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Economics Group

John Silvia, Chief Economist
john.silvia@wellsfargo.com ● (704) 410-3275
Azhar Iqbal, Econometrician
azhar.iqbal@wellsfargo.com ● (704) 410-3270
Erik Nelson, Economic Analyst
erik.f.nelson@wellsfargo.com ● (704) 410-3267

Capital Flows and Treasury Yields in the Post-Great Recession Era

Executive Summary

Our global economy is more open today than it has ever been. While this has many positive implications for growth and efficiency, openness also makes decision-making more challenging, as private and public policy actions in one part of the world affect private and public policy makers' decisions in other regions. In addition, the changing nature of the economic ties between countries requires a continuous reevaluation of the benchmark relationships. That is, the degree of economic interdependency of a country (the United States, for example) may increase with some countries (after NAFTA with Canada and Mexico) and decrease with others (trade sanctions with Russia or Iran, for example) over time.

In this second part of our series on the open economy, we continue the theme of identifying the interactions of capital flows and their influence on asset prices around the globe. Our goal is to help decision-makers characterize the differential behaviors among countries and asset classes in the ever-evolving open world economy.[1]

However, before we rush through an analysis of interactions, we must identify the underlying behavior of the economic series we wish to study. As illustrated in our prior work, a significant portion of economic commentary today rushes to find relationships without first understanding the underlying behavior of each economic series.[2] While first studying each series may appear tedious, it is necessary to avoid poorly specified models that are subject to significant statistical errors and would thus generate useless forecasts and lead to poor decision-making.

In this paper, we characterize U.S. capital inflows behavior using an annual dataset for the 1975-2012 period. The H-P filter based trends for total inflows and direct investment suggest that the pace of capital inflows has slowed down since the early 2000s. In addition, our analysis indicates that the three measures of the global economy that we focus on here (real GDP, inflation and current account balance) exhibit different behavior for the post-2007 period compared to the 2002-2007 era.

Is the Post-2007 Economy Structurally Different?

The Great Recession clearly led to a significant shake-up in global financial markets, but did it cause a structural shift in economic fundamentals? We utilize three different measures of the global economy to address this question: real GDP growth, CPI inflation and the current account balance. We test real GDP growth rates in the United States, Eurozone and China, and split the datasets between two periods: 2002-2007 and 2008-2014. In preview, our analysis indicates the average GDP growth rate during 2008-2014 is statistically different from the average growth rate from 2002-2007 for all three countries. Furthermore, the average GDP growth rates of all three

The evolution of the global economy forces us to constantly reevaluate our thinking.

The global economy experienced a structural shift during the Great Recession.

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[1] For detail about the first part of the series, see our Jan. 12, 2015 report, *"The Open U.S. Economy and Newton's Third Law."* The report is available upon request.

[2] Silvia, Iqbal et. al, Economic and Business Forecasting, Wiley, Hoboken, N.J. 2014

Together we'll go far

Inflation and growth have generally shifted downward in major advanced economies since 2007.

countries have shifted downward since 2008: the U.S. to 1.2 percent from 2.7 percent, the Eurozone to -0.1 percent from 2.0 percent and China to 8.6 percent from 10 percent. This shift was statistically significant for all three countries in our sample.

Patterns in inflation, as measured by the year-over-year percent change of each country's CPI, exhibit interesting alternative behaviors. The average inflation rates of the United States and Eurozone from 2008-2014 are statistically different from inflation during 2002-2007. For the United States and Eurozone, average CPI inflation shifted downward from 2002-2007 to 2008-2014. However, the average Chinese CPI inflation rates for the pre- and post-2007 periods are statistically indistinguishable.

As a final means of measuring structural change, we examine the current account balances of the United States, Germany (used as a proxy for Eurozone) and China. The average growth rates of the United States' and Germany's current account balances are statistically different for the post-2007 era compared to the 2002-2007 period. Furthermore, the U.S.'s current account deficit narrowed and Germany's surplus grew wider. On the other hand, the Chinese current account balance is statistically the same, on average, for the post-2007 vs. 2002-2007 periods.

