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Abstract

Financial economists have in recent times begun to analyze the reasons for and determinants *of* the non-zero cross-currency basis swap spread, a measure of the extent of deviations from covered interest parity (CIP) and risk-less arbitrage. They have however not examined the potential effects of the basis on the market performance of major asset classes, particularly the riskiest asset class – stocks – and how stock markets behave in response to changes in the basis. This paper addresses this question by examining how stock returns in the eurozone respond to changes in and shocks to the euro cross-currency basis. Our results show that there is a positive relationship between changes in the basis and stock market returns. Wider deviations from CIP go pari-passu with declines in stock returns, especially for the long-end basis. The relationship is strongest and most significant during periods of crisis but is generally preserved across the whole sample period. Although the effect of global risk sentiment, proxied by the VIX, on returns is generally the strongest, we show that the positive relation between stock returns and changes in the basis is preserved even after controlling for VIX, dollar exchange rate and other stock-return drivers.

Keywords: Cross-currency basis, stock market returns, exchange rates and risk sentiment

JEL Classifications: F3, G1, G2

1. Introduction

In recent times, several studies on covered interest parity (CIP) deviations have emerged. These studies have improved our collective understanding of the failure of CIP. The bulk of these studies have examined, in significant detail, the reason (*why*) for the existence of the basis, the determinants (*what*) of the basis and the characteristics (*behavior*) of the basis (for example, see Baba et al. (2008), Baba et al. (2009), Coffey et al. (2009), Griffolli and Ranaldo (2011); Bottazzi et al. (2012); Avdjiev et al. (2018), Du et al. (2018) and Liao (2019)). In a similar vein, others have investigated the monetary and macroprudential drivers of the basis (see Ivashina et al. (2015), Rime et al. (2017) and Cerutti et al. (2019)) while a growing number of studies have attempted to establish long-run links between the basis and macroeconomic factors (see Baran and Witzany (2017), Ibhagui (2018, 2019). All of these studies have one thing in common – they have investigated in broad terms the causes and largely ignored the effects or implications of CIP deviations for asset classes such as equities, thereby creating a vacuum in the literature. The outcome of this vacuum is that the effects of changes in cross-currency basis spreads on asset classes in the financial markets remain unknown. This paper initiates a campaign to fill this void and addresses this question by examining how stock returns respond to changes in and shocks to the euro cross-currency basis.

Thus, in this paper, we initiate a strand of studies that would focus on examining the response of different asset classes to changes in the cross-currency basis. As a start, our main objective is to examine how stock market returns behave in response to changes in the basis across maturities. For now, we will focus first on the eurozone, with plans to extend our coverage to the G10 regions and the entire emerging markets (EM) in subsequent studies, as the euro cross-currency swap market is the largest and most liquid globally.

An understanding of how asset classes in general, and stock market returns in particular, behave in response to variations in the cross-currency basis is imperative for several reasons. First, knowledge of the response of an asset class to changes in the basis is relevant for optimal management of portfolios of diversified asset classes. It would increase the likelihood of rebalancing portfolios more appropriately in anticipation of shocks that could alter the evolution of cross-currency basis spreads. Second, the variation in cross-currency basis carries in it some vital information that can help gauge the general sentiment on the market and the corresponding effect on performance. For instance, if the cross-currency basis widens because either inflow from outside sources have reduced or outflows from inside sources have increased, that could send a signal to the market which could influence performance asset classes. As an illustration, if the euro basis becomes wide and more negative, a dollar investor seeking arbitrage profit would be more likely to take positions in eurozone fixed income assets hedged into U.S dollars than in eurozone equities. If a large amount of dollar investors threads this path and domestic demand for equities does not offset lower demand from offshore, then stock performance would fall, lowering stock returns. In a similar vein, if there is a general market occurrence that raises uncertainty in the market and causes the basis to widen, the equity market is also likely to underperform. Thus, we would expect the response of stock market returns to changes in cross-currency basis to be positive: when the cross-currency basis widens, stock market returns worsen and when they tighten, stock market returns improve. We investigate the validity of this hypothesis in this paper using euro area data.

Our stock market returns are the logarithmic changes in the Euro Stoxx 50 Index. The Euro Stoxx 50 Index is the leading stock index for the eurozone and provides a blue-chip representation of super-sector leaders in the euro area monetary union. The index covers major 50 listed stocks from 11 eurozone countries. To get a broader understanding of the effects of the cross-currency basis at different maturities on the stock returns, we choose the basis spread at the short end (3-month) and long end (5-year) as is customary in the literature (see Avdjiev et al. (2018) and Cerutti et al. (2019)). We also draw from the literature a few other market variables that have been found to drive stock returns at a high frequency (see Haris et al. (1991), Fang and Loo (1994), Thorbecke (1997), Gozluklu and Morin (2015) and Qadan et al. (2019). Our empirical analysis is in two folds. First, we perform a step-by-step time series regression of changes in the basis on stock returns, each time increasing the amount of control variables included in the regression to ensure robustness of results. Second, we investigate the dynamic response of stock market returns to changes in cross-currency basis by performing standard impulse response analysis in a VAR framework.

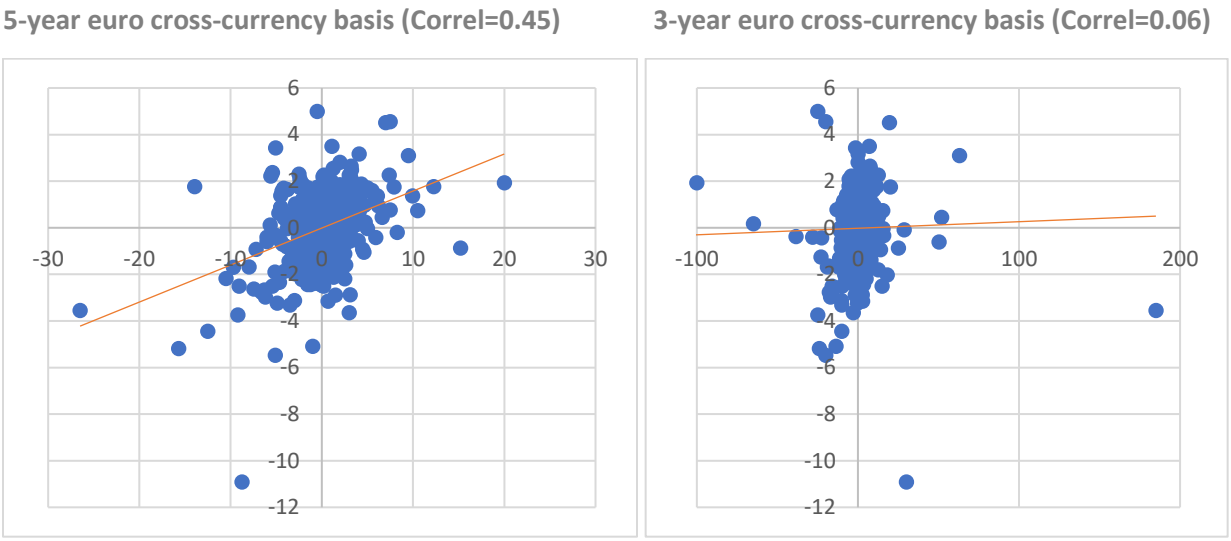
Interestingly, we find that wider deviations from CIP are associated with declines in stock returns in the eurozone, especially for the long-end basis. Particularly, our results suggest that the effect of changes in the basis on stock market returns is stronger for the 5-year basis than the 3-month basis. The 5-year euro

basis bears a positive relationship with eurozone stock returns. The relationship holds for the entire sample period considered and is especially strong and very significant during the eurozone crisis and the global financial crisis, whereas we find strong evidence that this positive relationship with stock returns holds for the 3-month basis only during the eurozone crisis. Our impulse response analysis generally supports the results obtained from the standard multiple regression analysis. On the whole, our results are robust to the inclusion of several control variables identified in the literature as potential drivers of stock returns. In times of market stress, we show that changes in cross-currency basis are significant in explaining stock returns in the eurozone. Unlike existing studies that investigate the causes of the basis, the reason for its persistence as well as its market determinants, we take one step further to investigate the effect of the basis in explaining asset market performance, particularly how stock returns behave in response to changes in the basis. Thus, the major contribution of our paper is in linking CIP deviations to stock performance. Overall, our finding is new and points to the role of CIP deviations as a potential factor in explaining variations in stock market returns across countries.

