„Die Bedeutung des Leistungsbilanzsaldos für die Erklärung der Wechselkurse“

E. STREISSLER und Th. SINGER, 14. XII. 2007

More and more as time goes on, and particularly since the years 2000 or 2002, traditional exchange rate theory lies in shatters and we have to start afresh in a know-nothing situation. Relative purchasing power parity theory, the explanation of intertemporal exchange rate changes by interlocal differences in inflation rates, is far off the mark as the exchange rates, and in particular the US dollar against the Euro fluctuate wildly around PPP in fluctuations of about fifteen years duration. Uncovered interest parity (UIP) as an equilibrium theory cannot be applicable for the case of the US dollar - and in consequence for most other developed country currencies - as it would say that in current account equilibrium the currency with the higher level of interest rates has to depreciate accordingly: But the US current account has hardly ever been in balance within the last 26 years except, for reasons of international war finance, in the one year of the first Iraq war, 1991. As a disequilibrium theory UIP is even more absurd for it would say that because of currency inflow - and therefore a current account disequilibrium - the country with the higher interest rate will appreciate.

Actually, the difference in the consumer price rate of inflation between the US and Germany was 0,5 percent (3,5 inflation in the US, 3,0 percent in Germany according to the Economist, Dec. 1); and the difference in short term interest rates for the same countries (and the same source) was - 0,4 % and for long term interest rates - 0,1 % (Short, i.e. 3 month rates: US 4,34 %, Germany 4,74 %, long, i.e. 10 year govt. bonds: US 4,03 %, Germany 4,11 %). All this is, in fact, well within the measurement uncertainty, as it is unclear which - if any - of the many price indices are relevant for investors in foreign exchanges and on the other hand, which of the many possible rates of return. To make matters worse, with the huge amount of cash dollars floating around in - to the US - foreign markets, we cannot even say whose country’s currency the US dollar actually is. The best guess at present might be to say that now - or rather, up to about a year ago, as China is now appreciating - the US dollar is above all the currency of China traded above all in the markets of London.

Recent literature reflects this chaotic situation. To mention only a few but typical results: ENGLE-WEST (2005) has pointed out that the exchange rate at best predicts monetary fundamentals but is not itself predicted by them, as both PPP as well as UIP would imply. Even for his weak conclusions the evidence is rather spotty. ALVAREZ-ATKENSON-KEHOE (2007) point out forcefully that, taking the US and Britain, exchange rate movements, being random walks, are completely delinked from interest rate movements; though I would not follow them in the conclusion that interest rate movements just show varying risk premia: in the usual version of measurement they are delinked without further simple theoretical consequences. MURRAY-PAPELL (2002) show that if variances are correctly measured the movement of the US dollar rate cannot be distinguished significantly from a random walk.

I would conclude from a fundamental dissertation by BRUCK (2006) that exchange rates do follow only a purely univariate pattern, but not random walks, much rather a mean reverting path. BRUCK's dissertation rests, however, on only about five years, but, on the other hand, on eight hourly measurements per day, a periodicity for which mean reversion in order to even out the irregularity of order flows would be most at the fore. BACCHETTA-WINCOOP (2006) has also stressed that with heterogeneous agents order flows would also typically confuse the markets and lead away from fundamentals which are difficult to discern.

Thus my endeavour together with Thomas SINGER starts from such a know-nothing point of view. In particular we recognize firstly that constraining money changes and interest rates to equal coefficients (in absolute terms) for both countries is unfounded and unitary coefficients in the case of money in equations derived from the quantity equation even more so. If anything, very rapidly known changes in interest rates (or changes in just as rapidly known base money) must be seen as mere signals for the state of complex market conditions and for the state of expectations about market developments. Thus different coefficients for interest rate changes in the US will show a much greater weight than those in other countries as the US dollar still dominates financial markets, about 65 % of all financial transactions having the dollar at least on one side. Secondly, however, we turn once more to real variables as important measures in the development of regional markets on exchange rates. Thomas SINGER has, e.g., found the US unemployment rate to be a good predictor for exchange rates. As argued in STREISSLER (2007) we take up once more in particular the current account as a determinant of exchange rates. After all, if in deficit, it shows the need of searching for finance to enable a desired current account disequilibrium. The current account and interest rates, unrestricted in the coefficients, are, however, correlated variables. In future research we intend to go into differences in productivity increases between countries and other real variable developments in order to explain exchange rate developments. After all the difficulty to explain the exchange rate by traditional theories need not imply complete impossibility all together. We are encouraged by the high degree of explanation we achieve and that our variables are I(0) as well.