In sum, our analysis suggests the global economy may have experienced a structural shift for the post-2007 period compared to the 2002-2007 era for our selected benchmark economic series.

Tracking U.S. Capital Flows: What Has Changed?

We characterize U.S. capital inflows behavior using an annual dataset for the 1975-2012 period. The H-P filter based trends for total capital inflows (Figure 1) and direct investment (Figure 2) have been moving upward since 1975.[3] However, during the past 10 years, both trends have begun to show signs of flattening out, suggesting that the pace of capital inflows has been slowing since the early 2000s.

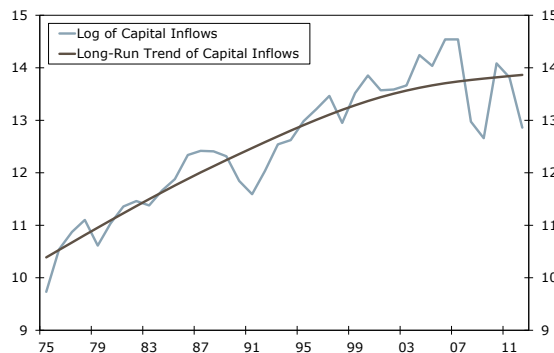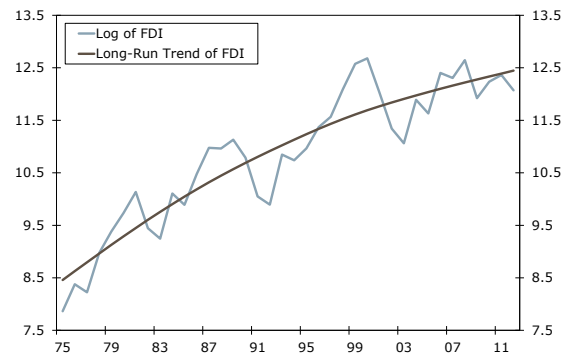**Figure 1**

Total Capital Inflows into the U.S.

Figure 2

Foreign Direct Investment in the U.S.

Source: U.S. Department of Commerce and Wells Fargo Securities, LLC

U.S. capital flows are mean-reverting, but can be particularly volatile.

The mean, standard deviation and stability ratio for each series is reported in Table 1. In all cases, the stability ratio is greater than 100, which is generally considered a sign of relative volatility. Yet, structural break test indicates no evidence of a break for all series except other private holdings, which has a structural break in 2008 (Table 4). However, outliers are present in all series, which is consistent with the higher stability ratio values of these volatile series. As a means of testing for structural breaks in these series, we conducted augmented Dickey-Fuller (ADF) tests on each series. The ADF test results suggest all series are mean-reverting. In sum, statistical results suggest the U.S. capital inflows series are mean-reverting, but there are some volatile periods when the current account series moves away from the mean.

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[3] **We utilize six different series to characterize U.S. capital inflows and only two of these measures contain all positive values. Thus, we only apply the H-P filter on those two series.**

Table 1

Variable	1975-2012			1975-1989			1990-2012		
	Mean	S.D.	Stability Ratio	Mean	S.D.	Stability Ratio	Mean	S.D.	Stability Ratio
Official Portfolio Holdings	-47.30	618.73	-1308.13	-237.84	804.80	-338.37	68.68	454.46	661.67
Direct Investment	24.70	57.22	231.63	36.90	53.62	145.30	17.28	59.22	342.71
Total Inflows	22.64	65.50	289.36	25.56	38.83	151.92	20.85	78.23	375.13
Private Portfolio Holdings	-222.93	1097.72	-492.41	28.69	44.89	156.47	-376.08	1380.50	-367.07
Other Private Holdings	28.22	119.15	422.23	55.77	123.81	221.99	11.45	115.74	1011.04
Other Official Holdings	370.25	2064.20	557.52	866.40	3328.24	384.14	68.24	418.07	612.64

Source: U.S. Department of Commerce and Wells Fargo Securities, LLC

Are Global Treasury Yields Mean-Reverting?

