The Carry Trade and Global Imbalances

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"A currency carry trade is a popular trading strategy in which an investor borrows currencies with low interest rates with negative forward premiums and invests in currencies with high interest rates which will subsequently have positive forward premiums. Robert Tolan, Jemima Owens and Vlad-Florian Lica discuss the interaction between national accounts, interest rates, speculation, and exchange rates with the intention of highlighting the drivers of carry trades. They discover heterogeneity between the drivers of different currency carry trades. They further outline that the carry trade effects national current account balances and thus, can obscure the net debtor / creditor position of countries."

Introduction

The carry trade consists of borrowing in currencies with low interest rates with negative forward premiums and investing in currencies with high interest rates and subsequently positive forward premiums (Menkhoff, et al., 2012). Given the Current Account (CA) captures the amount countries borrow from others in each period, currencies used to fund carry trade positions accumulate external debt positions due to speculation. In this way, the accumulation of carry trades in a particular currency increases CA deficits and decreases CA surpluses in a manner that separates the value of the currency from fundamentals (Della Corte et al, 2016). The existence of carry is a violation of Uncovered Interest Parity (UIP) which states exchange-rate changes should eliminate gains or losses from interest rate changes (Menkhoff, et al., 2012). The "forward premium puzzle" has been widely studied and its causes remain a cause of contention in international macroeconomics. By severing the relationship between fundamentals and exchange rates, the carry trade makes it more difficult to assess which countries are truly net debtors and net creditors.

To investigate the dynamics of the CA balance through the phenomena of the carry trade, this paper presents a new dataset combining the External Wealth of Nations (EWN) dataset (Lane & Milesi-Ferretti, 2021), measures of financial integration compiled by Bénétrix et al (2021) and financial data sourced from Bloomberg. The purpose is to capture some of the complex interplay between national accounts, speculation, exchange rates and ultimately the allocation of risk. We find that considerable heterogeneity exists across currencies when determining the drivers of carry trades. This has important implications for understanding how speculative financial activity impacts the CA balance which will improve central banks' understanding of how interest rates, exchange rates and the incidence of crises interact.

Literature Review

According to Della Corte et al (2016) net debtor countries offer a currency risk premium to compensate investors willing to finance negative external imbalances as currencies depreciate in times of stress. They find currency excess returns are higher when the funding (investment) country is a net foreign creditor and has a higher propensity to issue liabilities denominated in domestic currency. This means external imbalances are critical in determining the magnitude of currency risk premia and, by extension, the interplay between FX markets and national accounts. As a result, successful carry trades are a form of compensation for time-varying fundamental risk therefore such activity can be viewed as taking on global imbalance risk.

Gabaix and Maggiori (2015) revived portfolio balance theory by developing an exchange rate determination model with capital flows, termed the Gamma model. Della Corte et al (2016) use the Gamma model to test their hypothesis that the currency premia are higher when the interest rate differential is higher. The dataset used consists of the spot and one-month forward rates for fifty-five currency pairs denominated as units per USD as well as foreign assets and liabilities and GDP data from the EWN as well as data on external liabilities denominated in domestic currency constructed by Bénétrix et al (2015). Della Corte et al (2016) find the net debtor-net creditor relationship is key to understanding how excess returns arise in foreign exchange markets. They find that though the Covered Interest Parity (CIP) condition generally holds, the same is not true for the Uncovered Interest Parity (UIP) condition which agrees with Burnside (2018), a study of carry trade returns for G10 currencies from 1976-2018. Indeed, Burnside (2018) cites failure of UIP as one of the main culprits for Menkhoff's "forward premium puzzle" and thus the observed profitability of carry trades. Burnside (2018) believes UIP fails due to the assumption agents are risk averse. However, agents are risk takers thus the no-arbitrage fails thus creating positive returns for carry trades. As the G10 currencies are the most liquid portion of the FX market, the general failure of UIP suggests

exchange rates are an important component of national accounts vis-à-vis cross-border assets and liabilities.