Why do stock market returns decline when CIP deviations worsen? We reason that a wider euro basis induces interest from dollar-based investors with a desire to maximize arbitrage profits since they can earn higher synthetic dollars from foreign investment compared to investing in the direct dollar market. As the arbitrage profit is in fixed income market, these investors concentrate on eurozone fixed income assets. This increases demand for and flows to the fixed income space which, ceteris paribus, limits flows to equities, leading to a decline in stock returns.

The relationship between stock returns and the basis in the eurozone over the whole sample period is illustrated in Fig 1. The graph plots the weekly stock returns of major eurozone listed equities against changes in the 5-year and 3-month euro cross-currency basis. It reveals that while there appears to be a strong positive relationship between stock returns and the 5-year basis, there seems to be a weak positive or arguably no relationship between stock returns and the euro basis at the short end, i.e. 3-month basis. This suggests, as a preliminary evidence, that the sensitivity of stock returns to changes in the euro basis varies with basis maturity. It is strong for the long-end basis and weak for the short-end basis. In our main analysis, we find that this outcome is supported, and that the basis remains a significant driver of stock returns in the eurozone even after controlling for exchange rates, VIX, the short and long end of the euro treasury yield curve and other relevant variables.

Fig. 1: **Eurozone stock returns (y-axis) vs. changes in euro cross-currency basis (x-axis) – full sample**



Notes: In this figure, on the vertical axis, we plot weekly returns of the Euro Stoxx 50 Index denominated in euros. On the horizontal axis, we plot the weekly change in the euro cross-currency basis swap spreads for the 5-year and 3-month euro basis. Negative changes in the basis indicate wider basis and increased CIP deviations. The yellow line is a fitted regression line of the scatter plot. The sample period covers Jan. 2007 to Feb. 2019

Our paper also sheds light on how changes in global risk sentiment, proxied by changes in VIX, relates to stock returns in the eurozone. We show that irrespective of the economic cycle or period considered, global risk sentiment remains a significant factor driving stock market returns in the eurozone. A rise in global risk sentiment depresses eurozone stock returns regardless of the number of control variables included in the analysis. Finally, our results suggest that the global financial crisis is the period when the dollar has the most negative and highly significant effect on stock returns in the eurozone. This is consistent with the stronger dollar and weaker global equities that occurred during most of the global financial crisis.

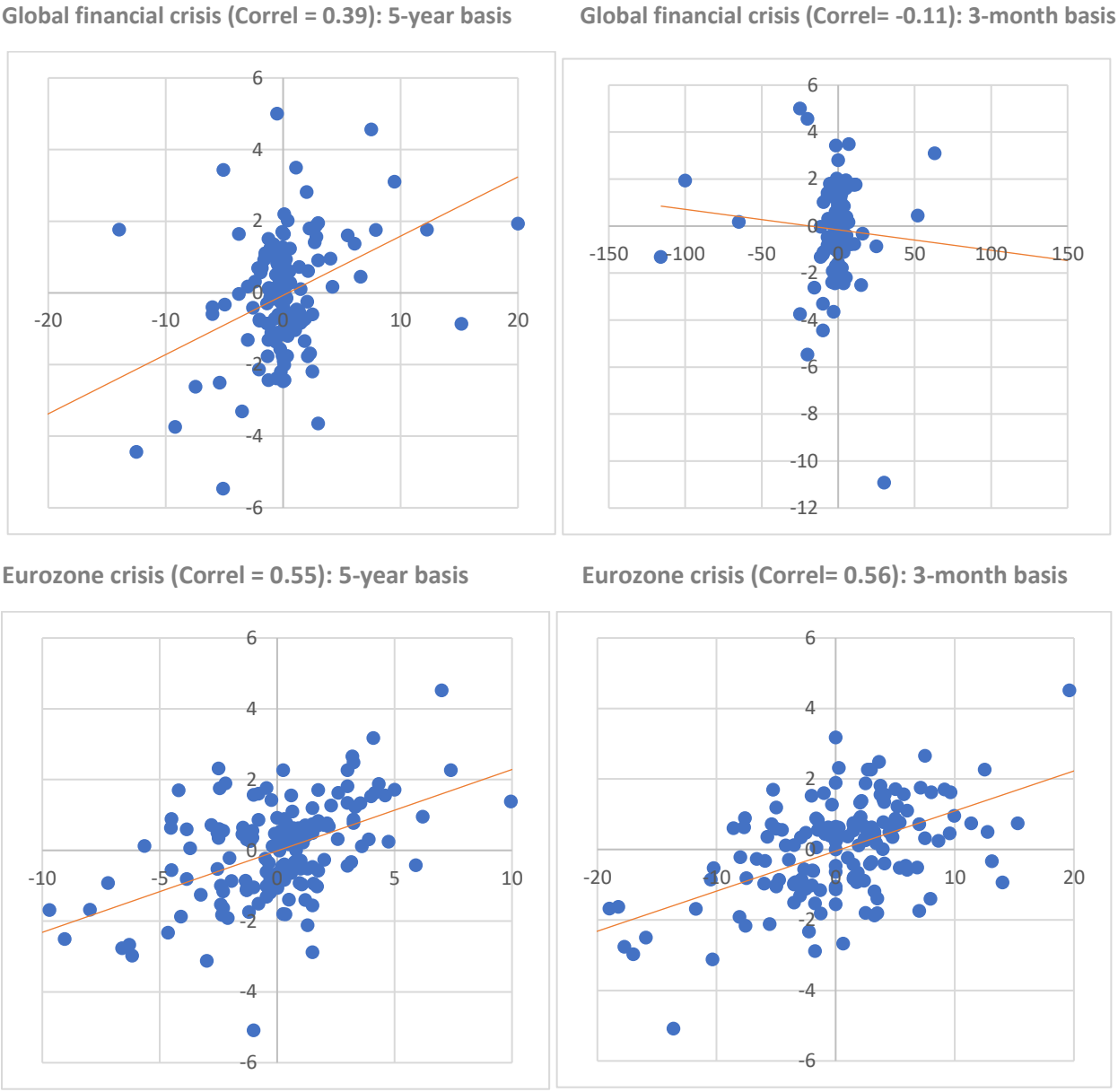
The rest of the paper is organized as follows. Section 2 discusses the data, their sources and presents a narrative evidence – based on scatter plots – on the stock market response to changes in the basis. Section 3 takes our hypothesis to data and presents empirical evidence on the hypothesized relationship between the basis and stock market returns. Section 4 examines the strength of the relation for two subsamples spanning the global financial crisis and eurozone crisis and also investigates dynamics of the relationship using impulse responses. Section 5 concludes and discusses the implications of the findings for further research.

2. Data

In this study, we examine the effect of changes in the basis on stock returns in the eurozone. Thus, for this analysis, our main variables of interest are the changes in the basis and stock market returns (logarithmic returns on Euro Stoxx 50). We consider respectively the basis at the short end (3-month) and long end (5-year) as is standard in the literature. Apart from these variables, we also include several control variables into our regressions. These are changes in the VIX, broad dollar exchange rate index, commodity index and the 2-year and 10-year euro government treasury yields to control for global risk sentiment, exchange rate fluctuations, variations in commodity prices and the euro area monetary policy respectively. Data on Euro Stoxx 50, euro-dollar cross currency basis, VIX (CBOE implied volatility of S&P 500 index options), commodity index (Dow Jones commodity index) and eurozone treasury yields are obtained from Bloomberg database while data on the broad dollar index (trade weighted dollar index) come from the Federal Reserve Bank of St Louis database. Our main analysis covers the period from January 2007 to February 2019. We also generate subsamples which enable us to extend our analysis to two subperiods – the global financial crisis (Jan 2007 – Dec 2009) and the eurozone crisis (Jan 2010 to Dec 2012). All data are first differenced, returns are log returns and the data frequency is weekly.

