. If VECM models offer this possibility, their estimation is however conditioned by the existence of a long-run relationship between the variables. As part of our preliminary analyses, we investigated the existence of a long-run relationship between the variables using the Engle-Granger and Johansen (both Trace and Maximum Eigenvalue) cointegration tests. Results —not reported but available upon request— indicate that the variables are not cointegrated therefore making irrelevant the use of VECM models.The absence of cointegration between the variables may come from the fact that monthly intervals are too long and consequently miss the co-variation in the prices of stocks traded in the markets. The frequency of the data also makes irrelevant the use of GARCH models.

[25]We use the US economic cycle as a summary statistic for the state of the global economic cycle, as the US dollar becomes the dominant international currency from the mid 1920's (Eichengreen and Flandreau, 2009).$USrec.$ is computed using information on the US Business Cycle Expansions and Contractions provided by the NBER (National Bureau of Economic Research).

account/control for delayed effects between the markets. Hence, our econometric model is in line with that of Chow et al. (2011).

Moreover, as there have been significant changes —over time— in the relationships between the Belgian, French, and US stock markets, the conventional practices of measuring the correlation of stock returns by means of a single coefficient slope in a linear model can lead to biased results since it limits the analysis to a monotonic correlation. Consequently, the ideal approach to analyze the relationships between the three markets is one that allows the coefficients to be time-varying. Accordingly, we begin by estimating Equation (1) on the different sub-periods considered before. Then, in a second stage, we rely on time-varying regressions and more specifically on rolling window regressions. Indeed, the main advantage of this approach is that it allows us to refine the analysis by showing trends (i.e. the dynamics of the coefficients) and breaks in the relationships between the markets.[26]

## 4.2. Results

For clarity and didactic purposes, we begin by examining the estimations based on the sub-periods before presenting the rolling window ones. Regarding rolling window regressions, we opted for a rolling window of 50 months to ensure a sufficient number of degree of freedom and thus enough statistical robustness of the coefficients. Furthermore, all our estimations include 4 lags —for each of the variable— as recommended by the Akaike Information Criterion (AIC). Let us begin with the analyses based on the nominal returns.

### *4.2.1. Sub-periods analysis*

Table 2 reports all the estimation results over the full sample as well as over the different sub-periods, and for each bilateral relationship between the market returns. For example, estimation results of the relationship between French and US stock markets are reported using alternatively the US and the French returns as the dependent variable. To save space, we report only the coefficients indicating the contemporaneous relationship between the stock markets or say differently, the influence of the foreign market on the domestic one. These coefficients are reported in the lines indexed by $r_t^*$.

[26]Furthermore, the rolling window approach does not require extra assumptions regarding the coefficients or the data generating process. As a result, this approach is relatively simple and intuitive hereby facilitating the comprehension and the coefficients' interpretation.

| Dep. var: | ***US*** | | | | | ***France*** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Full sample | Period I | Period II | Period III | | Full sample | Period I | Period II | Period III |
| $r_t^*$ | **0.489**$^{***}$ (4.77) | 0.119 (1.38) | **0.621**$^{***}$ (3.06) | **0.325**$^{**}$ (2.56) | $r_t^*$ | **0.256**$^{***}$ (6.03) | 0.145 (1.37) | **0.246**$^{***}$ (3.98) | **0.173**$^{**}$ (2.33) |
| $R^2$ | 0.23 | 0.21 | 0.38 | 0.21 | $R^2$ | 0.18 | 0.11 | 0.31 | 0.30 |
| Obs. | 247 | 88 | 80 | 79 | Obs. | 247 | 88 | 80 | 79 |
| Dep. var: | ***US*** | | | | | ***Belgium*** | | | |
| | Full sample | Period I | Period II | Period III | | Full sample | Period I | Period II | Period III |
| $r_t^*$ | **0.534**$^{***}$( 6.91) | 0.048 (0.54) | **0.726**$^{***}$ (6.39) | **0.522**$^{***}$ (2.97) | $r_t^*$ | **0.409**$^{***}$ (7.69) | 0.096 (0.54) | **0.443**$^{***}$ (6.34) | **0.385**$^{***}$ (5.44) |
| $R^2$ | 0.34 | 0.29 | 0.53 | 0.32 | $R^2$ | 0.28 | 0.16 | 0.46 | 0.30 |
| Obs. | 247 | 88 | 80 | 79 | Obs. | 247 | 88 | 80 | 79 |
| Dep. var: | ***France*** | | | | | ***Belgium*** | | | |
| | Full sample | Period I | Period II | Period III | | Full sample | Period I | Period II | Period III |
| $r_t^*$ | **0.452**$^{***}$ (9.83) | **0.405**$^{***}$ (3.53) | **0.483**$^{***}$ (8.91) | **0.452**$^{***}$ (4.24) | $r_t^*$ | **0.659**$^{***}$ (8.85) | **0.575**$^{***}$ (4.99) | **0.725**$^{***}$ (5.75) | **0.615**$^{***}$ (4.18) |
| $R^2$ | 0.35 | 0.31 | 0.45 | 0.43 | $R^2$ | 0.34 | 0.37 | 0.44 | 0.36 |
| Obs. | 247 | 88 | 101 | 58 | Obs. | 247 | 88 | 101 | 58 |

Notes: ***, **, * indicates statistical significance at 1%, 5%, and 10%. *t*-statistics are reported in parentheses. The period I corresponds to observations before October 1926. Period II corresponds to observations between October 1926 and June 1933 for the correlation between the US and France and the US and Belgium; for the correlation between France and Belgium, period II corresponds to observations between October 1926 and march 1935. Period III correspond to the rest of the observations. In all the regressions we consider 4 lags as suggested by the AIC.

Table 2 — Co-movements between the stock market returns (in nominal terms)

As indicated by the results displayed by sub-periods, the co-movements between stock returns have not been constant over time. Indeed, as can be observed, the effect of the French market on the US market in period I is very small (0.119) and above all not significant. The coefficient then dramatically increases in period II, reaching 0.621 before falling in period III to 0.325. A similar pattern emerges when considering the effect of the US returns on the

French returns, although of weaker magnitude. The US effect appears significant and stronger during period II before decreasing in the following period. Overall, in both cases (from France to US and from US to France), there is an increase in the coefficients in period II therefore illustrating a tightening of the links between the two markets under the GES period. The same conclusion emerges from the co-movements between Belgium and the US: the coefficients are always higher in period II. However, during this period, the influence of the US stock market on the two European countries is lower than the mutual influence between the two European stocks markets,[27] suggesting the importance of geographical and cultural proximity in the financial integration process.