Bénétrix et al (2021) presents a dataset on the currency composition of the international investment position (IIP) for 50 countries from 1990-2017. With a focus on external assets and liabilities, the paper lends itself to analysing how FX markets impact national accounts. They find considerable heterogeneity can be encountered in currency exposures among countries making it difficult to develop generalisations about the dynamics between currency exposures and global imbalances. Despite the volatility of carry trade returns, Eichengreen et al's (2003) "original sin" still holds true, and advanced economies predominantly fund liabilities in their domestic currency and emerging economies do the opposite. This has important implications for the IIP in the event of cross-border shocks such as the Great Financial Crisis, sudden interest rate reductions in foreign currencies can have significant valuation effects for the domestic national accounts.

Menkhoff et al (2012) show that high interest rate currencies deliver low, and generally negative, returns during times of stress and low interest rate currencies provide a hedge for high FX volatility. Given high interest rate currencies are generally in emerging markets and low interest rate currencies have become synonymous with advanced economies, these results provide valuable insight on the advanced - developed economy paradigm in FX markets. Using spot and 1-month forward FX rates from 1983 to 2009 for 48 currency pairs against the USD, they find FX volatility is a significant input for forward premia. By using spot and forward prices as well as their volatility in Merton's (1973) intertemporal capital asset pricing model (ICAPM), these results hold in a discrete time thereby giving Menkhoff et al's (2012) results additional weight. The only direct measure of carry trade activity is through exchange traded funds (ETFs) and exchange traded notes (ETNs) sold by banks.

According to Curcuru et al (2010), the most frequently used measure of carry trade activity is the US Commodity Futures Trading Commission (CFTC) Large Trader Reporting Data which gives the net positions of speculators on currencies. This gives an overall indication of market sentiment rather than wholly accurate data as some of these positions are not speculative and it does not include activity carried out in over-the-counter (OTC) markets. Bank of International Settlements (BIS) data on cross-border lending can also be used as banks may lend the funding currency to others engaged in the carry trade or may accumulate foreign-currency deposits to target carry themselves.

Empirical Approach

Based on the existing literature, the approach taken is to regress the CA balance against spot rates, *Spot*, 1-month forward rates, *Forward*, the interest rate differential im-

plied by the CIP, termed Fdt, the differential between 10-year government bonds, termed R10, net assets, $Nassets$, and net liabilities, $Nliabilities$. Generalised least squares is used to overcome heteroscedasticity in the underlying variables (Wooldridge, 2013). Investors observe the spot and forward rates as well as the return offered on government bonds and are assumed to take them into account when speculating (Bloomberg, 2021). The currency pairs studied are: GBPUSD, EURUSD, AUDUSD, JPYUSD, ZARUSD and TRYUSD. The last two developing market currencies are used as controls for the first four developed market currencies. The FX rates are taken against USD, the conventional approach, which also makes the data compatible with the EWN dataset. Bénétrix et al (2015) provide GDP figures and weightings for assets denominated in domestic and foreign currencies as well as weightings for liabilities denominated in domestic and foreign currencies. The weightings are multiplied by GDP to derive notional amounts for assets and liabilities, net positions are derived from subtracting foreign currency positions from domestic currency positions.

Spot and forward rates, along with risk-aversion, are the main inputs behind the forward premia puzzle. Given the difficulties in modelling risk appetite, the combination of spot and forward rates with an indirect measure of sentiment such as net market positions, sourced from the CFTC Large Trader Reporting Data should approximate the investment decisions faced by a speculator. This leads to a baseline global imbalance and carry trade equation of the form:

$$CA_i = \beta_0 + \beta_1(Spot)_i + \beta_2(forward)_i + \beta_3(Fdt)_i + \beta_4(R10)_i + \beta_5(Nassets)_i + \beta_6(Nliabilities)_i + u_i \quad (1)$$