The graphs below display scatter plots which depict the relationship between eurozone cross-currency basis and stock performance for the two subsamples representing the global financial crisis and the eurozone crisis. As before, vertical axis plots stock returns against changes in the euro basis shown in the horizontal axis. The plots reveal that there is a strong and significantly positive relationship between the 5-year euro basis and stock returns especially during the eurozone crisis. The same is true for the 3-month euro basis during the eurozone crisis whereas the 3-month basis displays a very weak and even negative relationship with the stock returns during the global financial crisis. Thus, the impact of changes in the 5-year and 3-month basis on stock returns in the eurozone is similar only during the eurozone crisis. In the global financial crisis, both basis impact stock returns dissimilarly, providing some evidence that the effect of the basis on stock performance across maturities may not be the same for all kinds of crisis.

Fig 2: Eurozone stock returns (y-axis) vs. changes in euro cross-currency basis (x-axis) – Crisis Periods



Notes: In this figure, on the vertical axis, we plot weekly returns of the Euro Stoxx 50 Index denominated in euros. On the horizontal axis, we plot the weekly change in the euro cross-currency basis swap spreads for the 5-year and 3-month euro basis. Negative changes in the basis indicate wider basis and increased CIP deviations. The yellow line is a fitted regression line of the scatter plot. The sample period covers Jan. 2007 to Dec. 2009 for the global financial crisis and Jan 2010 to Dec 2012 for the eurozone crisis. For the 3-month basis, it begins after Jan. 2007 due to data availability.

3. The cross-currency basis and stock market returns in the eurozone

We now formally examine the empirical relationship between the cross-currency basis and stock market returns of the major listed equities in the eurozone. First, we document a contemporaneous positive relationship between stock returns and CIP deviations in the eurozone. For the 5-year euro basis, this relationship is strongly positive and significant for the whole sample period and strongest during the periods of crisis, especially in the eurozone crisis. For the 3-month basis, the positive and significant relationship with stock returns is strongly valid only during the eurozone crisis. The 5-year basis is therefore a more robust driver of the stock returns in the eurozone than the 3-month basis. Also, both basis spreads drive stock market returns similarly only during the eurozone crisis. And even in this period, it is the 5-year basis that has the more impactful and statistically significant effect on stock returns.

Next, we present evidence that in general, the results of the baseline regressions are robust to the inclusion of different control variables. We then show that among the controls considered, the global risk sentiment, proxied by the VIX, is the most consistent and significant driver of stock returns in the eurozone, regardless of the chosen period or control variables included in the regressions. We also show that the effect of broad dollar appreciation on stock returns is most negative and highly significant during the global financial crisis. Finally, using impulse responses, we study the dynamics of the response of stock returns to shocks to the euro basis. We find that our initial results continue to hold. In general, the positive relationship between the euro basis and stock returns is more robust at the long-end of the euro basis than at the short end.

To examine the relationship between the basis and stock returns, we regress changes in the logarithm of Euro Stoxx 50, the index representing performance of major eurozone stocks, on changes in the cross-currency basis. The changes in the logarithm of Euro Stoxx 50 represents the logarithmic returns of the index. As motivated earlier, we control for other potential drivers of stock returns to concretize the robustness of our results to different specifications. Our benchmark regression can thus be expressed as

$$\Delta r_t = \beta_0 + \beta_1 \Delta x_t + \delta' CONTROL_t + \varepsilon_t \quad (1)$$

where β_0 is the standard regression constant, Δr_t and Δx_t represent eurozone stock returns and changes in the euro cross-currency basis between $t-1$ and t respectively and $CONTROL_t$ is a vector of the control variables.

For the vector of controls, we follow Haris et al. (1991), Fang and Loo (1994), Thorbecke (1997), Gozluklu and Morin (2015) and Qadan et al. (2019) and choose high-frequency market-based drivers of stock market performance. First, we include the log changes in the implied volatility of S&P 500 index options (VIX), ΔVIX_t , to control for changes in global risk sentiment. Then we control for changes in the broad dollar exchange rate, $\Delta Dollar_t$, and for changes in the log levels of general commodity prices, $\Delta Comm_t$. These two controls capture changes in the behavior of the dollar and the changes in the general prices of commodities. The variable $\Delta Dollar_t$ represents changes in US trade-weighted broad dollar index. Positive values of $\Delta Dollar_t$ implies an appreciation of the dollar. Next, we add changes in the 10-year and 2-year eurozone treasury bond yield, $\Delta 10Y_t$ and $\Delta 2Y_t$, and changes in the term spread ($\Delta(10Y_t - 2Y_t)$) to control for changes in the bond market conditions and monetary policy in the euro area.

3.1. The 5-year basis and stock returns in the eurozone

Table 1 shows results for the weekly changes in the 5-year euro basis regressed on the eurozone stock returns for the entire period since the crisis. The coefficient on Δx_t is positive and strongly significant across all specifications, suggesting that a more negative euro basis is associated with a decline in stock returns in the eurozone. That is, greater CIP deviations leads to declines in stock market performance in the eurozone. The coefficient on Δx_t in Column 1, which excludes the control variables, implies that a one basis point widening in the long end of the euro basis is associated with a 0.16 percentage point decline in the eurozone stock returns. The strengthen of the impact of the euro basis on stock returns declines as we increase the number of control variables. In particular, when all control variables are included, the impact of the basis loses some steam so that a one basis point widening of the euro basis only reduces eurozone stock returns by 0.07 percentage point (see Column 6). This suggests that although a wider basis is associated with a fall in stock returns, the effect can be mitigated in the presence of other more favourable market factors. In all the regressions, the impact of changes in the euro basis on stock returns is both statistically significant and economically meaningful.

Table 1: Regression results of stock returns regressed on the 5-year cross-currency basis – full sample

	1	**2**	**3**	**4**	**5**	**6**	**7**
Δx_t	0.16***	0.11***	0.10***	0.08***	0.08***	0.07***	0.07***
	(9.77)	(8.17)	(7.59)	(6.23)	(6.22)	(5.69)	(5.68)
ΔVIX_t		-11.83***	-11.82***	-10.61***	-10.60***	-9.91***	-9.91***
		(19.72)	(19.81)	(18.02)	(18.04)	(16.83)	(16.82)
$\Delta Dollar_t$,			-0.15***	-0.09	-0.09	-0.10*	-0.10*
			(2.70)	(1.58)	(1.57)	(1.82)	(1.81)
$\Delta Comm_t$				0.31***	0.31***	0.27***	0.27***
				(7.97)	(7.96)	(6.91)	(6.89)
$\Delta 2Y_t$					0.01	0.04	-
					(0.03)	(0.14)	-
$\Delta 10Y_t$						2.16***	2.21***
						(5.50)	(4.24)
$\Delta(10Y_t - 2Y_t)$							-0.05
							(0.14)
Observations	633	633	633	633	633	633	633
R^2	0.13	0.46	0.47	0.52	0.51	0.54	0.54

Notes: The table shows regression results of weekly stock returns on weekly changes in the 5-year Libor cross-currency basis and other controls. The dependent variable is the weekly stock returns of eurozone major listed equities; test statistic values are shown in the parentheses. ***, ** and * indicate 1%, 5% and 10% levels of statistical significance

Turning now to the control variables, we note that changes in the VIX has a negative impact that is significant on the eurozone stock returns in all specifications considered. Specifically, its minimum and maximum magnitude are 9.91 and 11.83 respectively, implying that a one percentage point increase in VIX is associated with a decline of between 9.91 and 11.83 percentage points in the eurozone stock returns. This result is particularly insightful as an increase in global risk sentiment which changes in the VX represent should trigger risk-off sentiments in the market and thus reduce stock performance. In addition, a stronger dollar also appears negatively linked with eurozone stock market performance, although to a much lower extent compared to the VIX. At the maximum, a one percentage point appreciation of the dollar is associated with a 0.15 percentage point decline in eurozone stock returns, suggesting that a dollar appreciation, caused by an increase in the preference for dollar assets, also contributes to declines in eurozone stock returns. The result shows commodities and eurozone stock returns are positively associated so that an improvement in global commodities is positive for the eurozone stock markets. Finally, while changes in the 10-year yield are positively linked with stock returns in the eurozone, which is consistent with positive correlation of 10-year yields and stock returns due to inflation expectations, we not that changes in both the 2-year and the term spreads do not enter the regressions significantly.