Finally, while the relationship between the Belgium and the French stock returns also shows higher coefficients during period II compared to the other periods, the magnitude of changes in these coefficients is however weaker and the estimated coefficients —and their significance—indicate a relatively high degree of integration between the Belgian and French markets over the full period. An interesting —and noteworthy— point to make is the greater influence of the French market on the Belgian one. Indeed, regardless the considered sub-periods, the coefficient reflecting the effect of the French market on the Belgian one is always higher than the coefficient capturing the effect of the Belgian market on the French one, reflecting the dominant position of Paris vis-à-vis Brussels as an international financial center.

### *4.2.2. Rolling window regressions analysis*

To take a closer look at the relationship between the stock markets, Figures 3 to 8 display the evolution of the estimated coefficients capturing the influence of one market on the other ($\gamma_j$ in Equation 1). Overall, the results tend to confirm our previous findings.

[27]For example, during period II, the coefficient of the US return relative to the French (Belgian) one is around 0.246 (0.443) while the coefficient of the Belgian (French) return relative to the French (Belgian) one is around 0.483 (0.725).

***The France- US case***

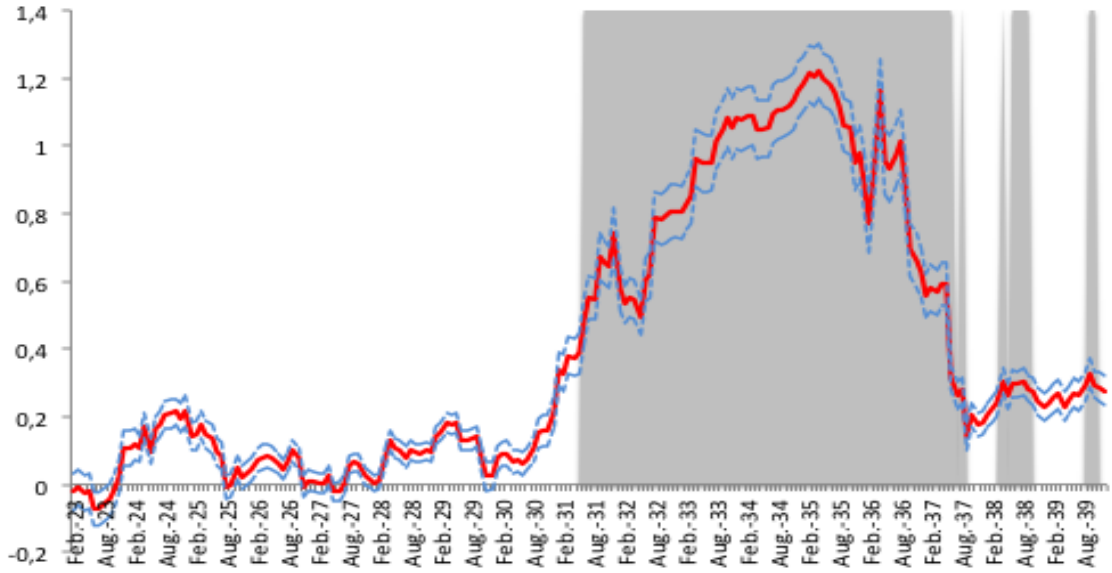


Figure 3 — Influence of the French market on the US market (nominal returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

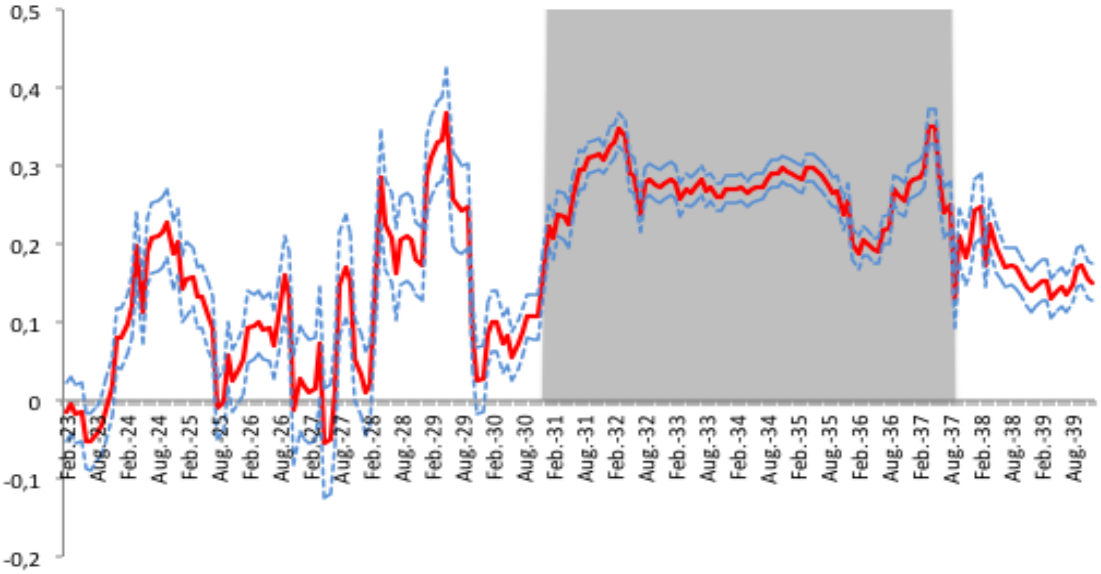


Figure 4 — Influence of the US market on the French market (nominal returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

Looking first at the US-France case, we note that in both ways, the relationship between the returns only become —statistically— significant around 1931. One can easily observe the upward trend for both coefficients starting in the early 1930's. Indeed, the

influence of the French returns on the US market is very low and not statistically significant before late 1930. For the opposite relationship (i.e. the influence of New York on Paris), the evolution of the coefficient is very volatile and not significant —at a 5% threshold— neither. Several reasons can explain this result. The first reason is that the French economy had a limited exposure to international fluctuations up to mid-1930-1931. For example, the great crash in Wall Street in late October 1929 had almost no impact on the Paris' Bourse in the short-term (see Hekimian and Le Bris, 2016). Nevertheless, both coefficients become statistically significant in late 1930-early 1931. The influence of Paris on New-York follows a bell curve, increasing up to mid-1935 and then decreasing until mid-1937.[28]It reaches two peaks: first in March 1935, and then in mid-1936 which correspond respectively to the devaluation of the Belgian and the French franc.