Given Menkhoff et al's (2012) emphasis on exchange rate volatility as a determinant of forward premium, the respective volatility of spot, *volspot*, and forward rates, *volforward,* are considered:

$$CA_i = \beta_0 + \beta_1(Spot)_i + \beta_2(forward)_i + \beta_3(Fdt)_i + \beta_4(R10)_i + \beta_5(volspot)_i + \beta_6(volforward)_i + u_i \quad (2)$$

Description of the Dataset

The EWN records the assets and liabilities for 212 economies as well as the European Monetary Union and the Eastern Caribbean Currency Union from 1970-2020. Using the International Investment Position (IIP) reported in national accounts and combining this with IMF Coordinated Investment Survey (CIPS) data, the dataset offers a cogent view on global capital flows. The dataset itself has been updated numerous times,

with the initial spanning from 1970-2001 and containing estimates for 67 countries, and in this way its evolution reflects the growing complexity of global imbalances.

The data extracted from the survey includes CA balances from the UK, Germany, taken as a proxy for the European Union, Japan, Australia, South Africa, and Turkey. Assuming modern carry traders are aware of Burnside's (2018) remark that gains "…go up by the stairs and down by the escalator", the increased liquidity associated with GBPUSD, EURUSD, JPYUSD and AUDUSD markets is assumed to make carry trades using these pairs much more attractive assuming some level of risk-aversity. Increased liquidity in financial markets leads to lower bid-ask spreads and therefore reduced transaction costs. In times of stress, their depth ensure loss-making positions can be exited to some degree. The relative predictability of central banks in advanced economies adds to the safety net.

In contrast, emerging market currencies such as ZAR and TRY are governed by unpredictable central banks whose sudden rate decisions can alter the dynamics of carry trades overnight. In a sense, the escalator descends much faster than in advanced economy currencies. Once the thinness of emerging market currency markets is considered, the resulting higher transaction costs and tendency to trade in much smaller notional amounts makes exiting carry trades accumulated over time much more difficult. As a result, they are a suitable control for developed markets currencies. ZAR and TRY have been used as they are often associated with speculation, of which the carry trade is a major component.

Spot and 1-month forward FX rates are derived from Bloomberg daily data. Due to market convention, forward points for specific contracts are provided e.g., 1-month, 3-month, 12-month etc, denoted *fp*, which are used to calculate the forward rate according to the formula:

$$F_t = S_t + \frac{fp}{10{,}000} \qquad (3)$$

where F_t , S_t are the forward and spot rates respectively. As per the literature, the 1-month forward rates are used as speculation normally occurs over a series of short-term trades. Given the increased importance of systematic investing, trend-following has started to meaningfully move FX markets and 1-month contract across various products are normally the most fundamental way in which sentiment is traded. The interest-rate differential, *fdt*, is defined as:

$$\frac{S_t - F_t}{S_t} \qquad (4)$$

as per Della Corte et al (2016). As shown in Figure 1, the CIP condition, i.e., fdt=0, generally holds in the dataset except for the emerging markets currencies which is likely a reflection of the increased efficiency associated with advanced economy FX pairs.

Figure 1

Descriptive Statistics for Spot, Forward, Rate Differential and Volatility 2010-17					
Currency Pair	**Spot**	**Forward**	**Fdt**	**Volspot**	**Volforward**
GBPUSD	1.5185	1.5185	0.0000	0.0420	1.3794
EURUSD	1.2507	1.2511	-0.0004	0.0375	0.0404
AUDUSD	0.8896	0.8882	0.0014	0.0342	0.0337
JPYUSD	0.0103	0.0102	0.0153	0.0004	0.0006
ZARUSD	0.1019	0.1562	-0.6179	0.0055	0.0043
TRYUSD	0.4715	0.4881	-0.0439	0.0215	0.0206