What remains left to search? Seemingly all theories about exchange rates contradict each other and shocks are unpredictable. Even worse, interest rates miss a theoretical understanding beyond the approach of relative marginal utility1.

But the well established theoretical concepts are not wrong per se. It turns out, as will be demonstrated, that only the frame that we search in is too marrow. If one understands the integrated global financial system as one without any possible losses then the main currency areas are commonly influenced on national accounts, exchange rates and interests. It follows that there is no need in explaining each variable on its own. Furthermore it is useless, trying to incorporate theories into empirical work, trying to test for validity of the theoretical approach. The approach is opposite. We want to draw conclusions from empirical work. So, every finding from a correctly specified model has to be discussed and explained. This is the only way to track world financial flows under free capital movement. Traditional theories help to interpret empirical findings but empirical testing will not help us to understand the global financial markets in a free world.

We turn to national accounts, because they aggregate the trading as well as the financial position of a country. One has to remark, that currency areas spread across the globe. Thus, a nation is by no means the owner of its currency. That’s because the character of money is threefold. Transaction demand is most important for trading goods and services. Whereas the store of value is mainly attributably to individuals who are concerned about their wealth holdings. Furthermore the use as accounting unit inter alias represents the attractiveness of a currency over another.

The decisive innovation of the modern understanding of money that evolves after the gold standard period is its use for accounting risk. Financial integration on a global as well as on a national level has the goal of financial innovations that incorporate risk. This is enforced by the fact that financial instruments are deemed to hedge business returns and to facilitate speculation, which is important for the non-arbitrage

[1]For example the only theoretical understanding of interest rates that economists developed so far is the one of relative marginal utility. Is it worth to save money for later consumption or shall one consume all the wealth today? The approach of an investor is exactly the same. Shall he provide money for present consumption or does it pay to invest for future consumption. By definition the play between consumers and investors has to be in equilibrium. But obviously it can not be explained how interest rates follow these theoretical considerations.

conditions in free capital markets. Thus, the possibility of a money to bear risk is valued as capital generated by an economy. This fact is not fully reflected by theoretical considerations about exchange rates and interests.

Furthermore monetary policy in free markets have to take foreign monetary actions into account. For example inflation targets are widely agreed, because substantial differences in inflation rates between currency areas lead to huge capital flows that damper world financial stability. It took money authorities a while to understand, that currency areas are not self defining, that money targets spur inflation and that financial innovation deteriorates the definition of the monetary base.

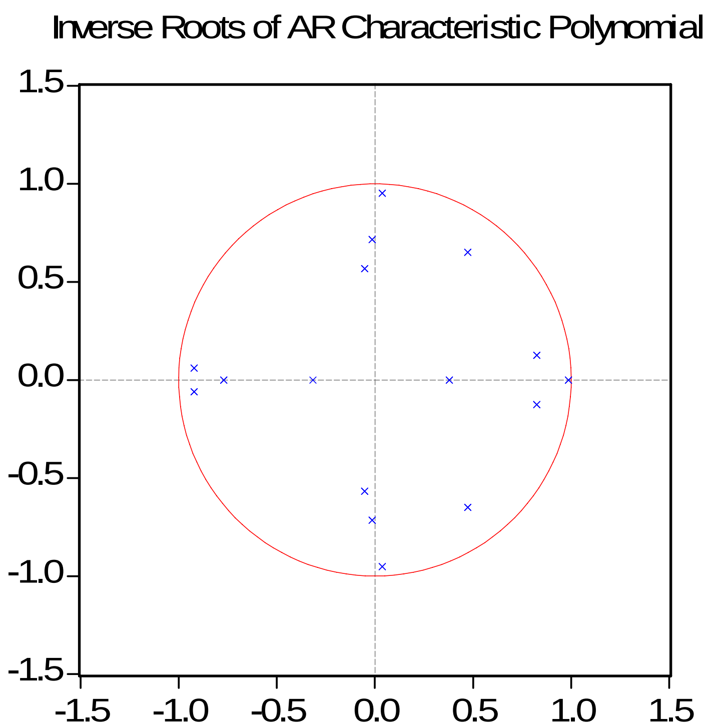
That all is due to the fact that within free global financial markets all market participants can buy whatever currency they need to maximize their wealth. Global financial markets are structured in a seemingly endless row of financial portfolios. And what counts is the return earned on portfolios that are again structured on risk diversification. Expectations are thus a new form of capital that generates returns. - Returns that can be shifted to other wealth holding units (that is: other currencies or commodities). So it is this shift in expected returns that causes financial flows and determines the terms of trade of a currency area.

