Destabilizing Carry Trades

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Introduction

FX carry trades consist in

- selling a low interest rate currency to fund the purchase of a high interest rate currency
- or selling forward a currency that is at a significant forward premium

High Sharpe ratio

Introduction

FX carry trades important in debates on global financial stability:

- Since 2008, USD-funded carry trades by the global banking system
- Important common component in local credit cycles and asset prices
- May be misaligned with local macroeconomic conditions/monetary policy objectives (Agrippino and Rey, 2014; Bruno and Shin, 2013, 2014; Rey, 2013)

Mundell Dilemma not Trilemma?

Introduction

- This paper develops a model in which carry traders earn true excess returns by exploiting asynchronous monetary policies
- Carry traders may earn positive excess returns if they successfully coordinate on supplying too much liquidity to a target economy
- The interest-rate differential is their coordination device

Simple perfect foresight model

- International investors enter into carry trades by borrowing in the world currency to make loans denominated in the currency of a small open economy
- The households in this small economy use these loans to frontload consumption
- Two central ingredients:
  1. The prices of the nontradable goods in the small economy are stickier than that of the tradable goods. (Burstein, Eichenbaum, and Rebelo; 2005)
  2. The interest rate rule responds to carry-trade inflows only insofar as they affect domestic inflation. It ignores the direct effect of these inflows on local capital markets.

Perfect-foresight model

- Unique tradable good with unit price in the world currency
- Small open economy with a domestic currency trades at S_t units of the world currency
- Populated by unit mass of households who live for two periods
- Set firms, work, and thus collect endowments when old
- Quasi-linear preferences:

$$\ln C_t + \frac{C_{t+1} - N_{t+1}^{1+\eta}}{R}$$

Perfect-foresight model

- Domestic consumption services C_t are produced combining the tradable good C_t^T and two nontradable goods $C_t^{N_1}$ and $C_t^{N_2}$:

$$C_t = \frac{\left(C_t^T\right)^\alpha \left(C_t^{N_1}\right)^\beta \left(C_t^{N_2}\right)^\gamma}{\alpha^\alpha \beta^\beta \gamma^\gamma}$$

- Simple model of rigid nontradable prices:
- The first nontradable good has a flexible price and can be transformed into F units of the tradable good
- The second nontradable good has a fully rigid price

Perfect-foresight model

Unit mass of carry traders consume the tradable good and can

- invest in the world currency earning a return R
- trade bonds with young households denominated in the domestic currency
- Each carry trader can take any position in the bond market within $\left[P_t e^{\underline{l}}, P_t e^{\bar{l}}\right]$, where these limits are denominated in the domestic currency, P_t is the domestic price level, and

$$\underline{l} < 0 < \bar{l}.$$

- L_t=aggregate real borrowing by young households at date t

Equilibrium conditions

- Taylor rule

$$I_{t+1} = R\left(\frac{P_t}{P_{t-1}}\right)^{1+\Phi}$$

- Euler equation

$$I_{t+1} = \frac{RP_{t+1}}{L_t P_t}$$

- Optimal consumption

$$P_t = (P_t^T)^{\alpha}(P_t^{N_1})^{\beta}(P_t^{N_2})^{\gamma},$$
$$= \left(P_t^T\right)^{1-\gamma} F^{\beta},$$

- PPP at the dock

$$P_t^T S_t = 1$$

Equilibrium

A perfect-foresight equilibrium is such that

- These 4 relations are satisfied
- Carry traders trade optimally:

$$L_t = \begin{cases} e^{\bar{l}} & \text{if } \Theta_{t+1} > 1 \\ e^{\underline{l}} & \text{if } \Theta_{t+1} < 1 \\ \in (e^{\underline{l}}, e^{\bar{l}}) & \text{if } \Theta_{t+1} = 1 \end{cases}$$

where

$$\Theta_{t+1} = \frac{S_{t+1} I_{t+1}}{R S_t}$$

Equilibrium

- This is a simple log-linear model. Let

$$
\begin{aligned}
r &= \ln R, \\
\theta_t &= \ln \Theta_t \\
i_t &= \ln I_t \\
s_t &= \ln S_t \\
l_t &= \ln L_t \\
\pi_{t+1} &= \ln \left(\frac{P_{t+1}}{P_t} \right)
\end{aligned}
$$

Equilibrium

- Taylor and Euler yield

$$
\begin{aligned}
\imath_{t+1} &= r + (1+\Phi)\pi_t \\
\imath_{t+1} &= r - l_t + \pi_{t+1} \\
&\rightarrow \pi_t = \frac{-l_t}{1+\Phi} + \frac{\pi_{t+1}}{1+\Phi} \\
&\rightarrow \pi_t = -\sum_{k\geq 0} \frac{l_{t+k}}{(1+\Phi)^{k+1}}
\end{aligned}
$$