James (1992) provides interesting insights regarding the growing influence of the French stock market at the beginning of the 1930's. First, after the Creditansalt's failure during the spring 1931 and the subsequent financial crisis in central and oriental Europe, France became a "*major center for funds moving out of central Europe*" (page 600). To justify the fact that French market was then considered as a safe haven, the author suggests to look at the rise in private deposits at the *Banque de France*. Indeed, if one looks at the recently available data from the *Banque de France*, the total amount of private deposits more than doubled between March and December 1931, going approximately from 10 to 22 billion francs. Second, it seems that the sterling crisis indirectly reinforced the capital inflows to France. Indeed, after the UK went off gold, the US became the only international short-term debtor left on the Gold Standard and hence, faced risks of withdrawals. In fact, large outflows occurred in the US in late September and October 1931: around $ 250 million in gold were shipped to France (James, 1992). Again in 1933, when the fear of US abandoning gold started to grow, a new round of gold outflows took place from February onwards: the Federal Reserve Bank of New-York lost three-fifth of its gold reserve and it caused several bank runs and even a bank holiday in March. According to James (1992), it resulted in a "*pronounced outflow of capital, a substantial proportion of which went to France*" (page 605).

[28] We note however two important perturbations. The first —on the upward trend— coincides with the UK's gold exchange standard exit (September-October 1931 on the graph) and is associated with a drop in the estimated coefficient of around 20 percentage points. The second perturbation occurs in late 1935, early 1936. According to Dessirier (1936), stock prices were decreasing in early 1936 in Paris while prices were increasing in every other stock exchange of large economies. The author evokes the rising political instability before the election of April. This could explain the decreasing interest of foreign investors for the French market.

Moreover, the years 1929 and 1930 saw efforts from the Paris stock exchange towards enhancing its short-term international financing (Brown, 1940; Myers, 1936). Even if this was not done, Myers (1936) outlines that the stock exchange of Paris was more an investment market than an acceptance market. Efforts were made to facilitate the exchange of foreign securities, for instance through a tax cut on their dividends. The minutes of the French stockbroker company reports many quotes showing the need to modernize the foreign exchange. There were however several improvements made that led to an expanded foreign exchange service.[29]The laws of 1916 and 1918 placed severe restrictions: indeed, under the law of May the 31st1916, the admission to official listing of new foreign securities required the permission of the minister, while the law of April the 3rd 1918 prohibited sales of securities to nonresidents.[30] But in the 1930's, many stockbrokers were in fact willing to list new foreign securities, especially from early 1931 and on.[31]

Besides, other quotes from the French stockbrokers suggest that Paris became more important againfrom an international perspective, especially after UK went off gold. On September the 15th, so less than one week before UK's exit, we can read: "*The current situation (persistent decrease in stock prices) comes mostly from foreign investors' sales that are done in Paris precisely because of the healthy position of our market*". We also note that relations with the New-York financial place were increasing in 1932: on September the 20th:" *A French stockbroker would like to open a special account to ease trading with New-York*"; on November the 10th:" *While the Paris market only deals with a small number of foreign securities, many brokers from New-York opened offices in Paris to get buying orders from French clients on American securities, without paying French taxes.*"[32] In order to support this new feature of Paris as an international financial center, an extra session was established on the afternoon, when Wall Street was opened. The purpose of this session was to benefit from potential arbitrages among stock exchanges which implied more foreign securities listed.

***The Belgium - US case***

[29] For example, phones were installed in 1924-25 in order to ease currency trades.
[30] However, Quennouëlle-Corre (2015) explains how difficult the 1918 law was to apply. This still lasted until 1928.
[31] See, among others, minutes of the Stockbrokers guild from 02/06/1931; 04/30/1931: 11/12/ 1931; 01/28/1932; 03/04/1932: 07/28/1932.
[32] The next week, the Minister of Finance said that he was in favor of the listings of four large American companies: American British Tobacco, General Electric, AT&T, United States Steel Corp.

Looking now at the Belgium-US relationship, one can observe that the estimated coefficients display a similar pattern compared to the France-US case. Indeed, the influence of the Belgian market returns on the US market returns also displays a bell-shaped evolution over time. As in the France-US case, the effect of Brussels on New York is not significant during the first period (before October 1926). Periods II and III are the most instructive regarding the relationship. In fact, both periods witnessed a succession of —marked— upward and downward trends. Among these trends, the most noticeable is undoubtedly the upward one observed between the first half of 1927 and March 1935 (see Figure 5). This feature is consistent with the growing internationalization of the Belgian market starting in 1927 (Bussière 1992).If the reversal of this trend corresponds with the Belgium exit of GES(March 1935), it is interesting to note that the US exit which occurred earlier (April 1933) did not really modified the dynamics of the Belgian stock market returns' coefficient as the UK exit in September 1931 did.[33]As we stated above, the creation of the Exchange Equalisation Account in Britain and the Exchange Stability Fund in the US were most likely the main reasons explaining the tightness of the links after 1933.

The Belgian exit from the GES in 1935seems to have had a deleterious effect on the relationship between the Belgian and US markets. Indeed, the coefficient associated with the effect of Brussels on New York fell by 26%between March 1935 and April 1935, followed by a slight increase and a short stability. Then from the second half of 1936 up to July 1937, the coefficient again fell sharply, before once again taking off on an upward trend associated with "important" perturbations occurring in September 1937, October 1938, and June 1939.

The influence of the US market on the Belgian market (Figure 6) is neither statistically significant during period I.But the coefficient dramatically increases in mid-1927 and becomes significant simultaneously. Despite some fluctuations, it remains relatively high until mid-1931. Then, there is a clear downward trend between 1931 and 1937 and a smooth resumption thereafter. The relationship has remained statistically significant until the end of the period.

For the US-Belgian case, the shaded area in which the relationship between the two markets is significant starts earlier: from late 1927 up to 1939. As for the previous case, but even more surprising, the influence of the Belgian returns on the US ones seems to be higher at some point. The difference lies in the date of the reversal: the coefficient for the Belgian returns gets higher in September-October 1931, so right after the sterling crisis.

[33]This observation also noted in the France-US case supports and complements the abovementioned importance of the British stock market at that time.

