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Economic Watch

US

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Economic Analysis

US

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Exchange Rate Fundamentals
First of a Series on Equilibrium Exchange Rates

- **Although subject to unwieldy assumptions, PPP is the canonical model**
- **Recent data suggests AUDUSD's current misalignment is diverging from its implied long-term misalignment**
- **Augmenting PPP with Uncovered Interest Rate Parity shows mixed results**

Equilibrium PPP Exchange Rate Models for US Dollar Currency Pairs

One of the most basic measures of an equilibrium exchange rate is based on purchasing power parity (PPP), which is the theory that through arbitrage the forces of supply and demand will equalize prices across countries (also known as the "Law of One Price"). Of course, these assumptions are not without controversy as there are many reasons why these conditions may not hold in the long run. For example, PPP may fail if separate countries' consumers have different preferences, if productivity variances drive relative prices of tradables and nontradables or if separate countries have contrasting production specialties. The existence of trade barriers, transportation costs or limits to arbitrage may cause the law of one price to break down, which also sinks PPP. Additionally, PPP measures may neglect other important explanatory levels of what may constitute an equilibrium exchange rate: capital flows, net foreign asset positions, relative changes in GDP, and others. Empirically, exchange rates have been found to persistently diverge from their implied PPP level in what has been termed the "PPP Puzzle."

Despite these limitations, PPP equilibrium exchange rate models are the first step in the assessment of misalignment in any country's exchange rate. Most famously, PPP was used to calculate the entry of the pound into Europe's Exchange Rate Mechanism (ERM) in 1991. Data for both exchange rates and inflation indices are available on monthly basis. Given the existence of a long-term relationship between inflation and exchange rates, we model the PPP equilibrium exchange rate using a vector error correction model that allows for both short-term and long-term effects. With a calculation of the long-term model, we further determine two different estimated equilibrium levels: one using the current data and a second using trend inflation. The rationale is that current data can give a level of misalignment different from the misalignment suggested by trend data. In our calculations below, this is the case for the Australian/US Dollar exchange rate.

Table 1
Misalignment Statistics (%) by US Dollar Currency Pair

Date	EUR	Current	LT	JAP	Current	LT	UK	Current	LT	AUS	Current	LT	CAN	Current	LT	SWZ	Current	LT
Jan-11	1.34	-0.3	0.5	82.63	-3.1	-3.2	1.58	-6.6	-6.9	1.00	-10.8	-6.5	0.99	-13.9	-10.3	0.96	-19.2	-18.8
Feb-11	1.37	1.9	2.7	82.54	-2.6	-3.0	1.61	-4.2	-4.7	1.01	-9.7	-6.0	0.99	-11.2	-10.9	0.95	-19.6	-19.1
Mar-11	1.40	6.5	5.6	81.65	-3.4	-3.8	1.62	-4.3	-4.3	1.01	-8.1	-6.3	0.98	-13.6	-11.9	0.92	-22.4	-21.5
Apr-11	1.45	10.7	9.0	83.18	-1.2	-1.7	1.64	-2.2	-2.9	1.06	-3.5	-2.5	0.96	-15.0	-13.6	0.90	-23.8	-23.1
May-11	1.43	9.1	8.1	81.13	-3.3	-3.8	1.63	-2.6	-3.0	1.07	-2.8	-2.2	0.97	-14.0	-12.7	0.87	-25.4	-24.8
Jun-11	1.44	9.0	8.7	80.43	-3.8	-4.3	1.62	-3.5	-3.5	1.06	-4.7	-3.3	0.98	-10.0	-12.0	0.84	-27.9	-27.5
Jul-11	1.43	5.4	7.8	79.24	-4.8	-5.5	1.62	-4.2	-3.7	1.08	-1.7	-2.4	0.96	-10.5	-13.9	0.82	-28.0	-28.8
Aug-11	1.43	5.4	8.3	76.97	-7.4	-7.9	1.64	-2.7	-2.3	1.05	-2.0	-5.4	0.98	-8.1	-11.5	0.78	-30.8	-32.2
Sep-11	1.37	2.4	4.0	76.80	-7.3	-7.8	1.58	-5.7	-5.7	1.02	-2.8	-8.4	1.00	-7.1	-9.7	0.88	-22.2	-23.5
Oct-11	1.37	3.4	3.9	76.64	-7.6	-7.7	1.58	-5.6	-5.6	1.02	-4.1	-9.4	1.02	-8.0	-8.1	0.90	-20.5	-21.5
Nov-11	1.36	2.3	2.7	77.56	-5.7	-6.3	1.58	-5.3	-5.2	1.01	-4.0	-10.4	1.02	-7.5	-7.7	0.91	-19.0	-20.2
Dec-11	1.32	0.2	-0.3	77.80	-5.4	-5.7	1.56	-6.1	-6.3	1.01	-3.9	-10.7	1.02	-6.4	-7.8	0.93	-16.5	-17.6
Jan-12	1.29	-3.5	-2.1	76.96	-6.3	-6.5	1.55	-7.3	-6.6	1.04	-0.1	-8.6	1.01	-9.3	-8.7	0.94	-15.1	-17.0