Practically all monetary models explain expected values in a risk neutral world. Expected returns on exchange rates and interests are said to be riskless, because full knowledge of variance decomposition is assumed. Differently stated, it is assumed that the error term in predicting future returns on a certain asset is fully understood and there is no innovation disturbing the expected return of the dependent variable. This is inevitable wrong as long as financial shocks are not equally spread over time. It happens that one is left with the problem of either knowing that variances of all explaining variables and the error term in a simple regression model are constant over time or not. In both cases no fundamental approach to explain the dependent variable – for example the exchange rate – can be verified. In the first case the random walk of the time series will ever perform better than all explaining variables. And in the second case - where no random walk is observable - the missing knowledge of the error term makes all models developed under risk neutral considerations obsolete.

To take all the above mentioned problems into account, we estimate a Vector Auto Regression Model (VAR) that is suited to overcome the hidden co-variances between the variables under research. Within this concept it is possible to test multiple regression equations of the same specification. The specification of every single equation has the form:

Current Account = 3 months interest rate + 10 years interest rate + logged exchange rate

Clearly, with four currency areas and three variables plus a lag of four in the dependent variable, 116 coefficients will be tested for statistical significance. To improve the result, a Vector Error Correction can be calculated. The additional “Error Correcting Equation” tests the error term on the specified VAR. That procedure stabilizes the VAR model and incorporates a trend equation into the estimated system. The problem with the VEC is that it breaks down as soon as too many variables cancel out because of not being statistically significant. Therefore the possibility of using a VEC is neglected in the following VAR model. The VAR of course has first to fulfil the stability condition of constant variance over time. -That is stationarity[2]. As presented below, no root lies outside the unit circle.



[2] Another way to show stability of the system are Impulse response functions:

After 10 iterations in the variance one equation’s error term, the variance of another’s equation is constant. It follows, that the VAR system is stable and stationary.

The next step is to exclude all variables above certain levels of significance and to redo the estimation till an acceptable significance level is reached. It has to be mentioned, that below the significance level of 5% the model is very soon well specified with high R^2 values.

System: SYS_ALLDATA_REDONE5
Estimation Method: Least Squares
Date: 12/08/07 Time: 23:24
Sample: 1985Q2 2006Q2
Included observations: 85
Total system (unbalanced) observations 331

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.329722	0.087864	3.752635	0.0002
C(4)	0.381272	0.077101	4.945125	0.0000
C(5)	0.203206	0.042261	4.808413	0.0000
C(10)	-0.363910	0.133506	-2.725784	0.0068
C(22)	-0.261074	0.050885	-5.130710	0.0000
C(24)	0.220869	0.048810	4.525100	0.0000
C(25)	-0.217777	0.052719	-4.130913	0.0000
C(33)	0.716401	0.059096	12.12276	0.0000
C(45)	1.290680	0.258315	4.996540	0.0000
C(53)	-0.112394	0.027717	-4.055000	0.0001
C(68)	0.443010	0.110241	4.018563	0.0001
C(71)	0.046357	0.008422	5.504152	0.0000
C(74)	0.336415	0.086905	3.871055	0.0001
C(77)	-0.181947	0.046211	-3.937274	0.0001
C(78)	-0.199201	0.056939	-3.498492	0.0005
C(86)	-0.462987	0.124132	-3.729780	0.0002
C(89)	-0.704413	0.137982	-5.105101	0.0000
C(97)	0.342740	0.069270	4.947896	0.0000
C(100)	0.467483	0.069845	6.693137	0.0000
C(111)	-0.572133	0.213354	-2.681609	0.0077
C(104)	0.431040	0.099247	4.343091	0.0000