To characterize the global bond market, we utilize four major countries' 10-year treasury yields: the United States, Germany, Italy and the United Kingdom. The H-P filter based trend and log of the U.S. 10-year Treasury yield is plotted in Figure 3. The H-P trend moved steadily downward from 1994 to 2012, but has rebounded since then. The uptick in the trend is consistent with the ending of quantitative easing (QE) programs by the Federal Reserve Board. In addition, the recent upward trend may signal that an era of rising short and long-term rates is about to commence.
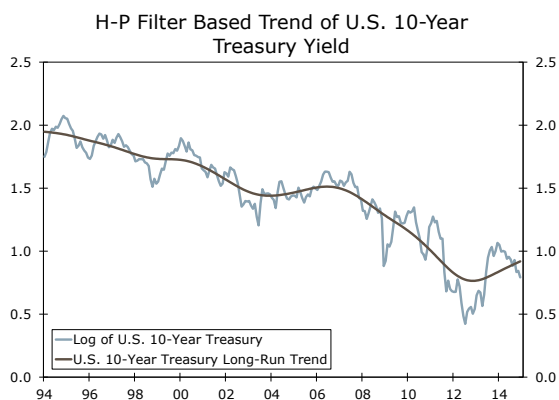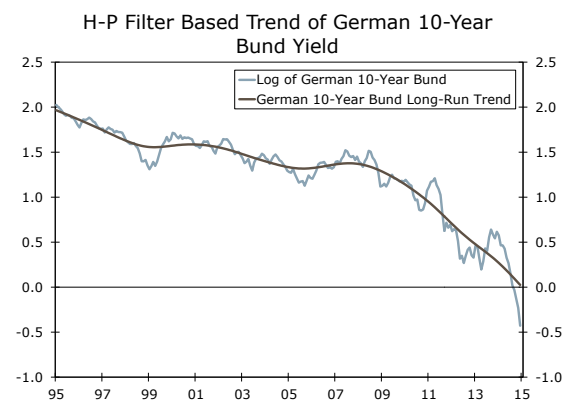
Figure 3

H-P Filter Based Trend of U.S. 10-Year Treasury Yield

Figure 4

H-P Filter Based Trend of German 10-Year Bund Yield

Source: Bloomberg LP and Wells Fargo Securities, LLC

Trends for Germany (Figure 4) and Italy (Figure 5) have also generally been downward since 1994. In contrast to the United States, both countries' trends have plunged in the past few years, which may signal that investors believe current expansionary monetary policy may continue in the near future and the economic recovery has been disappointing relative to expectations. The downward trends of the German and Italian 10-year treasury yields are consistent with the announcement of QE from the European Central Bank. The trend in the U.K. 10-year treasury yield (Figure 6) has a pattern consistent with the U.S. Treasury trend, bottoming out in 2013 and moving upward since then. Overall, the H-P filter analysis shows the global treasury market has a mixed trend, as two major markets (U.S. and U.K.) are trending toward higher rates while the other two (Germany and Italy) are expecting further stimulus and rates are thus staying low.