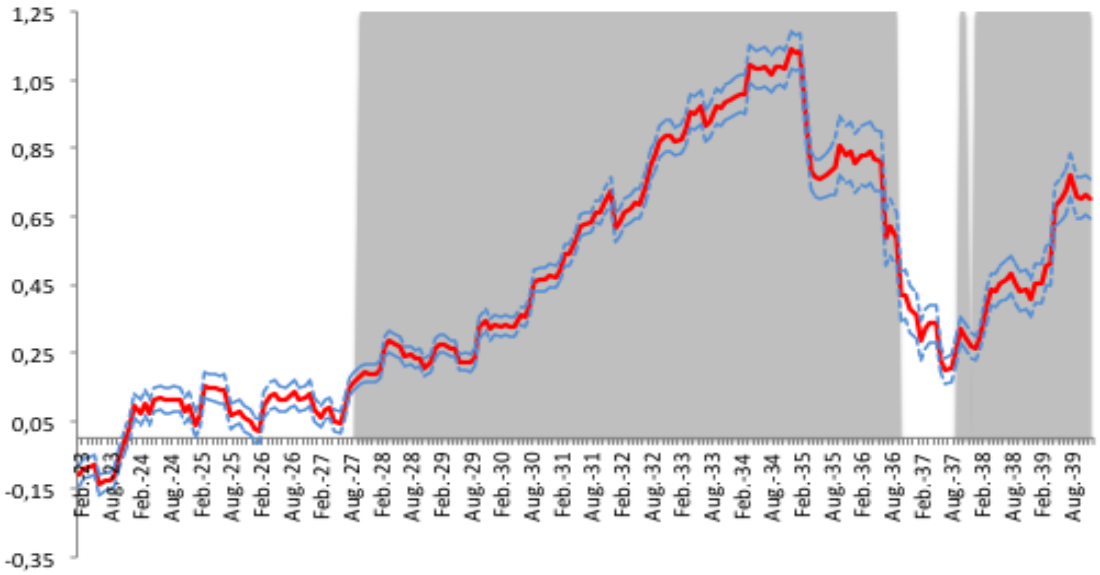


Figure 5 — Influence of Belgian market on the US market (nominal returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

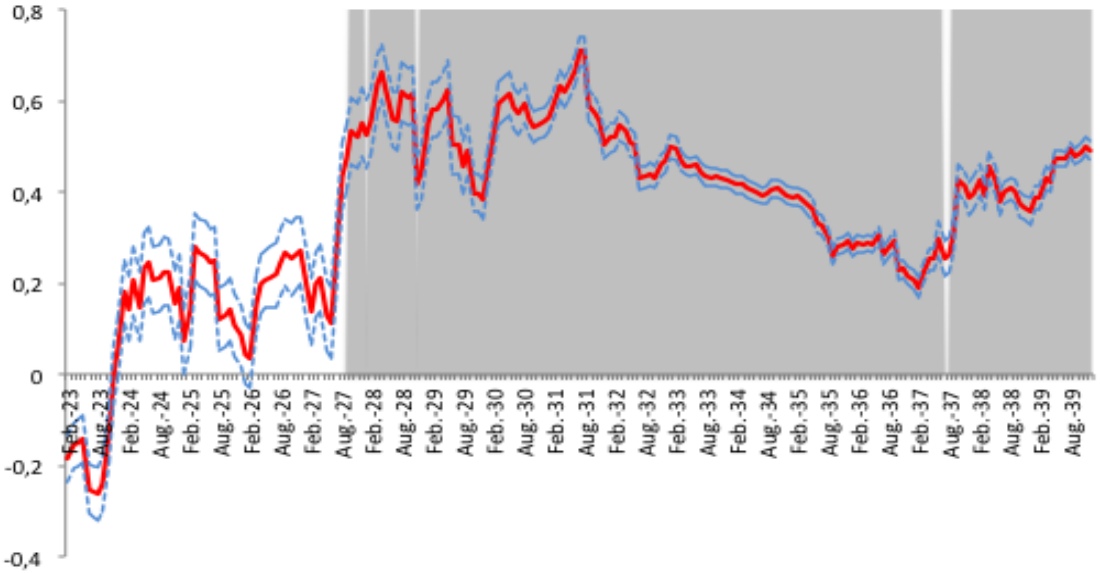


Figure 6 — Influence of the USmarketon the Belgian (nominal returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

***The France - Belgium case***

The relationship between the returns of Paris and Brussels is statistically significant in either direction during the inter-war period. Even though there were some disturbances on both markets in the early 1920's, especially with the crisis of the French franc during 1924-26, it seems that the two markets stayed closely tied. Whereas the influence of Brussels over Paris (Figure 7) remains in the same fluctuation band (between 0.3 and 0.6), the influence of Paris over Brussels (Figure 8) after having increased in 1923-24 decreases until late 1927. There is then an upward trend until mid-1931. This trend denotes the increasing role of Paris as an international financial center. Buissière (1992) states that in 1927-28 a capital shortage occurred on the Belgian capital markets while there was an expansion of capital flows directed to the Paris' stock exchange. After 1931, the coefficient falls back and remains quite stable until the devaluations of 1935 in Belgium and 1936 in France.

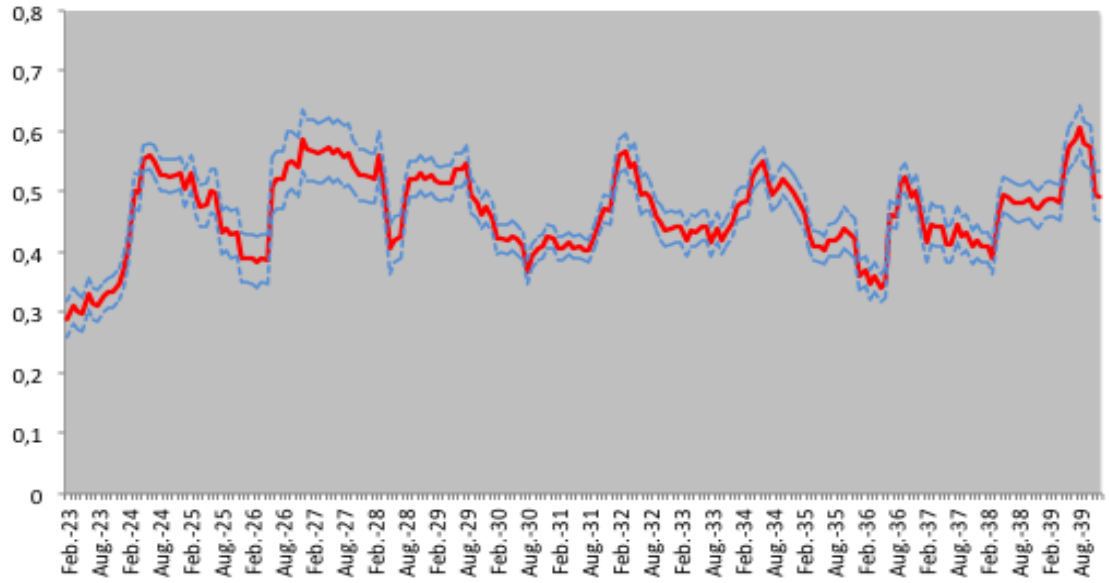


Figure 7 — Influence of the Belgian market on the French market (nominal returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