Determinant residual covariance 0.001470

Equation: CA_GER_ZT = C(1)*CA_GER_ZT(-1) + C(4)*CA_GER_ZT(-4)
+ C(5)*CA_JAP_ZT(-1) + C(10)*CA_UK_ZT(-2) + C(22)
*IR_3M_GER + C(24)*IR_3M_UK + C(25)*IR_3M_US
Observations: 82

R-squared	0.888096	Mean dependent var	0.500521
Adjusted R-squared	0.879144	S.D. dependent var	1.306549
S.E. of regression	0.454214	Sum squared resid	15.47328
Durbin-Watson stat	1.953405		

Equation: CA_JAP_ZT = C(33)*CA_JAP_ZT(-1) + C(45) + C(53)
*IR_3M_US
Observations: 85

R-squared	0.818458	Mean dependent var	2.614848
Adjusted R-squared	0.814030	S.D. dependent var	0.900049
S.E. of regression	0.388139	Sum squared resid	12.35344
Durbin-Watson stat	2.459211		

Equation: CA_UK_ZT = C(68)*CA_UK_ZT(-4) + C(71)*CA_US_ZT(-3) +
C(74)*IR_10Y_GER + C(77)*IR_10Y_US + C(78)*IR_3M_GER
Observations: 82

R-squared	0.579606	Mean dependent var	-0.618969
Adjusted R-squared	0.557767	S.D. dependent var	0.469911
S.E. of regression	0.312494	Sum squared resid	7.519226
Durbin-Watson stat	1.754295		

Equation: CA_US_ZT = C(86)*CA_GER_ZT(-2) + C(89)*CA_JAP_ZT(-1)
+ C(97)*CA_US_ZT(-1) + C(100)*CA_US_ZT(-4) + C(111)
*LER_JAP + C(104)*IR_10Y_UK
Observations: 82

R-squared	0.979992	Mean dependent var	-6.496851
Adjusted R-squared	0.978675	S.D. dependent var	5.642579
S.E. of regression	0.823983	Sum squared resid	51.60011
Durbin-Watson stat	1.492798		

Every coefficient of the model is highly significant at the 1% level. Especially the Current Accounts (CA) of Germany and Japan are well explained with regard to R-squared and Durbin Watson Statistic. It is remarkable, that the Japanese CA is best explained by its own past value, a constant and the 3 months US interest rate. The Durbin Watson Statistic shows that there is no other variable within the tested system, which could explain more of the equation’s error term. Interestingly, the 10 years US interest rate can be included with the same but positive coefficient at 5 percentage points less R-squared.

The German CA is explained by past levels of all foreign Current Accounts, but not by the one of US. Germany shows the only specification of the system that includes its own interest rate, namely the short term 3 months rate. Moreover it depends negatively upon the 3 months US and positively on the 3 months UK interest rate.

The UK and US Current Accounts are less well explained. The R squared is with 55% the lowest of all four equations, the Durbin Watson Statistic is still good. Explaining variables of the UK Current Account are the UK, US and German CA, plus the 10 years US and the 3 months German interest rates.

Finally, the US CA depends on the US, German and Japanese CA plus the 10 years UK interest rate. Furthermore the US equation is the only one to include an exchange rate, typically the YEN/USD rate.

The Durbin Watson statistic is low, which states that there has to be some better specification of the US CA by other variables that are not included in the system. Could it be Chinese data?

And why after all is it interest rates and not exchange rates that explain so much?