U.S. and U.K yields are trending slightly upward, but Italian and German yields continue downward.
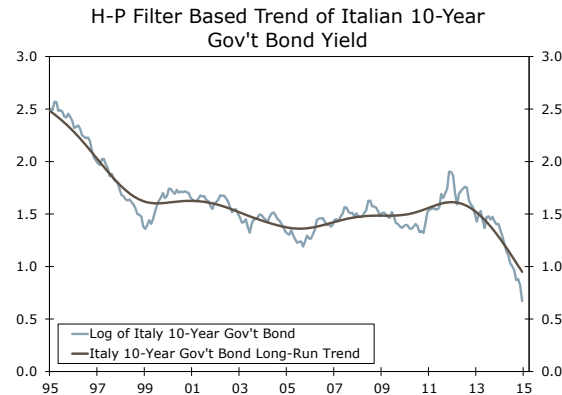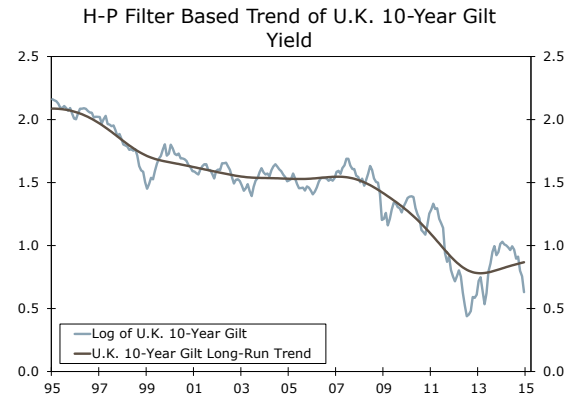
Figure 5

H-P Filter Based Trend of Italian 10-Year Gov't Bond Yield

Figure 6

H-P Filter Based Trend of U.K. 10-Year Gilt Yield

Source: Bloomberg LP and Wells Fargo Securities, LLC

Yields in all four economies are not mean-reverting.

The mean, standard deviation and stability ratio for each country's treasury yields are reported in Table 2. For all four countries, the stability ratios are less than 50, which indicates treasury yields were very stable during the complete sample period (1994-2014) and sub-samples. In the final step, we determine whether measures of global treasury market are mean-reverting (Table 5). All four treasury yields experienced structural breaks and are non-stationary, indicating these series are not mean-reverting. Thus, investors should not assume treasury yields in these nations will return to any sort of long-run average.

Table 2

Variable	1994-2014			2000-2014			1994-1999		
	Mean	S.D.	Stability Ratio	Mean	S.D.	Stability Ratio	Mean	S.D.	Stability Ratio
U.S. 10-Yr	4.51	1.53	34.00	3.82	1.17	30.76	6.23	0.79	12.67
Germany 10-Yr	4.06	1.58	38.96	3.43	1.24	36.19	5.74	1.09	19.04
Italy 10-Yr	5.38	2.26	41.94	4.45	0.78	17.43	7.88	2.95	37.42
U.K. 10-Yr	4.82	1.77	36.69	3.99	1.13	28.30	6.92	1.28	18.55

Source: Bloomberg LP and Wells Fargo Securities, LLC

The Volatility of Foreign Purchases of U.S. Securities

Investors purchase securities from different countries for any number of reasons, e.g., perhaps to achieve better returns or to diversify their portfolios. That creates opportunities for a country to sell securities not only to domestic investors but also to foreigners. Foreigners, both in the private sector and in the government sector, buy hundreds of billions of dollars worth U.S. securities every year, on average.

Foreign purchases of U.S. securities are highly volatile.

Here, we utilize foreign private purchases of U.S. Treasuries, equities and agency/corporate debt to represent foreign purchases of U.S. securities.[4] In addition, we include total private and official (government) purchases of U.S. Treasury debt. The mean, standard deviation and stability ratio for each series is shown in Table 3. One noticeable observation is that all measures of foreign purchases are very volatile, as each series' standard deviation is significantly larger than its mean. The smallest stability ratio is 448, which indicates the standard deviation is more than four times higher than the mean.

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[4] **We apply the H-P filter on a log of a time series, and if a series contain negative values, then that would restrict the H-P filter application. All measures of foreign purchases of the U.S. securities include negative values and thereby we are unable to utilize the H-P filter for these series.**