3.2. The 3-month basis and stock returns in the eurozone

The significantly positive and economically meaningful association between eurozone stock returns and changes in the euro basis seems to be a phenomenon of the long-end of the euro basis. Indeed, after repeating the same exercise, with the 5-year euro basis replaced with the 3-month basis, we obtain results for the short-term basis that are surprisingly dissimilar to the longer-term cross-currency basis. Table 3 presents our regression results for the response of the stock returns to changes in the 3-month cross-currency basis and other control variables. At odds with results for the long-term basis, we find that the coefficient on Δx_t completely losses its positive effect and significance in all specifications. Moreover, not only have the signs changed and significance is lost, the results are no more economically meaningful. This suggests that the behavior of stock returns in response to changes in the euro cross currency basis is not the same across maturities of the basis. It is strongest at the long-end of the basis and weakest or non-existent in the short end of the basis.

Nonetheless, similar to the long-end regression, the behavior of stock returns with respect to the other control variables is largely unchanged. The control variables that are significant in the long-end basis regressions remain significant in the current regression. In particular, VIX retains its leading negative effect on stock returns in the eurozone.

Table 2: Regression results of stock returns regressed on the 3-month cross-currency basis – full sample

	1	2	3	4	5	6	7
Δx_t	0.003	-0.001	-0.001	-0.001	-0.001	-0.002	-0.002
	(0.63)	(0.19)	(0.25)	(0.24)	(0.24)	(0.53)	(0.53)
ΔVIX_t		-13.11***	-11.25***	-11.24***	-11.24***	-10.47***	-10.47***
		(19.61)	(17.22)	(17.27)	(17.26)	(16.13)	(16.13)
$\Delta Comm_t$,			0.39***	0.37***	0.37***	0.31***	0.31***
			(9.41)	(8.88)	(8.88)	(7.51)	(7.51)
$\Delta Dollar_t$				-0.13***	-0.13***	-0.14***	-0.14***
				(2.25)	(2.25)	(2.44)	(2.44)
$\Delta 2Y_t$					-0.06	-0.02	2.41***
					(0.15)	(0.06)	(4.24)
$\Delta 10Y_t$						2.43***	-
						(5.71)	-
$\Delta(10Y_t - 2Y_t)$							2.43***
							(5.71)
Observations	580	580	580	580	580	580	580
R^2	0.001	0.40	0.48	0.48	0.48	0.51	0.51

Notes: The table shows regression results of weekly stock returns on weekly changes in the 3-month Libor cross-currency basis and other controls. The dependent variable is the weekly stock returns of eurozone major listed equities; test statistic values are shown in the parentheses. ***, ** and * indicate 1%, 5% and 10% levels of statistical significance

To investigate the sensitivity of our main results to the periods chosen, we follow Du et al. (2018) and repeat all regressions for the period starting in January 2009 in order to ensure the effects of the global financial crisis on regression results are eliminated. Interestingly, in the results, not reported but available on request, we find that the coefficient on the 5-year basis continues to relay a similar story. However, contrary to the insignificant and economically meaningless result obtained above for the effects of the 3-month basis, we find that, for this starting period and in the presence the controls, the 3-month basis is positively associated with eurozone stock returns for the subsample. The results are both statistically significant and economically meaningful. This could be a signal that the divergence in results for the 3-month basis is driven by the global financial crisis. Nonetheless, the result is mixed and less consistent relative to the 5-year basis.

In sum, there is adequate evidence to believe that changes in the euro basis is positively linked with stock returns in the eurozone. However, this evidence is stronger and more consistent for the long-end of the basis but appears to be mixed for the short-end basis. Thus, the phenomenon wherein a wider basis is associated with declines in stock returns appears to be more tenable for the long-end basis than the short-end.

4. Stock Returns and CIP Deviations in the Global Financial Crisis and European Sovereign Crisis

In the whole sample analysis performed in the preceding section, we find evidence that there is a strong contemporaneous association between changes in the euro basis at the long end and eurozone stock returns. In addition to the entire period analysis, we now examine whether the strength of this relationship is preserved in two different subsamples covering the global financial crisis and eurozone crisis periods. We also make comparisons to see in which crisis period the relationship is stronger.

We generate two nonoverlapping subsamples for the global financial crisis (2007 - 2009) and the eurozone crisis (2010 – 2012). For these subsamples, we estimate the same regression as in equation (1) using the same focus regressors – changes in the 5-year and 3-month euro basis – as well as the market-based control variables.

4.1 The 5-year basis and stock returns in the eurozone during the global financial and eurozone crisis

The results for both subsamples are reported in Tables 3a and 3b for when the focus regressor is the 5-year basis and in Tables 4a and 4b when the 3-month basis is the focus regressor.

Table 3a: Regression results of stock returns on the 5-year cross-currency basis – *global financial crisis*

	1	**2**	**3**	**4**	**5**	**6**	**7**
Δx_t	0.17***	0.12***	0.10***	0.07***	0.07***	0.07***	0.07***
	(5.33)	(4.65)	(4.14)	(2.91)	(2.95)	(2.99)	(2.99)
ΔVIX_t		-17.71***	-17.22***	-15.17***	-15.33***	-14.21***	-14.21***
		(9.89)	(9.78)	(9.13)	(9.22)	(8.32)	(8.32)
$\Delta Dollar_t,$			-0.34***	-0.24**	-0.22*	-0.26**	-0.26**
			(2.79)	(2.13)	(1.91)	(2.27)	(2.27)
$\Delta Comm_t$				0.37***	0.36***	0.31***	0.31***
				(5.38)	(5.27)	(4.33)	(4.33)
$\Delta 2Y_t$					0.92	1.04	-
					(1.32)	(1.50)	-
$\Delta 10Y_t$						2.06***	3.10***
						(2.32)	(2.66)
$\Delta(10Y_t - 2Y_t)$							-1.03
							(1.49)
Observations	156	156	156	156	156	156	156
R^2	0.15	0.48	0.50	0.58	0.58	0.59	0.59

Notes: The table shows regression results of weekly stock returns on weekly changes in the 5-year Libor cross-currency basis and other controls. The dependent variable is the weekly stock returns of eurozone major listed equities; test statistic values are shown in the parentheses. ***, ** and * indicate 1%, 5% and 10% levels of statistical significance

Table 3b: Regression results of stock returns on the 5-year cross-currency basis – *eurozone crisis*