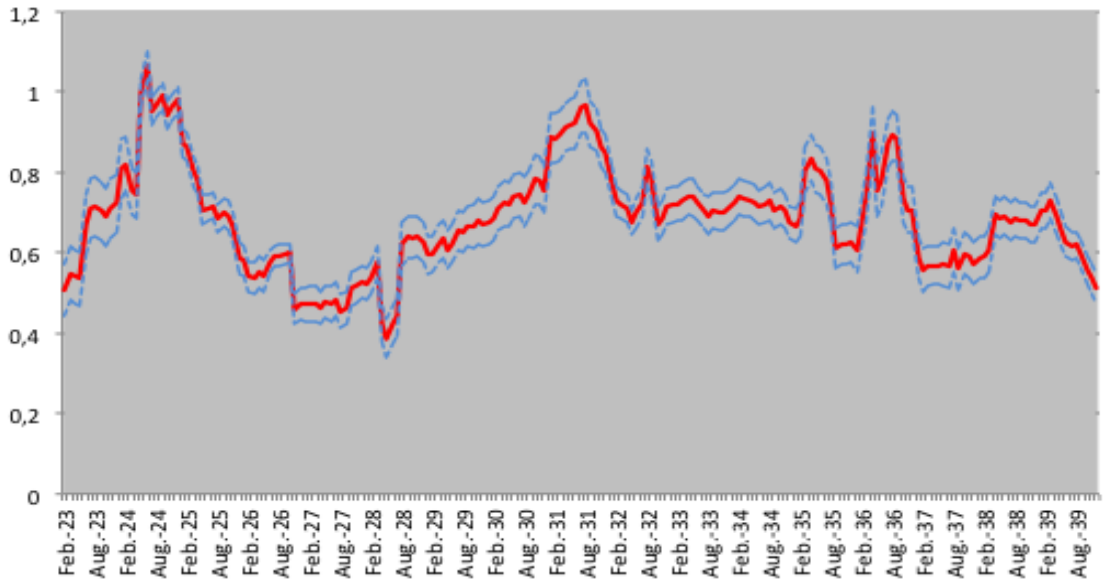


Figure 8 — Influence of the French market on the Belgian market (nominal returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

## 5. Conclusion

The aim of this paper was to investigate the effect of monetary integration on stock market correlations during the interwar period, with a particular interest on the interactions between European gold bloc members and the US. For data quality purposes, we focused on the Belgian and the French stock markets. The main contribution of the paper lies in the attention put on bilateral financial links in a time-varying framework. First, the rolling correlation exercise shows the precise timing of the stock markets'tightening which argues in favor of the importance of the exchange rate regime. In previous analyses of stock market correlations over the long run, many authors outlined that the increased average correlation among capital markets in the late 1920s was the result of rising volatility in stock prices due to the Great Crash of October 1929 in New-York and the subsequent depression. Our results show that cross-correlations increased before the beginning of the international financial crisis of the 1930s, with a tightening of the linkages among the three financial places during the GES period. Financial integration between the second half of the 1920s and the first half of the 1930s made investors able to diversify their investments when the major currencies were stabilized. It may also explain how large capital flows were possible even though legal restrictions and capital controls were supposed to be effective after WWI, as it was the case in France. Finally, this paper provides a relevant case study to illustrate the potential

consequences of a departure from a fixed exchange regime on capital markets integration. We can easily imagine what it would be like if a large economy departed from a currency union such as the Eurozone.

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# Appendices

## Appendix A. Data

Table A1 – The data

| Variables | | Definitions | Sources |
|---|---|---|---|
| ***Stock market index*** | | | |
| | Belgium:*SCOB40* | 40 stocks, weighted by market capitalization, monthly | SCOB database |
| | France:*CAC40* | 40 stocks, weighted by market capitalization, monthly | Le Bris and Hautcoeur (2010) |
| | US:*S&P500* | Average 90 stocks, weighed by market capitalization, monthly | GFD |
| | | | |
| ***Stock marketreturns*** | | | |
| | | | |
| ***Deflators*** | | | |
| | Belgium | Purchase Power of the Belgian franc on yearly basis (= 1/CPI) | Van de Velde (1943) |
| | France | Consumer Price Index / yearly basis | WTID |
| | US | Consumer Price Index / monthy basis | NBER |
| | | | |
| ***US recessions*** | | | NBER |
| | | | |

Notes :
*NBER* : *National Bureau of Economic Research*
*WTID: World Trade and Income Database*
*Van de Velde (1943):"Le rendement des placements 1865-1939"*

# Appendix B. Results based on real returns

## B.1. Descriptive and preliminary analyses

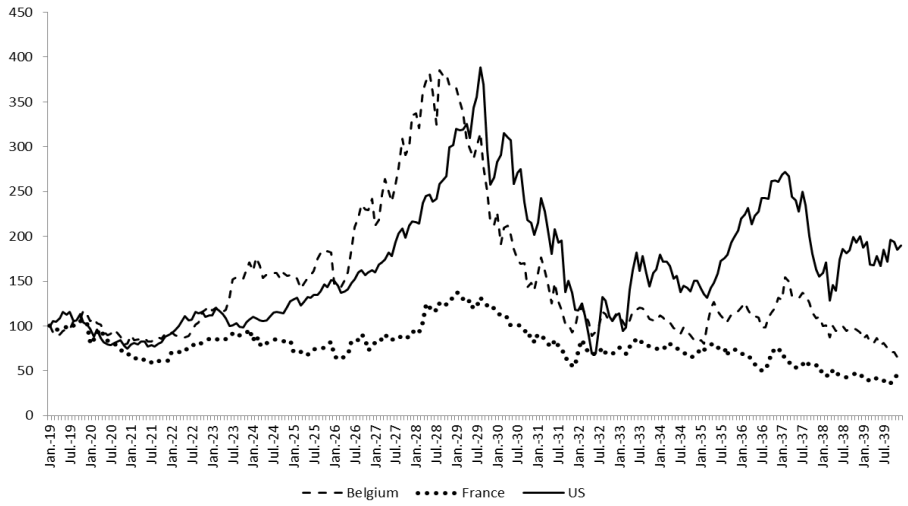


Figure B.1 — Returns in real terms (1919 =100)