Well, usually the Current Account is defined as the difference in exports and imports of goods and services plus net investment. The other definition - commonly ignored – states, that the Current Account is equal to the difference between Savings and Investment. A Current Account deficit is thus equal to a lack in Savings with regard to a given Investment position. Obviously, the Investments that had been made to a country must be financed by Savings, no matter if national Savings, which is private and public, or Savings from abroad. But unfortunately it is hard to tell from which foreign country these savings will be made available and in what form. If one considers the foreign Current account, than the foreign country has the option to deliver goods to close the savings gap or to fill up the lack in savings by contributing money, which by definition is short termed financial assets -3 months Treasury Bills. Even more complex, the investment position of the domestic country can be determined by foreigners holding long term assets or direct investments. Thus, in principal, every country within a free global capital market has the possibility to trade with three other countries in completely different ways. It turns out that the way countries trade with each other depends on present financial, productivity and consumption conditions that occur mainly due to different states of economic integration. For example, financially well developed countries trade consumption against investment and emerging countries trade productivity against money. In each case the respective country offers the excess factor at a discount to attract the factor needed and distorts exchange rates. It is clear, that in such a world no single theory can prevail and that the only view on exchange rates is a random walk. The exchange rate is then a unit of account, driven by counteracting financial flows. Another VAR, where exchange rates have been regressed on interest rate differentials and Current Accounts, shows that the German exchange rate follows a near random walk behaviour with a stable trend and various influences from other currency areas. Also the Yen can be regarded as near random walk. Solely the UK sterling shows some disturbing sinusoid behaviour on its own past values when interest rate differentials are included.

System: SYS_LER_3M_10Y_CA
Estimation Method: Least Squares
Date: 12/09/07 Time: 23:24
Sample: 1985Q1 2006Q2
Included observations: 86
Total system (balanced) observations 258

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.028290	0.050107	20.52188	0.0000
C(3)	-0.189798	0.056072	-3.384871	0.0008
C(6)	-0.185090	0.059965	-3.086616	0.0023
C(7)	0.900557	0.292174	3.082266	0.0023
C(8)	0.029864	0.006590	4.531767	0.0000
C(9)	0.018930	0.005945	3.184042	0.0017
C(11)	-0.072715	0.012396	-5.865938	0.0000
C(12)	-0.030314	0.010147	-2.987368	0.0031
C(14)	-0.010762	0.004372	-2.461466	0.0146
C(15)	-0.022837	0.006729	-3.393576	0.0008
C(19)	0.844798	0.044975	18.78356	0.0000
C(23)	0.618585	0.211323	2.927198	0.0038
C(24)	0.017089	0.006934	2.464596	0.0144
C(25)	0.023326	0.006306	3.699148	0.0003
C(26)	0.021433	0.005021	4.268768	0.0000
C(27)	-0.027404	0.011073	-2.474804	0.0140
C(34)	0.246120	0.063318	3.887018	0.0001
C(37)	0.788381	0.103722	7.600901	0.0000
C(38)	-0.363845	0.109009	-3.337738	0.0010
C(39)	-0.289527	0.052175	-5.549200	0.0000
C(40)	0.019709	0.006977	2.824675	0.0051
C(41)	0.014494	0.006331	2.289351	0.0230
C(42)	-0.011571	0.004723	-2.450059	0.0150
C(43)	-0.027886	0.009682	-2.880373	0.0043
C(45)	0.026192	0.008513	3.076715	0.0023
C(46)	-0.012563	0.003848	-3.264745	0.0013

Determinant residual covariance 1.10E-09

Equation: LER_GER = C(1)*LER_GER(-1) + C(3)*LER_JAP(-1) + C(6)
*LER_UK(-2) + C(7) + C(8)*DIFFIR_3M_EUR_US + C(9)
*DIFFIR_3M_JP_US + C(11)*DIFFIR_10Y_EUR_US + C(12)
*DIFFIR_10Y_JP_US + C(14)*CA_GER_ZT + C(15)*CA_JAP_ZT
Observations: 86

R-squared	0.959353	Mean dependent var	-0.090160
Adjusted R-squared	0.954539	S.D. dependent var	0.165908
S.E. of regression	0.035374	Sum squared resid	0.095100
Durbin-Watson stat	1.985307		

Equation: LER_JAP = C(19)*LER_JAP(-1) + C(23) + C(24)
*DIFFIR_3M_EUR_US + C(25)*DIFFIR_3M_JP_US + C(26)
*DIFFIR_3M_UK_US + C(27)*DIFFIR_10Y_EUR_US
Observations: 86

R-squared	0.949802	Mean dependent var	4.830596
Adjusted R-squared	0.946664	S.D. dependent var	0.198635
S.E. of regression	0.045874	Sum squared resid	0.168352
Durbin-Watson stat	1.745248		