	1	2	3	4	5	6	7
Δx_t	0.23***	0.13***	0.13***	0.12***	0.12***	0.11***	0.11***
	(8.24)	(5.21)	(4.99)	(4.87)	(4.85)	(4.70)	(4.70)
ΔVIX_t		-13.34***	-13.32***	-11.17***	-11.25***	-8.52***	-8.52***
		(10.17)	(9.99)	(7.75)	(7.76)	(6.07)	(6.07)
$\Delta Dollar_t$,			0.01	0.09	0.08	0.04	0.04
			(0.06)	(0.69)	(0.63)	(0.35)	(0.35)
$\Delta Comm_t$				0.27***	0.27***	0.24***	0.24***
				(3.38)	(3.36)	(3.25)	(3.25)
$\Delta 2Y_t$					-0.71	-0.21	3.47***
					(0.64)	(0.21)	(2.79)
$\Delta 10Y_t$						3.68***	-
						(5.65)	-
$\Delta(10Y_t - 2Y_t)$							3.69***
							(5.65)
Observations	156	156	156	156	156	156	156
R^2	0.30	0.58	0.58	0.60	0.60	0.67	0.66

Notes: The table shows regression results of weekly stock returns on weekly changes in the 5-year Libor cross-currency basis and other controls. The dependent variable is the weekly stock returns of eurozone major listed equities; test statistic values are shown in the parentheses. ***, ** and * indicate 1%, 5% and 10% levels of statistical significance

Our results suggest that for the 5-year basis, the positive impact of its changes on eurozone stock returns remains valid and continues to hold in both subsamples. However, the strength of the relationship is higher during the European sovereign crisis compared to the global financial crisis. Particularly, the maximum impact of changes in the basis on stock returns in the global financial crisis is 0.17 compared to 0.23 during the eurozone crisis. After including all the control variables, the coefficient drops to 0.07 for the global financial crisis period and 0.11 for the eurozone crisis period. This means that when the basis widens by one basis point, stock returns in the eurozone decline by a maximum of 0.23 percentage point and 0.17 percentage point during the eurozone crisis and global financial crisis respectively. Therefore, our results suggest that the impact of basis widening on stock market performance is much worse for eurozone stocks during the eurozone crisis than during the global financial crisis.

Turning to the control variables, the response of eurozone stock returns to VIX is qualitatively similar in both crisis periods, implying that irrespective of the crisis period or subsamples considered, a rise in the global risk sentiment is associated with declines in stock returns in the eurozone. These declines are higher in the global financial crisis period compared to the period of eurozone crisis. Compared to the GFC period where the result shows a negative and significant relationship between the dollar and eurozone stock market returns, the dollar has no significant effect on stock returns during the eurozone crisis. In both crisis periods, commodities link positively with eurozone stock returns and the relationship enters positively, slightly higher during the global financial crisis. Finally, changes in the 10-year yield associate positively and significantly with stock market returns in both periods while the 2-year yield does not bear a significant relation with stock returns in both crisis periods.

4.2 The 3-month basis and stock returns in the eurozone during the global financial and eurozone crisis

Table 4a and 4b below display the results obtained for the two periods when the regressor of interest is the short-end of the euro basis. We find that the response of stock returns to changes in this basis is completely different in both crisis periods. For the global financial crisis, the short end of the euro basis has a statistically insignificant and economically meaningless effect on stock returns, with the signs changing unsustainably as we increase the number of control variables. In fact, for most of the regressions, the effect on the stock returns is essentially zero.

Table 4a: Regression results of stock returns on the 3-month cross-currency basis – *global financial crisis*

	1	2	3	4	5	6	7
Δx_t	-0.01	-0.01	-0.004	-0.664	-0.003	-0.003	-0.003
	(1.13)	(0.92)	(0.72)	(0.66)	(0.62)	(0.61)	(0.61)
ΔVIX_t		-27.76***	-22.82***	-22.03***	-22.31***	-21.28***	-21.28***
		(9.82)	(8.49)	(8.03)	(8.11)	(7.50)	(7.50)
$\Delta Comm_t$,			0.43***	0.41***	0.40***	0.36***	0.36***
			(5.22)	(4.98)	(4.87)	(4.05)	(4.05)
$\Delta Dollar_t$				-0.18	-0.16	-0.20	-0.20
				(1.32)	(1.11)	(1.37)	(1.37)
$\Delta 2Y_t$					1.08	1.16	2.75*
					(1.17)	(1.25)	(1.82)
$\Delta 10Y_t$						1.59	_
						(1.39)	-
$\Delta(10Y_t - 2Y_t)$							1.59
							(1.39)
Observations	103	103	103	103	103	103	103
R^2	0.01	0.50	0.61	0.61	0.62	0.63	0.63

Notes: The table shows regression results of weekly stock returns on weekly changes in the 3-monthLibor cross-currency basis and other controls. The dependent variable is the weekly stock returns of eurozone major listed equities; test statistic values are shown in the parentheses. ***, ** and * indicate 1%, 5% and 10% levels of statistical significance

For the eurozone crisis, however, the narration is entirely different. We find that, in line with the 5-year basis, the effect of the 3-month euro basis on stock market returns in the euro turns positive and statistically significant across all control variables considered. At the maximum, this suggests that one basis point widening in the 3-month euro basis is associated with an 0.11 percentage point decline in eurozone stock returns. Although this magnitude pales in comparison to the magnitude of the effect of the 5-year basis on eurozone, and in fact equates the minimum stock-returns effect of the 5-year basis, still it is interesting to find evidence in support of the hypothesis that changes in cross-currency basis associate positively with stock returns in the eurozone. Nonetheless, when the basis associated positively with stock returns, the effect is always higher in the long-end of the euro basis than the short end.

Table 4b: Regression results of stock returns on the 3-month cross-currency basis – *eurozone crisis*

	1	2	3	4	5	6	7
Δx_t	0.11***	0.06***	0.06***	0.06***	0.06***	0.05***	0.05***
	(8.31)	(5.33)	(4.82)	(4.76)	(4.86)	(4.59)	(4.59)
ΔVIX_t		-13.36***	-11.64***	-11.64***	-11.72***	-8.98***	-8.98***
		(10.22)	(8.32)	(8.16)	(8.22)	(6.43)	(6.43)
$\Delta Comm_t$,			0.24***	0.24***	0.24***	0.21***	0.21***
			(2.98)	(2.92)	(2.88)	(2.84)	(2.84)
$\Delta Dollar_t$				0.00	-0.01	-0.04	-0.04
				(0.01)	(0.06)	(0.34)	(0.34)
$\Delta 2Y_t$					-1.31	-0.76	-
					(1.19)	(0.75)	-
$\Delta 10Y_t$						3.63***	2.86**
						(5.49)	(2.27)
$\Delta(10Y_t - 2Y_t)$							0.76
							(0.75)
Observations	156	156	156	156	156	156	156
R^2	0.31	0.59	0.61	0.61	0.62	0.68	0.68

Notes: The table shows regression results of weekly stock returns on weekly changes in the 3-monthLibor cross-currency basis and other controls. The dependent variable is the weekly stock returns of eurozone major listed equities; test statistic values are shown in the parentheses. ***, ** and * indicate 1%, 5% and 10% levels of statistical significance

4.3 Vector Autoregression Evidence of CIP Deviations and Stock Returns in the Eurozone

The vector autoregression (VAR) methodology has overtime proven useful for investigating dynamic interdependencies between stock returns and other variables. In this section, we employ the generalized impulse response to estimate the VAR and generate impulse responses of stock returns to innovations in the basis. The baseline specification that we feed into the VAR can be written as

$$\boldsymbol{y}_t = [\Delta 10Y_t, \Delta Comm_t, \Delta lnVIX_t, \Delta r_t, \Delta x_t]'$$

The stock returns variable Δr_t is ordered ahead of the changes in the euro basis. This specification rules out the contemporaneous effect of the euro basis on the stock returns.

Figure 5, 6 and 7 show the accumulated impulse responses from our VAR specification. We concentrate on the responses of stock returns to shocks to the basis. The accumulated impulse responses are reported for the whole period as well as for the subsamples of the two crisis periods. We put side-by-side the responses of stock returns to shocks in the 5-year and 3-month basis respectively.