Source: BBVA Research; Note: Jan-2012 data is based on incomplete inflation data and is preliminary

Interest rate differentials between countries are another natural candidate for understanding equilibrium exchange rates. According to the theory of Uncovered Interest Rate Parity (UIP), higher interest rates in one country leads to a depreciation of that currency, otherwise investors would purchase more of the higher-yielding asset. Expected nominal returns are equalized across borders in currency terms. This is termed "uncovered" because the theory is not allowing for forward contracts to hedge exchange rate risk. We can add UIP to the PPP condition and estimate similar equilibrium models as before, but with a few testable implications. First, we use both 3-Month and 5-year interest rate differentials. It may be the case that UIP is stronger at the end of the yield curve rather than the front. We also impose different conditions on the model (specifically, the cointegrating vector once it is proven statistically significant) to reflect: (1) strict form PPP and UIP, (2) strict PPP and weak UIP, and (3) PPP symmetry and weak form UIP. Condition (1) implies everything works as theorized, while condition (2) suggests that price differentials affect exchange rates proportionately, but interest rates affect exchange rates only partially and not as rigidly as theorized. The last condition is attempting to test if there are only partial effects from prices and interest rates (in other words, both prices and interest rates are less rigid than theorized). We test the models across several different US currency pairs with our monthly data. Some models do no converge at all and many fail to accept the statistical significance of the conditions. The models including long-maturity interest rate differentials tend to converge more frequently, lending credence to research implying a better fit via this method. The models are particularly poor for both Japan and Europe. In Japan's case, years of deflation and low interest rates are causing difficulties in our cointegration framework. In Europe's case, the data tends to be shorter or synthetically crafted from discontinued data, with potential problems for analysis. The acceptable results in some cases clash with the model results from the PPP only estimates. Given the above, our future work will focus on models beyond PPP and UIP.

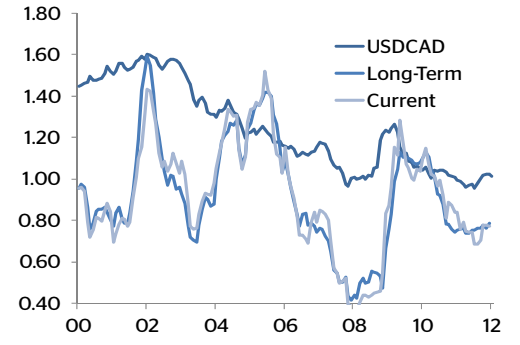
Table 2
P-Values of Likelihood Ratio Tests of Identifying Restrictions, Blue Denoted Acceptance Beyond 10%

Exchange Rate	3-Month Interest Rates			5-Year Interest Rates		
	Strict Form PPP and UIP	Strict PPP and Weak UIP	PPP Symmetry and Weak UIP	Strict Form PPP and UIP	Strict PPP and Weak UIP	Symmetry and Weak UIP
EURUSD	*	*	0.17	0.00	0.03	0.09
GBPUSD	*	*	0.00	*	0.00	0.18
USDJPY	0.00	0.00	0.00	0.00	0.00	0.12
USDCAD	*	*	0.64	0.00	0.01	0.00
USDCHF	*	*	0.86	*	*	0.08