Table 3

Variable	1990-2014			2000-2014			1990-1999		
	Mean	S.D.	Stability Ratio	Mean	S.D.	Stability Ratio	Mean	S.D.	Stability Ratio
Agency (YoY)	159.10	1751.57	1100.90	22.34	672.87	3011.41	363.10	2633.54	725.29
Equity (YoY)	568.75	5592.19	983.24	557.11	5895.08	1058.15	586.11	5131.33	875.49
Treasury (YoY)	221.89	1421.91	640.83	276.26	1710.99	619.34	140.78	820.40	582.75
Corporate (YoY)	242.47	2778.16	1145.78	-13.11	253.89	-1935.91	623.71	4357.37	698.62
Official (YoY)	306.59	1624.03	529.70	362.86	1934.32	533.08	222.67	998.13	448.26
Private (YoY)	114.73	2775.71	2419.24	85.11	3564.49	4188.20	158.93	534.29	336.18

Source: U.S. Department of Commerce and Wells Fargo Securities, LLC

Structural break tests for these series indicate no evidence of a break in any measure of foreign purchases (Table 6). There are, however, outliers in all series, which is consistent with the higher stability ratio values of these volatile series. The ADF test results suggest all series are mean-reverting. In sum, statistical results suggest the foreign purchases of U.S. securities are mean-reverting, but there are some volatile periods when the series moves away from the mean. We speculate that these outliers represent periods of global panic (i.e., Asian Financial Crisis, Tech Bubble, Great Recession, Double Dip Recession in Eurozone, etc.), although with annual data it is difficult to nail down a specific cause for large inflows or outflows.

Concluding Remarks: Future Looks Different

In sum, the Great Recession caused significant structural shifts in a number of economic and financial barometers. Specifically, our three benchmark indicators of global economic performance (real GDP, inflation and the current account balance) have exhibited different behavior in the post-Great Recession era relative to the 2002-07 era. Financial indicators have also experienced important shifts as well. After over a decade of trending downward, 10-year government bond yields in the United States and United Kingdom are showing signs of turning upward, while 10-year yields in Germany and Italy are continuing to show signs of trending downward. Interestingly, all four of these countries' yields experienced structural breaks and are not mean-reverting. Thus, investors should not assume that economic and financial conditions will necessarily return to the way they were prior to the Great Recession; instead, the future looks to be uncharted territory.

Do not assume prerecession economic and financial conditions will be restored.

Appendix

Table 4

Identifying a Structural Break Using the State-Space Approach		
Official Portfolio Holdings (Mean-reverting)		
Break Date	Type of Break	Coefficient
Jan-86	Additive Outlier	-3010
Jan-90	Additive Outlier	1873
Jan-99	Additive Outlier	-1006
Direct Investment (Mean-reverting)		
Break Date	Type of Break	Coefficient
Jan-93	Additive Outlier	160
Jan-84	Additive Outlier	135
Jan-04	Additive Outlier	121
Total Inflows (Mean-reverting)		
Break Date	Type of Break	Coefficient
Jan-10	Additive Outlier	306
Private Portfolio Holdings (Mean-reverting)		
Break Date	Type of Break	Coefficient
Jan-91	Additive Outlier	-5827
Jan-10	Additive Outlier	-3310
Other Private Holdings (Not Mean-reverting)		
Break Date	Type of Break	Coefficient
Jan-08	Level Shift	-103
Jan-97	Additive Outlier	225
Other Official Holdings (Mean-reverting)		
Break Date	Type of Break	Coefficient
Jan-86	Additive Outlier	12378
Jan-92	Additive Outlier	1355
Jan-95	Additive Outlier	1244

Table 5

Identifying a Structural Break Using the State-Space Approach		
U.S. 10-Year Treasury (Not Mean-reverting)		
Break Date	Type of Break	Coefficient
Dec-08	Level Shift	-1.0
May-00	Additive Outlier	0.43
Aug-11	Level Shift	-0.59
German 10-Year Bund (Not Mean-reverting)		
Break Date	Type of Break	Coefficient
Aug-11	Level Shift	-0.53
Italian 10-Year Gov't Bond (Not Mean-reverting)		
Break Date	Type of Break	Coefficient
Nov-11	Level Shift	0.98
May-95	Level Shift	-0.94
U.K. 10-Year Gilt (Not Mean-reverting)		
Break Date	Type of Break	Coefficient
Jun-94	Level Shift	1.74
Dec-08	Level Shift	-0.68
Nov-99	Level Shift	-0.55