Table B.1 — Correlations between the stock market returns (real returns)

| | **Period I** | | | **Period II** | | | **Period III** | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***BEL*** | ***FR*** | ***US*** | ***BEL*** | ***FR*** | ***US*** | ***BEL*** | ***FR*** | ***US*** |
| ***BEL*** | 1.000 | | | 1.000 | | | 1.000 | | |
| ***FR*** | 0.519 | 1.000 | | 0.628 | 1.000 | | 0.496 | 1.000 | |
| ***US*** | 0.123 | 0.155 | 1.000 | 0.616 | 0.451 | 1.000 | 0.445 | 0.241 | 1.000 |

Notes: The period I corresponds to observations before October 1926. Period II corresponds to observations between October 1926 and June 1933 for the correlation between the US and France and the US and Belgium; for the correlation between France and Belgium, period II corresponds to observations between October 1926 and march 1935. Period III correspond to the rest of the observations.

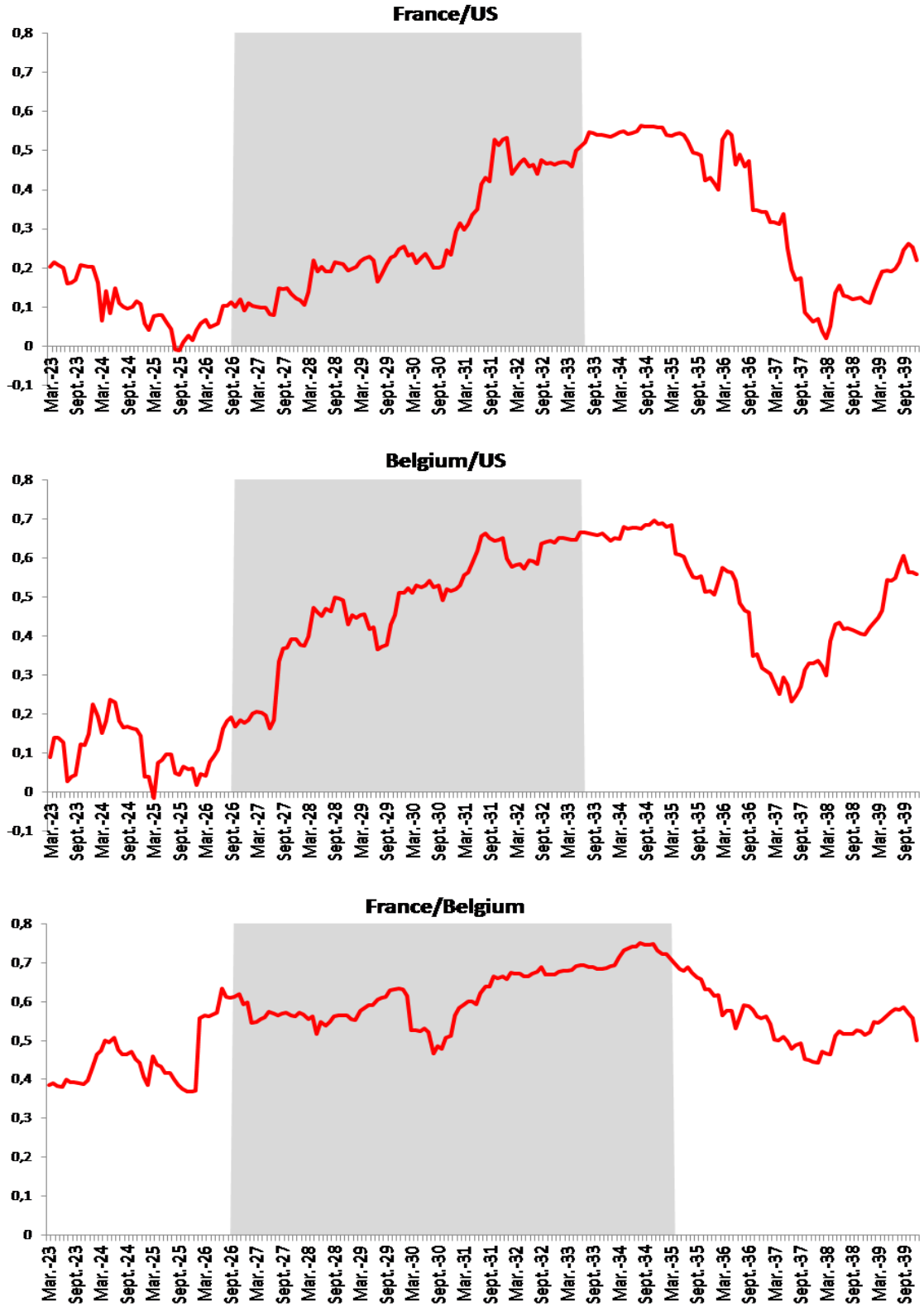


Figure B.2 — Pairwise rolling correlations (50 months' basis) on returns (in real terms)
Note: the shaded area corresponds to the period of when both country are on gold

## B.2. Econometric analyses

Table B.2 — Co-movements between the stock market returns (in real terms)

| Dep. var: | ***US*** | | | | | ***France*** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Full sample | Period I | Period II | Period III | | Full sample | Period I | Period II | Period III |
| $r_t^*$ | **0.343**$^{***}$ (4.01) | **0.102**$^{*}$ (1.73) | **0.534**$^{***}$ (2.81) | 0.163 (1.25) | $r_t^*$ | **0.239**$^{***}$ (5.58) | 0.212 (1.45) | **0.258**$^{***}$ (3.79) | 0.115 (1.19) |
| $R^2$ | 0.18 | 0.13 | 0.37 | 0.24 | $R^2$ | 0.14 | 0.12 | 0.26 | 0.29 |
| Obs. | 247 | 88 | 80 | 79 | Obs. | 247 | 88 | 80 | 79 |