Equation: LER_UK = C(34)*LER_GER(-2) + C(37)*LER_UK(-1) + C(38)
*LER_UK(-2) + C(39) + C(40)*DIFFIR_3M_EUR_US + C(41)
*DIFFIR_3M_JP_US + C(42)*DIFFIR_3M_UK_US + C(43)
*DIFFIR_10Y_EUR_US + C(45)*DIFFIR_10Y_UK_US + C(46)
*CA_GER_ZT
Observations: 86

R-squared	0.864026	Mean dependent var	-0.478569
Adjusted R-squared	0.847924	S.D. dependent var	0.096238
S.E. of regression	0.037530	Sum squared resid	0.107045
Durbin-Watson stat	1.900851		

However, as a first result of tracking international financial flows it can be stated that in the period under research (1985 – 2006) the Japanese with domestic interest rates near zero had a strong incentive to depress the JAP/USD by consistently buying US short term T-Bills in order to earn the higher US interest rates. Under National Account considerations Japanese Investors financed US consumption by counteracting the US tendency of dissaving. This fact can be observed by the strong influence of the Japanese exchange rate on the US CA. At the same time Germany, holding a CA surplus, contributed to dissavings of the US, but traded the short term money returns against very attractive UK sterling rates (Table 1) and thus saved for UK investments. The 10 years US interest rate explains a good part of the UK CA, whereas the 10 years UK interest rate is relevant for the US CA. At first sight it seems surprising that the 10 years US interest rate had negative effects on the UK CA, but the 10 years UK interest rates positively contributed to the US CA. Well, after a view on the respective Capital Accounts, one remarks positive net direct investments of the UK (inflow) and negative net direct investments of the US (outflow). Perhaps one can explain such a condition as a long term interest rate differential or an exchange rate in favour of UK investments. That potentially means, the US exported long term money because it attracted short term money from Japan and Germany.

Taking up China into the estimations and by defining some productivity measures the view of world capital flows should further improve. By knowing the causes of these financial flows we are able to give fundamental explanations of trends in exchange rates and the risks that potentially deteriorate them.

Annex

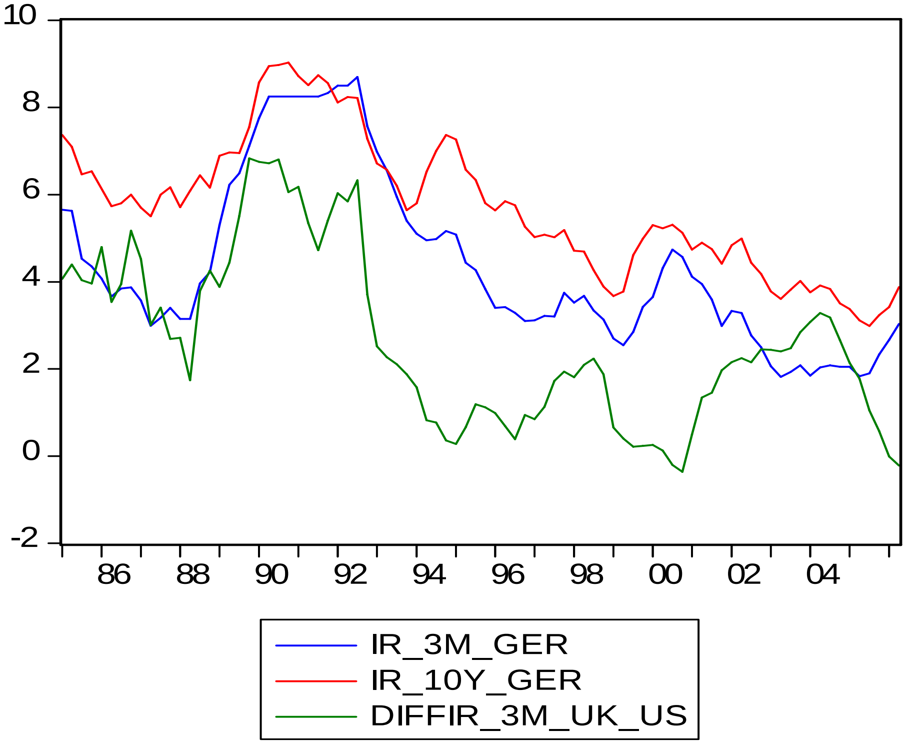


Table 1