Table 6

Identifying a Structural Break Using the State-Space Approach		
Agency (YoY) (Mean-reverting)		
Break Date	Type of Break	Coefficient
Sep-99	Additive Outlier	28620
Mar-09	Additive Outlier	-6699
Feb-08	Additive Outlier	4662
Equity (YoY) (Mean-reverting)		
Break Date	Type of Break	Coefficient
Apr-13	Additive Outlier	78679
Sep-97	Additive Outlier	55561
Aug-99	Additive Outlier	8218
Treasury (YoY) (Mean-reverting)		
Break Date	Type of Break	Coefficient
Nov-09	Additive Outlier	20399
Jun-92	Additive Outlier	7891
Jun-02	Additive Outlier	6032
Corporate (YoY) (Mean-reverting)		
Break Date	Type of Break	Coefficient
Feb-92	Additive Outlier	42740
Jul-94	Additive Outlier	20830
Mar-91	Additive Outlier	5084
Offical (YoY) (Mean-reverting)		
Break Date	Type of Break	Coefficient
Aug-02	Additive Outlier	21389
Nov-13	Additive Outlier	12286
Jun-94	Additive Outlier	7071
Private (YoY) (Mean-reverting)		
Break Date	Type of Break	Coefficient
Sep-02	Additive Outlier	34376
Jun-13	Additive Outlier	-32276
Jan-10	Additive Outlier	5736

Source: U.S. Dept. of Commerce, Bloomberg LP and Wells Fargo Securities, LLC

Wells Fargo Securities, LLC Economics Group

Diane Schumaker-Krieg	Global Head of Research, Economics & Strategy	(704) 410-1801 (212) 214-5070	diane.schumaker@wellsfargo.com
John E. Silvia, Ph.D.	Chief Economist	(704) 410-3275	john.silvia@wellsfargo.com
Mark Vitner	Senior Economist	(704) 410-3277	mark.vitner@wellsfargo.com
Jay H. Bryson, Ph.D.	Global Economist	(704) 410-3274	jay.bryson@wellsfargo.com
Sam Bullard	Senior Economist	(704) 410-3280	sam.bullard@wellsfargo.com
Nick Bennenbroek	Currency Strategist	(212) 214-5636	nicholas.bennenbroek@wellsfargo.com
Eugenio J. Alemán, Ph.D.	Senior Economist	(704) 410-3273	eugenio.j.aleman@wellsfargo.com
Anika R. Khan	Senior Economist	(704) 410-3271	anika.khan@wellsfargo.com
Azhar Iqbal	Econometrician	(704) 410-3270	azhar.iqbal@wellsfargo.com
Tim Quinlan	Economist	(704) 410-3283	tim.quinlan@wellsfargo.com
Eric Viloria, CFA	Currency Strategist	(212) 214-5637	eric.viloria@wellsfargo.com
Sarah Watt House	Economist	(704) 410-3282	sarah.house@wellsfargo.com
Michael A. Brown	Economist	(704) 410-3278	michael.a.brown@wellsfargo.com
Michael T. Wolf	Economist	(704) 410-3286	michael.t.wolf@wellsfargo.com
Zachary Griffiths	Economic Analyst	(704) 410-3284	zachary.griffiths@wellsfargo.com
Mackenzie Miller	Economic Analyst	(704) 410-3358	mackenzie.miller@wellsfargo.com
Erik Nelson	Economic Analyst	(704) 410-3267	erik.f.nelson@wellsfargo.com
Alex Moehring	Economic Analyst	(704) 410-3247	alex.v.moehring@wellsfargo.com
Donna LaFleur	Executive Assistant	(704) 410-3279	donna.lafleur@wellsfargo.com
Cyndi Burris	Senior Admin. Assistant	(704) 410-3272	cyndi.burris@wellsfargo.com