Equilibrium

- PPP at the dock and optimal consumption yield

$$P_t^T S_t = \left(P_t F^{-\beta}\right)^{\frac{1}{1-\gamma}} S_t = 1$$
$$\rightarrow s_{t+1} - s_t = -\frac{1}{1-\gamma}\pi_{t+1}$$

- Thus

$$\begin{aligned}
\theta_{t+1} &= s_{t+1} - s_t + i_{t+1} - r \\
&= -\frac{1}{1-\gamma}\pi_{t+1} + \pi_{t+1} - l_t \\
&= \frac{\gamma}{1-\gamma}\sum_{k\geq 0}\frac{l_{t+k+1}}{(1+\Phi)^{k+1}} - l_t
\end{aligned}$$

Equilibrium

- Steady-states with constant l?

$$\theta = \frac{\gamma - \Phi\left(1-\gamma\right)}{\Phi\left(1-\gamma\right)} l$$

There exists a steady-state $l = 0$ in which the domestic real rate is R, the nominal exchange rate and the price level are constant, and the carry trade earns no excess return ($\Theta = 1$). If $\Phi(1-\gamma) > \gamma$, this is the only steady-state.

If $\Phi(1-\gamma) < \gamma$ there also exists a steady-state with maximum lending ($l = \bar{l}$) in which $\Theta > 1$, and the nominal exchange rate constantly appreciates. There also exists a steady-state with minimum lending ($l = \underline{l}$), $\Theta < 1$, and a constant depreciation of the exchange rate.

Three issues

1. Unclear how agents can coordinate on any equilibrium behavior at all
2. If carry traders keep lending $\bar{l}$ forever, prices and the interest rule must eventually adjust
3. The interest-rate differential plays no role in the determination of the steady-state

Next: model with a unique equilibrium in which a stochastic interest-rate differential serves as a coordination device for carry traders switching from excessive to insufficient lending

Destabilizing carry trades

- Time is continuous
- The interest rate at which carry traders borrow in the world currency is stochastic: $R\left(1 - w_t\right)$,
- Each carry trader can revise his lending policy only at discrete switching dates that are generated by a Poisson process with intensity λ. In between two switching dates, each carry trader commits to lend a fixed real amount

Destabilizing carry trades

- Carry trader "active" if committed to maximum lending $e^{\bar{l}}$ at his last switching date, "inactive" if commited to the minimum lending $e^{\underline{l}}$.
- x_t = fraction of active carry traders at date t. Endogenous state variable, Lipschitz continuous
- Expected return on the carry trade Θ_t

Equilibrium

An equilibrium is characterized by a process x_t that is adapted to the filtration of w_t and has Lipschitz-continuous paths such that:

$$\frac{dx_t}{dt} = \begin{cases} -\lambda x_t & \text{if } \Theta_t < 0, \\ \lambda(1 - x_t) & \text{if } \Theta_t > 0. \end{cases}$$

and the domestic economy is in equilibrium given (correct) beliefs about x_t

Main proposition

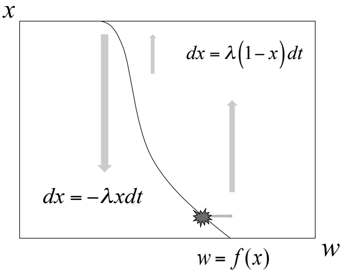
Suppose that

$$\gamma > \Phi\left(1 - \gamma\right).$$

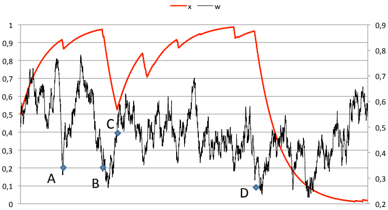
For λ sufficiently small, there exists a unique equilibrium defined by a decreasing Lipschitz function f such that

$$\frac{dx_t}{dt} = \begin{cases} -\lambda x_t & \text{if } w_t < f(x_t), \\ \lambda(1 - x_t) & \text{if } w_t > f(x_t). \end{cases}$$

Equilibrium dynamics (1)



Equilibrium dynamics (2)



Sample paths of x and w

Empirical content

- Profitability of FX momentum strategies
- Profitability of FX carry trades
- Peso problem
- Leverage and currency appreciation predict financial crises. Gourinchas and Obstfeld (2011)
- A more passive monetary policy generates more "bubbly" carry trade returns