The similarity of spot and forward rates throughout the dataset suggests a regression involving some interaction between them will suffer from multicollinearity which is indeed the case. This also holds for all combinations of log transformations for spot, forward and spot*forward. Despite the apparent efficiency of currency markets, the volatility of spot and forward rates hints at some level of disconnect between fundamentals and market efficiency, the tension between the two has critical implications for national accounts. Bénétrix et al (2021) compiles data on the IIP of 50 countries from 1990-2017. Using an approach that combines actual with estimated figures, aggregate foreign currency exposures are calculated with a view to unmasking heterogeneities across groups. Therefore, combining EWN and financial data with markers from Bénétrix et al (2021) creates a data set of the same philosophy: a recognition that acknowledges the critical link between the exchange rates observed by market participants, of both speculative and non-speculative natures, and the gyrations of national accounts. As all of the figures are denominated in USD, the associated weightings are multiplied by GDP to derive the foreign assets and foreign liabilities as well as the domestic assets and domestic liabilities positions. Net assets are then found by subtracting assets derived in foreign currency from assets derived in domestic currency and the same approach is used for net liabilities.

Empirical Results

Taking the baseline model, (1), the spot and forward rates, interest rate differential, 10-year interest rate differential, net assets and net liabilities all have statistically significant effects on the CA balance for JPYUSD. The 10-year interest rate differential, net ass-

ets and net liabilities have a statistically significant effect on the CA balance for GBPUSD. These factors do not have statistically significant effects on the CA balance for EURUSD, AUDUSD, TRYUSD and ZARUSD as shown in Figure 2.

The results of (2) shown in Figure 3, contradict the results of Menkhoff et al (2012). The volatility of spot and forward rates are not statistically significant for AUDUSD. Given the statistical significance of the 10-year rate differential, an area for further research would be to test whether the volatility in 10-year rates has an impact on CA dynamics. Indeed, this may be part of the "forward-premium puzzle" and to the authors' knowledge this is yet to be studied. Across the models, statistically significant relationships are not found among pairs involving emerging markets currencies. This may be an inherent consequence of the unpredictability of central bank policymaking in these economies.

Figure 2

	Dependent variable:					
	CA					
	GBPUSD	EURUSD	AUDUSD	JPYUSD	TRYUSD	ZARUSD
	(1)	(2)	(3)	(4)	(5)	(6)
Spot	464,724,623.000	143,467,471.000	-16,749,225.000	1,247,316,015.000*	-2,058,151,338.000	-2,489,894.000
	(100,095,922.000)	(477,268,372.000)	(3,536,792.000)	(182,785,383.000)	(1,886,129,471.000)	(2,870,929.000)
Forward	-464,873,019.000	-143,440,492.000	16,726,740.000	-1,244,868,492.000*	2,058,151,302.000	2,829,183.000
	(100,123,217.000)	(477,635,718.000)	(3,547,746.000)	(182,818,444.000)	(1,886,129,343.000)	(2,920,268.000)
Fdt	-701,760,685.000	-174,771,818.000	15,755,942.000	-11,154,280.000*	157,285,838,232.000	122,013.800
	(130,569,922.000)	(512,710,661.000)	(3,345,888.000)	(1,631,452.000)	(144,351,426,101.000)	(144,588.100)
R10	-89,044.100*	-19,302.410	18,664.380	3,485.050*	-4,849.430	-8,043.329
	(11,679.270)	(60,541.140)	(3,367.981)	(319.313)	(14,567.950)	(15,906.250)
Nassets	0.109*	-0.197	0.008	-1.168***	-0.078	-0.033
	(0.017)	(0.476)	(0.019)	(0.009)	(0.246)	(0.252)
Nliabilities	-0.276*	0.141	-0.009	0.724**	-0.057	0.131
	(0.024)	(0.151)	(0.044)	(0.020)	(0.142)	(0.156)
Constant	265,195.500	182,749.500	-60,196.130	-31,542.540**	-179,991.500	-209,298.300
	(80,780.070)	(357,483.700)	(14,798.880)	(1,204.913)	(253,031.400)	(144,711.000)
Observations	8	8	8	8	8	8
R^2	0.999	0.890	0.985	1.000	0.788	0.903
Adjusted R^2	0.992	0.230	0.895	1.000	-0.485	0.324
Note:						*p<0.1; **p<0.05; ***p<0.01