Note: * denotes no convergence of the model with the identifying restrictions

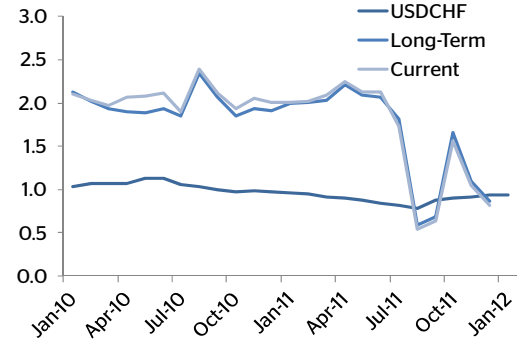
Source: BBVA Research

Chart 1
USDCAD by PPP with UIP



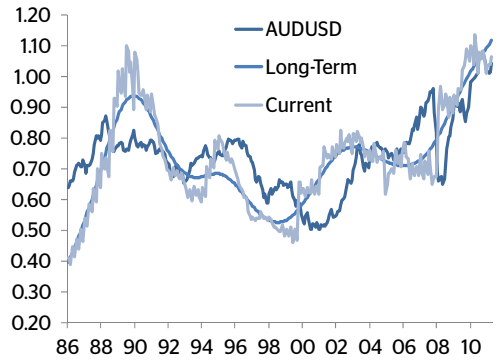
Source: BBVA Research

Chart 2
USDCHF by PPP with UIP



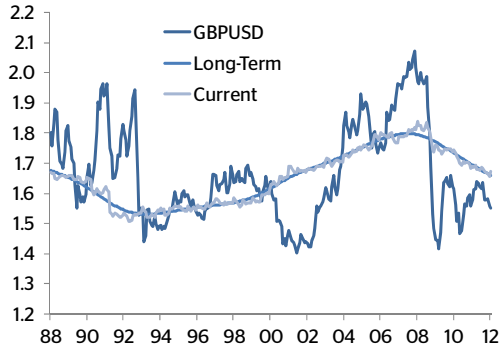
Source: BBVA Research

Chart 3
AUDUSD by PPP



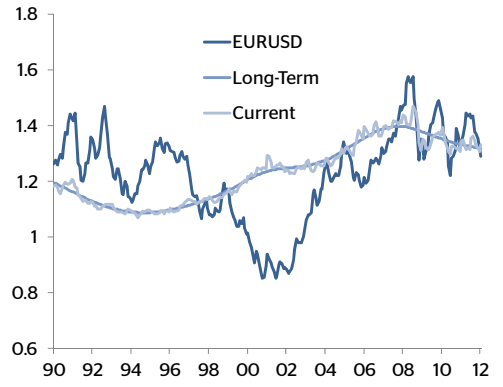
Source: BBVA Research

Chart 4
GBPUSD by PPP



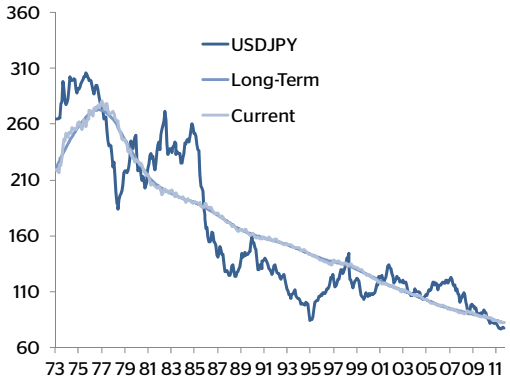
Source: BBVA Research

Chart 5
EURUSD by PPP



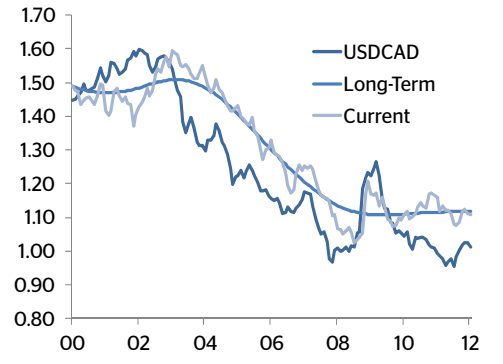
Source: BBVA Research

Chart 6
USDJPY by PPP



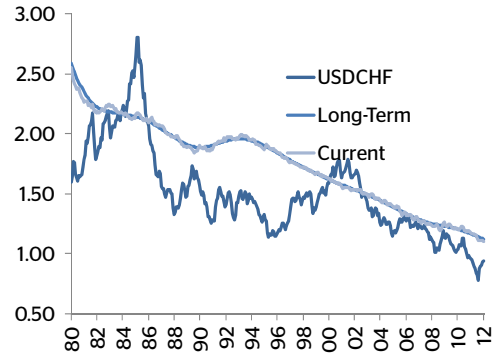
Source: BBVA Research

Chart 7
USDCAD by PPP



Source: BBVA Research

Chart 8
USDCHF by PPP



Source: BBVA Research