| Dep. var: | ***US*** | | | | | ***Belgium*** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Full sample | Period I | Period II | Period III | | Full sample | Period I | Period II | Period III |
| $r_t^*$ | **0.512**$^{***}$ (6.69) | 0.092 (1.18) | **0.679**$^{***}$ (5.90) | **0.495**$^{***}$ (2.98) | $r_t^*$ | **0.411**$^{***}$ (7.97) | 0.174 (1.13) | **0.465**$^{***}$ (6.19) | **0.373**$^{***}$ (5.31) |
| $R^2$ | 0.31 | 0.20 | 0.51 | 0.30 | $R^2$ | 0.25 | 0.14 | 0.41 | 0.28 |
| Obs. | 247 | 88 | 80 | 79 | Obs. | 247 | 88 | 80 | 79 |

| Dep. var: | ***France*** | | | | | ***Belgium*** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Full sample | Period I | Period II | Period III | | Full sample | Period I | Period II | Period III |
| $r_t^*$ | **0.513**$^{***}$ (8.77) | **0.562**$^{***}$ (4.71) | **0.503**$^{***}$ (6.71) | **0.587**$^{***}$ (4.78) | $r_t^*$ | **0.592**$^{***}$ (9.25) | **0.515**$^{***}$ (3.89) | **0.713**$^{***}$ (6.44) | **0.582**$^{***}$ (4.46) |
| $R^2$ | 0.36 | 0.38 | 0.46 | 0.49 | $R^2$ | 0.33 | 0.34 | 0.43 | 0.48 |
| Obs. | 247 | 88 | 101 | 58 | Obs. | 247 | 88 | 101 | 58 |

Notes: ***, **, * indicates statistical significance at 1%, 5%, and 10%. *t*-statistics are reported in parentheses. The period I corresponds to observations before October 1926. Period II corresponds to observations between October 1926 and June 1933 for the correlation between the US and France and the US and Belgium; for the correlation between France and Belgium, period II corresponds to observations between October 1926 and march 1935. Period III correspond to the rest of the observations. In all the regressions we consider 4 lags as suggested by the AIC.

***The France-US case***

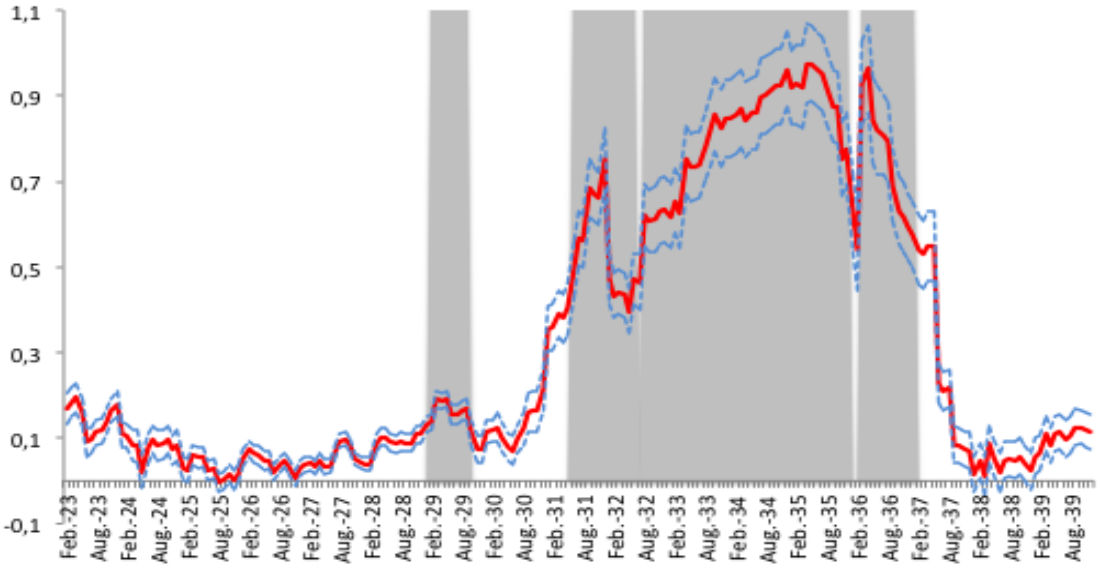


Figure B.3 — Influence of the French market on the US market (real returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.


Figure B.4 — Influence of the US market on the French market (real returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

***The Belgium-US case***

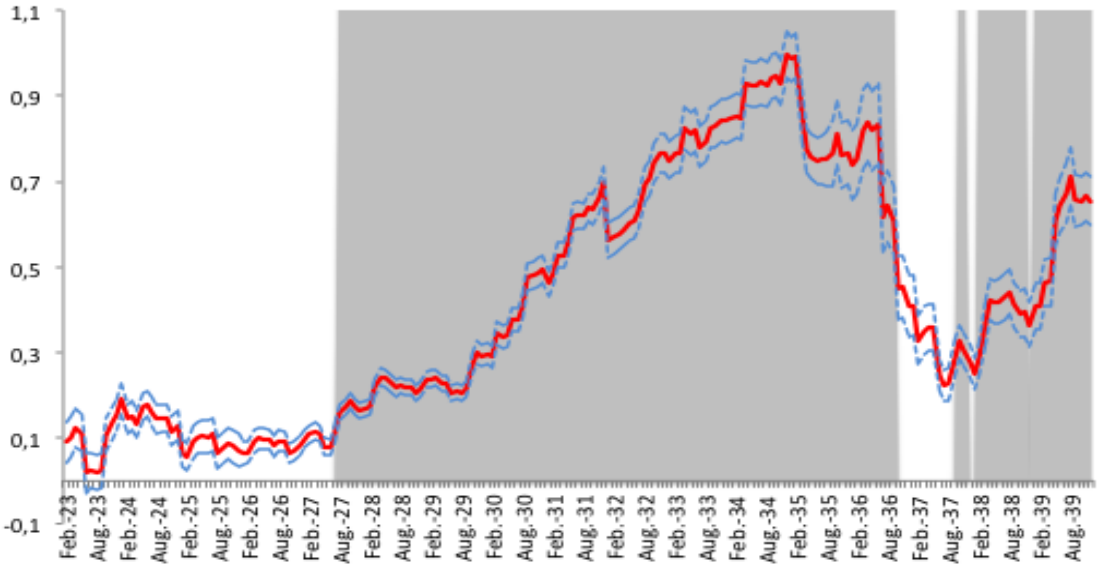


Figure B.5 — Influence of the Belgian market on the US market (real returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