Figure 3

	Dependent variable:					
	CA					
	GBPUSD	EURUSD	AUDUSD	JPYUSD	TRYUSD	ZARUSD
	(1)	(2)	(3)	(4)	(5)	(6)
Spot	-52,147,705.000	-70,409,013.000	-16,666,996.000**	-22,415,361,819.000	-2,591,434,485.000	-1,431,687.000
	(703,957,708.000)	(161,145,089.000)	(851,878.800)	(52,031,762,951.000)	(2,333,720,855.000)	(2,957,785.000)
Forward	52,563,581.000	70,594,268.000	16,638,349.000**	22,417,724,320.000	2,591,434,294.000	1,881,956.000
	(704,140,071.000)	(161,085,040.000)	(853,478.600)	(52,020,274,719.000)	(2,333,720,480.000)	(2,898,831.000)
Fdt	230,563,977.000	55,522,815.000	15,488,168.000**	177,253,277.000	198,193,036,658.000	85,706.240
	(933,033,775.000)	(190,585,861.000)	(746,251.800)	(486,573,956.000)	(178,555,274,055.000)	(182,914.900)
R10	191,019.200	40,424.080	19,732.400**	-17,924.490	-20,870.490	-11,489.870
	(74,827.190)	(23,265.340)	(973.695)	(249,739.100)	(46,421.190)	(38,684.300)
volspot	-1,756,545.000	-907,537.700	-1,374,014.000	-1,691,606,813.000	9,353,666.000	-687,494.200
	(1,575,576.000)	(499,348.600)	(370,208.800)	(3,212,716,581.000)	(17,157,139.000)	(2,044,755.000)
volforward	36,046.300	-950,403.100	1,418,888.000	1,655,237,599.000	-9,682,894.000	187,359.300
	(18,849.320)	(720,868.400)	(372,098.600)	(3,426,129,044.000)	(16,964,928.000)	(4,927,347.000)
Constant	-779,098.800	50,941.050	-66,242.930**	149,552.400	-218,123.300	-172,319.000
	(553,235.200)	(207,420.600)	(3,239.980)	(616,749.700)	(318,513.600)	(203,722.300)
Observations	8	8	8	8	8	8
R^2	0.910	0.965	0.999	0.677	0.829	0.777
Adjusted R^2	0.368	0.756	0.993	-1.262	-0.198	-0.558

Note: *p<0.1; **p<0.05; ***p<0.01

Conclusion and Possible Extensions

The relationship between CA balances and the common drivers of FX and fixed income carry trades is hetoregenous across countries. From 2010-17, the CA balance for the UK is found to have a statistically significant relationship at the 10% level with the 10-year interest rate differential, net assets and net liabilities. This may indicate a preference for fixed income carry trades in this particular currency pair (e.g funding 10-year Gilt purchases with USD). Given spot and forward FX rates are not significant, there may be another driver of net assets and net liabilities, equity carry trades, which deserves further study. For the same period for JPYUSD, spot and forward FX rates as well as the interest rate differential, 10-year interest rate differential, net assets and net liabilities are found to be statistically significant at various levels. A potential extension to this study would be to examine the effects that Covid-19 had on the carry trade. The data used in this study does not include the effect of Covid-19. Therefore, an extension of the paper could include the years 2020 and 2021 into the dataset to gain an understanding of how and to what degree the carry trade was impacted by Covid-19 and which currencies were affected the most. According to (Feng, et al., 2021), an increase in coronavirus cases results in higher levels of exchange rate volatility. Curcuru et al (2010) states that exchange rate volatility poses a high risk to carry trade investors. Thus, it is likely that the exchange rate volatility caused by Covid-19 had a major effect on the currency markets and thus induced losses for carry traders.

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