Fig 5: Response of stock returns to shocks in 5-year (*left*) and 3-month (*right*) basis – whole sample

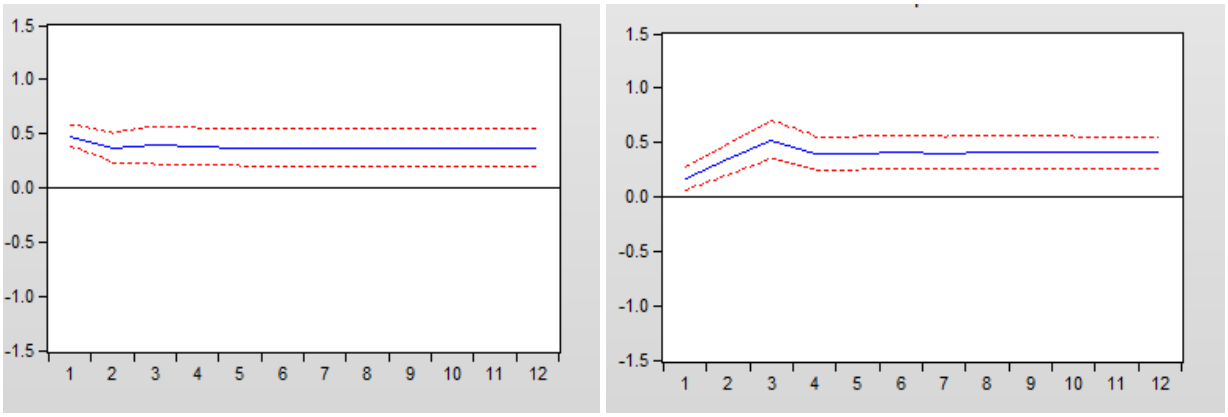


Fig 6: Response of stock returns to shocks in 5-year (*left*) and 3-month *(right*) basis – global financial crisis

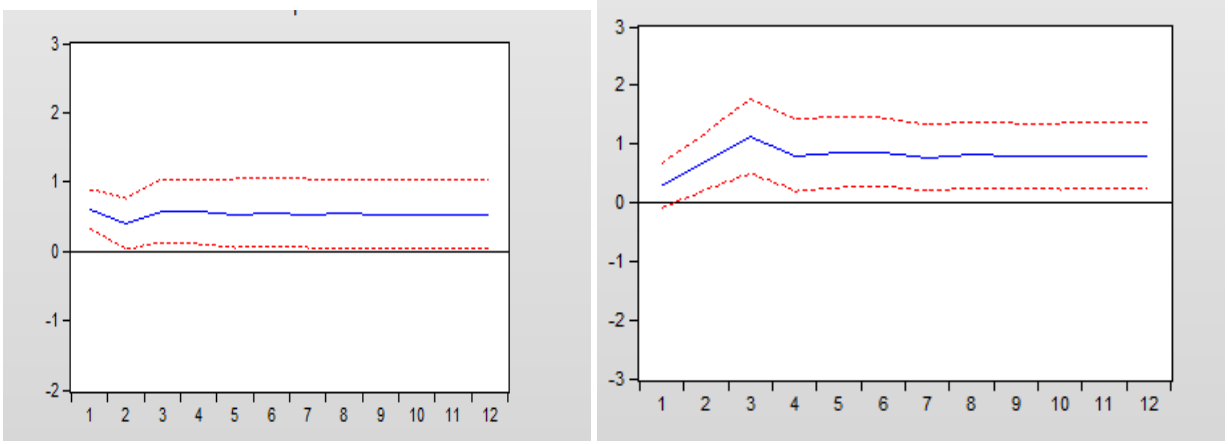
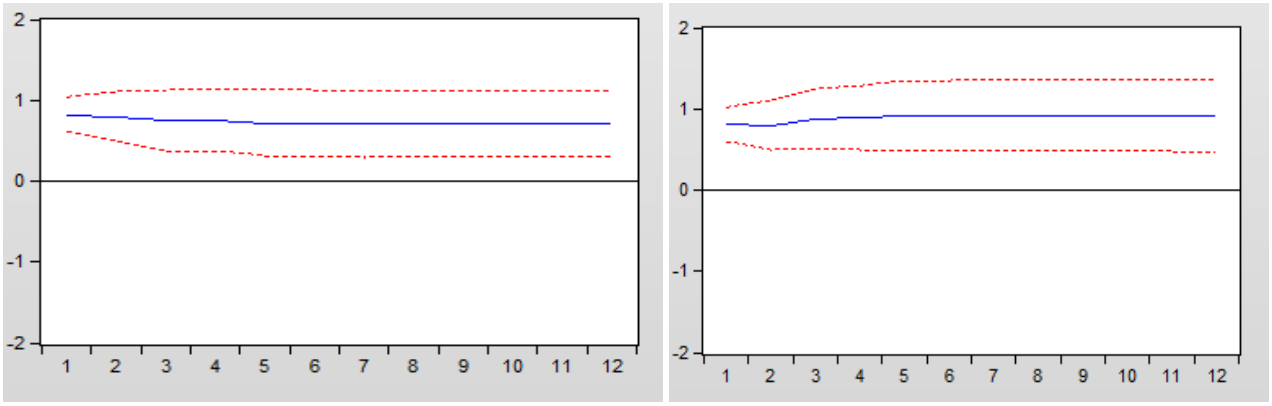


Fig: 7 Response of stock returns to shocks in 5-year (*left*) and 3-month (*right*) basis – eurozone crisis



Notes: All figures display the cumulative impulse response of stock market returns to a one standard deviation shock to changes in the basis. The bounding red lines denote 95% confidence intervals. The first panel in Fig. 5 shows the response for the whole sample period, the second panel is the response during the global financial crisis and the third panel represents the response in the eurozone crisis period. The sample period for the whole sample is Jan 2007/2008 to Feb 2019 for the 5-year/3-month basis. In the global financial crisis, it is Jan 2007/2008 – Dec 2009 when the basis is the 5-year/3-month basis and Jan 2010 to Dec 2012 for the eurozone crisis period for both basis. The slightly later start when the basis is 3-month basis is due to data availability.

The results reveal that the euro basis has a cumulative positive and significant impact on stock returns in the eurozone. This is the case for the whole sample, as well as for the two subsamples covering the global financial crisis and eurozone crisis. In general, the initial response of stock returns to the basis shocks is lower for the 3-month basis compared to the 5-year basis. This is particularly the case for the whole sample and for the period covering the global financial crisis. Over time, the cumulative response of stock returns to the 3-month basis shocks adds up, eventually catching up with the cumulative response to the returns to the 5-year basis shocks. We note that the estimated positive impact of the shocks is not persistent. In general, it tends to level off between 3-4 weeks after the shocks for both the 3-month and 5-year basis. In terms of the magnitude, in response to shocks that lead to a one standard deviation tightening of the euro basis, the stock returns increase by about 0.5 percentage point on impact when the basis is the 5-year basis compared to below 0.5 percentage point when the basis is the 3-month basis.

5. Conclusion

Financial economists have in recent times begun to analyze the reasons for and determinants of the non-zero cross-currency basis swap spread, a measure of the extent of deviations from CIP. They have however not examined the potential effects or implications of changes in the basis on the performance of asset classes in the financial markets - particularly how stock markets behave in response to changes in the cross-currency basis. With the high CIP deviations of recent years, the effect of basis changes on stock returns is an important issue for investors with broad asset portfolios. This paper addresses this question by examining how stock returns of major listed firms in the eurozone respond to changes in and shocks to the euro cross-currency basis swap. Economic theory posits that the basis should be negligibly zero because CIP should hold and every arbitrage opportunity from non-zero basis should be fully exploited quickly. Thus, the persistence of non-zero basis since the global financial crisis implies the availability of exploitable riskless arbitrage opportunities. This would lead agents to gravitate towards currencies and financial instruments offering this riskless arbitrage opportunities and have implications for the performance of more risky asset classes in the financial markets – notable of which is equities.