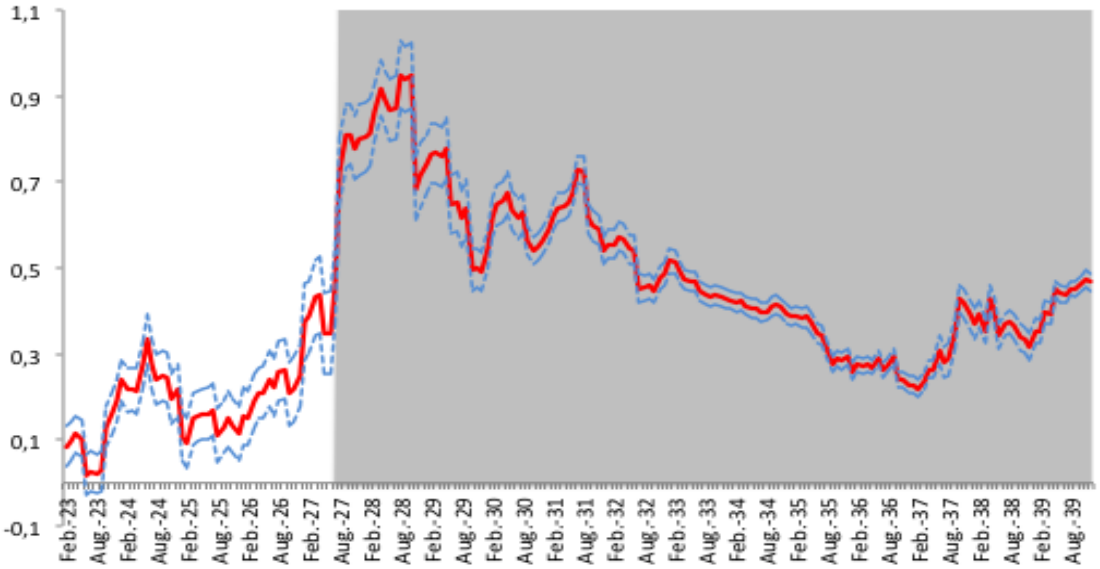


Figure B.6 — Influence of the US market on the Belgian market (real returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

***The Belgium-France case***

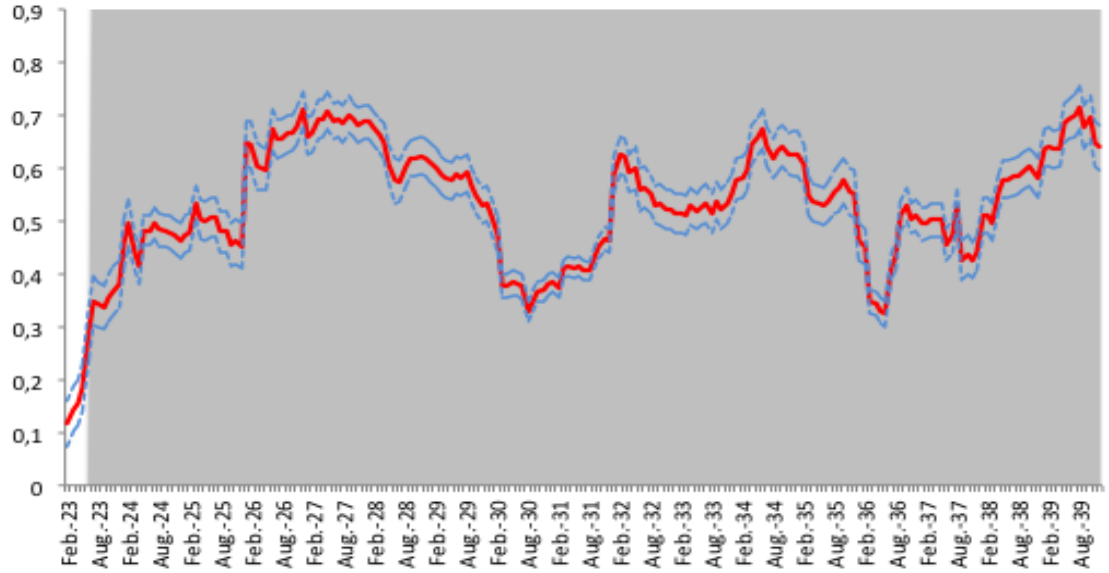


Figure B.7 — Influence of the Belgian market on the French market (real returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.

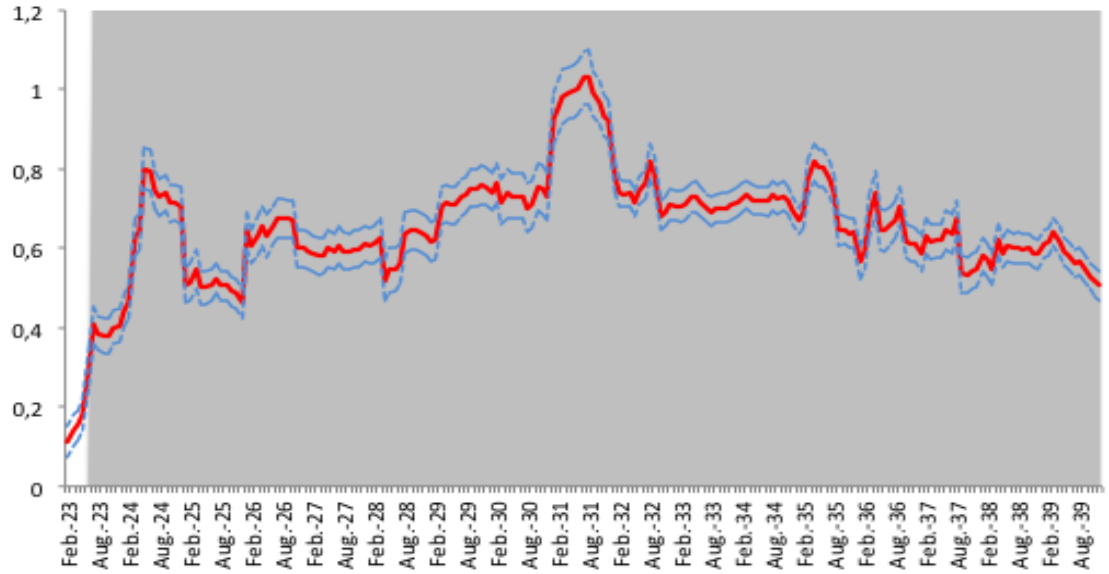


Figure B.8 — Influence of the French market on the Belgian market (real returns)

Note: The bold line shows the evolution of the coefficient over time. The dashed lines delimit the confidence interval. The shaded area indicates significance of the coefficient at 5%.