Using the euro basis at the long and short end, this paper presents evidence that changes in the basis exert large effects on stock returns in the eurozone. We document a mostly positive relationship formed by the euro basis and major stock returns in the eurozone. A wider euro cross-currency basis, especially at the long end of the basis, is associated with lower stock returns. Among other plausible explanations, we reason that this relationship exists because a wider basis induces returns-maximizing arbitrageurs to favour the credit or fixed income market - where this riskless arbitrage opportunities could be made - over the riskier equities market which could in turn lead to the rebalancing of portfolio and reallocation of funds from equities to credit, the consequence of which is the underperformance of equities and compression of stock returns. Furthermore, we also find evidence that the relationship held firm during the global financial crisis and the eurozone crisis, is stronger during the eurozone crisis and is robust to the inclusion of several control variables notable of which is the VIX whose impact on stock returns is unaltered across all regressions. In all, although the effect of global risk sentiment, proxied by the VIX, on stock returns is the strongest and most consistent, we show that our main result of a positive relation between stock returns and changes in the basis is preserved across all control variables. In sum, our main message is that wider cross-currency basis goes together with lower stock returns, at least in the eurozone.

The evidence presented here is a prelude to ongoing research efforts and suggests several directions of future research. First, while the findings above indicate that stock returns positively respond to changes in the basis in the eurozone, they do not necessarily reveal whether this generalizes to other currencies, including G10 currencies and other monetary unions. To answer this question, the approach of analyzing a broader amount of stock returns and cross-currency basis of major currencies, taking into consideration both the time series, cross-section and panel characteristics of the data to account for market-specific idiosyncrasies and average relationships, respectively, would be useful. This would uncover whether there are significant differences in the sensitivities of stock returns to changes in the basis and whether the stock returns are generally lower for currencies with wider basis that have wider arbitrage profits. Throughout this study, we have attempted to rationalize why changes in cross-currency basis affects stock

returns as our results do not provide answers to this question specifically. Therefore, a second, and interesting, direction for future research that builds on this paper would involve investigating the dynamics of the positive response of stock returns to changes in the basis among G10 and emerging markets.

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Appendix

Covered Interest Parity, Deviations and Some Arbitrage Implications for Investing and Funding

i. Covered Interest Rate Parity

How does it work?

Suppose there is a U.S. dollar-based investor who seeks to obtain the highest possible returns on each dollar invested**.** The investor has two possibilities:

1. Invest at Home, in U.S. dollar assets: Investor buys a commercial paper (in dollars), holds till maturity and earns the associated dollar income which is the USD Libor $+$ USD_{Spread}. At maturity, the total amount received from the transaction by the investor, all in dollars, equals: Principal Invested + Periodic Interest Earned – Transaction Cost Incurred (dollar brokerage fees, etc.). Suppose that, for simplicity, the investor invests \$1 for one period and incurs zero transaction cost, then the total amount, TA_{direct}, the investor receives at the end of the one-period investment horizon equals

$$TA_{direct} = \$1(1 + r_{us}) \qquad (a)$$

where $r_{us} = USD$ Libor $+$ USD_{Spread}

2. Invest Abroad: Instead of investing domestically, the investor can choose to invest in a fixed income security denominated in the euro for one period. This happens in different phases. The investor converts dollars to euros, enters a currency forward contract at the swap market and invests the euros in the euro-denominated security. At the end of the investment horizon, the investor exits her euro position and converts (swap) the euro proceeds to dollars using the earlier-agreed currency forward contract rate.

Suppose the prevailing spot exchange rate per \$ is *S*, then the U.S. dollar-based investor having \$1 to invest would have an equivalent investible principal in euros of *S* euros. Investing the euros *S* euros earns the investor EUR Libor $+$ $\text{EUR}_{\text{Spread}}$ at maturity. Neglecting transaction costs, the total amount, in euros, the investor receives at the end of the investment horizon is $S(1 + r_{euro})$, where $r_{euro} =$ EUR Libor $+$ $\text{EUR}_{\text{Spread}}$. The U.S. investor the exchanges the euro amount into dollars at the earlier agreed currency forward contract. Let this currency forward rate be *F*, then the resulting total amount in dollars, called synthetic dollars, $TA_{synthetic}$, is given by

$$TA_{synthetic} = \frac{S(1 + r_{euro})}{F} \qquad (b)$$

If covered interest parity holds, the U.S. investor cannot generate a higher total amount by investing in euro-denominated assets or dollar-denominated assets. In other words, when expressed in dollars, the investor makes the same from dollar assets that can be made from euro assets with proceeds converted to dollars. In other words, $TA_{direct} = TA_{synthetic}$.

$$(1 + r_{us}) = \frac{S(1 + r_{euro})}{F} \qquad (c)$$

The equality in equation *(c),* otherwise known as a no arbitrage condition, is the covered interest parity condition.

ii. Deviations from Covered Interest Parity

When deviations from covered interest parity exist, the equation in *(c)* breaks down. When the deviations are large, the inequality between TA_{direct} and $TA_{synthetic}$ becomes larger. These deviations imply the existence of a non-zero cross-currency basis swap spread. The cross-currency basis swap spread is thus the differential between the amount realized from investing in dollar assets and the dollar amount that is realized from investing in euro assets and converting the euro proceeds to dollars at the currency forward contract rate. This has implications for both international investors and borrowers.

- ***From Investors Perspective***

When there are deviations from covered interest parity and the cross-currency basis swap spread is negative, then $TA_{direct} - TA_{synthetic} < 0$. In this case, arbitrage opportunities exist, and it is more profitable investing abroad in euro assets and swapping the euro proceeds into dollars, than it is investing directly in dollar assets domestically. The euro cross-currency basis is currently negative. The wider and more negative is the cross-currency basis, the greater the arbitrage profits that a dollar-based investor can make.

- ***From Borrowers' Perspective***

International borrowers of dollars can take advantage of deviations from covered interest parity to lower their dollar funding costs via first issuing euro-denominated bonds and the swapping the euro raised to dollars.

Suppose there is an international issuer looking to raise U.S dollars. Assume that $USD is to be raised. The issuer can directly issue dollar-denominated bond in the U.S market. For a one-period maturity, the issuer will pay back to the U.S. dollar lenders a sum, TP_{direct}, equal

$$TP_{direct} = USD(1 + r_{us}), \qquad \text{where } r_{us} = \text{USD Libor} + \text{USD}_{\text{Spread}} \tag{d}$$

Alternatively, the international issuer might wish to take advantage of covered interest parity deviations in the euro to raise dollars at a cheaper rate. In this case, the issuer instead first issues euro-denominated bonds in the eurozone and swaps the euro proceeds into the required amount of dollars.

Let the cost of issuing the euro-denominated bond be r_{euro}, where $r_{euro} = \text{EUR Libor} + \text{EUR}_{\text{Spread}}$. Suppose the issuer issues *Y* euros which, at the prevailing exchange rate, is equivalent to the $USD it originally sought to raise. After the one-period maturity, the issuer will pay the euro lenders the sum

$$TP_{euro} = Y(1 + r_{euro}) \tag{e}$$

With the *Y* euros in hand, the issuer converts the *Y* euros at the prevailing spot exchange rate S to the required $*USD* it originally sought to raise. Thus, the $USD to be borrowed is equivalent to the *Y* euros already borrowed according to the simple relation via the exchange rate S, $USD \times S = Y$.

At the cross-currency swap market, the *Y* euros are swapped/exchanged for the equivalent $USD. Let the non-zero cross-currency basis swap spread be $-\delta_{euro/USD}$, where, as it is understood in the market, the euro cross-currency basis is negative and quoted on the euro leg. In this swap, the euro owner receives

$\text{EUR Libor}+(-\delta_{euro/USD})$ for the *Y* euros provided in the swap deal and pays a cost of USD Libor for the $USD received from the swap deal. Thus, he receives $\left[\text{EUR Libor}-\ \delta_{euro/USD}\right] \times Y$ in euros and incurs a cost of $\text{USD Libor}\ \times USD$ in dollars.

At the end of the maturity and hence swap deal when the principals are re-exchanged, the total amount, in euros, the euro owner would have received, from the swap transaction, is

$$TA_{euro\_swap} = Y(1 + \text{EUR Libor}- \delta_{euro/USD}) \qquad (f)$$

And the total payment, in dollars, that would be made to the dollar owner on the other leg of the swap is

$$TP_{\$swap} = USD(1 + \text{USD Libor}) \qquad (g)$$

The net total amount to be paid back, and hence net cost, *NTC*, incurred in indirectly raising dollars by first issuing in euros and swapping the euro proceeds to dollars equals the total payment the issuer makes to the euro lenders, TP_{euro}, for the direct issuance of euro-denominated bond plus the total payment, $TP_{\$swap}$, made to the dollar owner in the swap market for providing dollars minus the total amount, TA_{euro_swap}, received for providing euros in the swap market, i.e. , $TP_{euro} + TP_{\$swap} - TA_{euro\_swap}$.

Thus,

$$NTC = Y\big(1 + \text{EUR Libor}\ +\ \text{EUR}_{\text{Spread}}\big) + USD(1 + \text{USD Libor}) -\ Y(1 + \text{EUR Libor}- \delta_{Yen/USD})$$

which simplifies to

$$NTC = Y(\text{EUR}_{\text{Spread}} +\ \delta_{euro/USD}) + USD(1 + \text{USD Libor}) \qquad (h1)$$

This equation tells us that the net total cost incurred to raise $USD by first issuing Y euros, swapping to the $US and attempting to take advantage of the deviations from covered interest parity is a function of the levels of spreads in the eurozone, $\text{EUR}_{\text{Spread}}$, the extent of covered interest parity deviations, $\delta_{Yen/USD}$, and level of USD Libor. In particular, for fixed Y euros and $\$USD$, we have

$$\frac{\partial NTC}{\partial \text{EUR}_{\text{Spread}}} = Y > 0, \qquad \frac{\partial NTC}{\partial\ \delta_{euro/USD}} = Y > 0, \qquad \frac{\partial NTC}{\partial \text{USD Libor}} = USD > 0 \qquad (h2)$$

From $(h2)$, several deductions are possible. First, when spreads increase in the eurozone, the cost of indirectly raising dollars via euros also increases. Second, when the euro cross-currency basis widens (i.e. becomes more negative), which causes deviations from covered interest parity to increase, the cost of raising dollars via euros increases. The same is also true when the USD Libor increases. Thus, to achieve a lower dollar funding cost when the dollar is raised indirectly via the euro, the spreads in the eurozone must decline, euro basis must tighten, or USD Libor must fall. Nonetheless, even when deviations from covered interest parity become large and the euro basis, $\delta_{euro/USD}$, widen from current levels, the cost of raising dollars indirectly can still fall, provided the other two determinants of funding cost – the euro spread $\text{EUR}_{\text{Spread}}$ and/or the USD Libor - decrease considerably. To see this, we take the total differential associated with equation $(h1)$. This gives

$$\boldsymbol{d}NTC = \frac{\partial NTC}{\partial \mathrm{EUR}_{\mathrm{Spread}}}\boldsymbol{d}\mathrm{EUR}_{\mathrm{Spread}} + \frac{\partial NTC}{\partial\, \delta_{euro/USD}}\boldsymbol{d}\delta_{euro/USD} + \frac{\partial NTC}{\partial \mathrm{USD\ Libor}}\boldsymbol{d}\mathrm{USD\ Libor}$$

or

$$\boldsymbol{d}NTC = Y\boldsymbol{d}\mathrm{EUR}_{\mathrm{Spread}} + Y\boldsymbol{d}\delta_{euro/USD} + USD\boldsymbol{d}\mathrm{USD\ Libor} \qquad (h3)$$

Thus, even when $\delta_{euro/USD}$ ↑, i.e. $\boldsymbol{d}\delta_{euro/USD} > 0$, it is still possible for NTC ↓, i.e. $\boldsymbol{d}NTC < 0$, provided $\mathrm{EUR}_{\mathrm{Spread}}$ ↓, i.e. $\boldsymbol{d}\mathrm{EUR}_{\mathrm{Spread}} < 0$, and or USD Libor ↓, i.e. $\boldsymbol{d}\mathrm{USD\ Libor} < 0$. Specifically, when the inequality $(Y\boldsymbol{d}\mathrm{EUR}_{\mathrm{Spread}} + USD\boldsymbol{d}\mathrm{USD\ Libor}) < -Y\boldsymbol{d}\delta_{euro/USD}$ or $(S\boldsymbol{d}\mathrm{EUR}_{\mathrm{Spread}} + \boldsymbol{d}\mathrm{USD\ Libor}) < -S\boldsymbol{d}\delta_{euro/USD}$ holds and is binding, where $USD \times S = Y$, then $\boldsymbol{d}NTC < 0$ and NTC ↓ for any S.

Finally, when is it better to raise dollars indirectly in the swap via issuing the euros versus directly borrowing the dollar? The answer to this question follows immediately from comparing the total payment to be made to dollar lenders at maturity for borrowing directly in the dollar market, i.e. equation (*d*), versus the net total payment to be made at maturity to the lenders of the *Y* euros borrowed in the eurozone bond market and to the providers of dollars in the swap market, i.e. equation (*h1*).

Thus, taking the difference between (*h1*) and (*d*) gives the relative cost function ∇ as

$$\nabla = Y(\mathrm{EUR}_{\mathrm{Spread}} + \delta_{euro/USD}) - USD\mathrm{USD}_{\mathrm{Spread}} \qquad (g1)$$

and

$$\frac{\partial \nabla}{\partial \mathrm{USD}_{\mathrm{Spread}}} = -USD < 0$$

Thus, ceteris paribus, when US spreads increase, it becomes cheaper to raise dollars indirectly as compared to direct dollar borrowing in the US dollar market.

However, reasoning as in the previous fashion, we note that, even in a falling US spreads environment, it is still possible for the indirect dollar borrowing cost to be lower than the direct dollar borrowing cost. To see this, we proceed as before and take the total differential of equation $(g1)$, giving

$$\boldsymbol{d}\nabla = Y\boldsymbol{d}\mathrm{EUR}_{\mathrm{Spread}} + \boldsymbol{Y\boldsymbol{d}\delta}_{euro/USD} - USD\boldsymbol{d}\mathrm{USD}_{\mathrm{Spread}} \qquad (g2)$$

and $\boldsymbol{d}\nabla < 0$ so that ∇↓, i.e. indirect dollar funding cost is lower than direct dollar funding cost, when $Y(\boldsymbol{d}\mathrm{EUR}_{\mathrm{Spread}} + \boldsymbol{d\delta}_{euro/USD}) < USD\boldsymbol{d}\mathrm{USD}_{\mathrm{Spread}}$. Recalling that the $*USD* amount is equivalent to the *Y* euros via the exchange rate *S* according to the simple relation $USD \times S = Y$, we get

$$S(\boldsymbol{d}\mathrm{EUR}_{\mathrm{Spread}} + \boldsymbol{d}\delta_{euro/USD}) < \boldsymbol{d}\mathrm{USD}_{\mathrm{Spread}} \qquad (g3)$$

Implying that even when spreads decline in the US, if spreads in the eurozone fall significantly more or if the euro cross-currency basis tightens well enough (less deviations from covered interest parity), or if both of these events occur, then the cost of borrowing dollars indirectly would be lower than the cost of direct dollar borrowing in the US market for the prevailing spot exchange rate, S.