Dr. Tihomir Janjiček
Department of Economics and Business Economics
University of Dubrovnik

EXCHANGE RATE MOVEMENTS FROM 1961 TO 2001

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Summary

In this research I have tried to discover the relations between marginal utility on the one hand and government expenditure, real money balances and external habit on the other hand. I took two approaches one with exogenously missing markets but an endogenous discount rate, where anchors the distribution of wealth and one with endogenous market segmentation. No one of these approaches did not satisfied the theory and over identifying restrictions for every country. Only the utility with external habit persistence had the best match with real exchange rates for OECD countries between 1961 and 2001.

Key words: exhange rate; marginal utility; government expenditure

1. INTRODUCTION

A large volume of research in international macroeconomics focuses on explanations of the persistence in real exchange rates. Most models of persistent deviation from purchasing power parity imply that relative marginal utilities of consumption across countries should be as persistent as the real exchange rate. Unfortunately, there is little evidence of this link between the real exchange rate and relative consumption. For example, work by Chary Kehoe and McGratten replicates the autocorrelation of the real exchange rate, but the autocorrelation of relative consumption in their model is almost twice the empirical level. Obstfeld and Rogoff list this "disconnect" among the key, unresolved issues in open-economy macroeconomics.

This issue in historical data has been re-examined, using a variety of marginal utility models. These augmented models include government spending,

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leisure, real money balances and an external habit stock, under a variety of functional forms. It was try to be identified a utility model that resolves the inconsistency of the predicted real exchange rate with its empirical counterpart. It was also considered two models of incomplete asset markets. In one, non-contingent bonds are the only assets, while an endogenous discount rate anchors the distribution of wealth. In the other, markets are endogenously segmented to a degree that depends on the rate of inflation.

Roughly speaking, traditional models of marginal utility imply that a country undergoing a real depreciation also should experience relatively rapid consumption growth, with the scale between the two changes governed by the elasticity of intertemporal substitution in consumption. The logic can be understood by considering a positive, country-specific, supply shock, which tends to raise national consumption and lower national prices at the same time. But the empirical evidence suggests that the consumption change may be in the opposite direction, and that real depreciations are weakly associated with relatively slow consumption growth.

However, this effect is statistically insignificant. Rea exchange rates tend to be quite persistent, but their growth rates are not closely linked to those of current, relative consumption. The evidence has been found says rates of real depreciation related to a moving average of relative consumption growth. This finding can be interpreted as evidence of external habit persistence, as introduced by Abel[1]. The implication is that these preferences might be worth adopting in open-economy, macroeconomic models.

The remainder of this paper is organized as follows. In section 2 has been provided the background on the condition tested in this research work. In Section 3 has been outlined a parametric model of utility, allowing a role for government spending. In section 4 has been given statistical evidence for OECD countries since 1961. In section 5 have been extended the estimating equations to reflect, in turn, leisure, real balances and external habit persistence. In section 6 has been examined the models with incomplete asset markets. Section 7 is conclusion.

2. ESTIMATING EQUATIONS

Obstfeld[2], Backus and Smith[3], and Kollmann[4] observed that a range of international macroeconomic models with non-traded goods link the real exchange rate to relative consumption. Suppose that two countries “x” and “y”

[1] Abel A.B. (1990) “Asset prices under habit formation and catching up with the Joneses”, American Economic Review 80, page 39.
[2] Obstfeld M., and K. Rogoff (2000) “Tsix major puzzles in international macroeconomics: is there a common cause”?, NBER Macroeconomics Annual, page 352
[3] Backus D. and G.W. Smith (1993) “Consumption and real exchange rates in dynamic economies with non-traded goods”, Journal of International Economics 35, page 304
[4] Kollman r. (1995) “Consumption , real exchange rates and the structure of international assets”, Journal of International Money and Finance 14, page 199

have price level P_x and P_y. Let nominal exchange rate between them e_{xy}, be local currency price for one unit of country y's currency in term of country x's currency. Suppose that utility U depends on a vector of quantities "q" that includes consumption "c", with marginal utility U_c. Then under complete asset markets the real exchange rate is equal to the ratio of marginal utilities of consumption:

$$E_{xyt}\, P_{yt} / P_{xt} = U_c(q_{yt}) / U_c(q_{xt}) \qquad \text{(A)}$$

As noted by Obstfeld[5], Apte-Sercu-Uppal[6] and Engel[7], this link between relative prices and relative quantities holds under complete asset markets even if there are frictions in goods markets, including non-traded goods, pricing to market (PTM), local currency pricing (LCP), or transport cost. Obstfeld[8] and Apte-Sercu-Uppal[9], Provide comprehensive derivations of this condition. In this research work has been reconsidered several parametric models of utility used in studies witch embody this condition. The method –of-moments has been used what links between the endogenous variables to estimate preference parameters without specifying a complete model and to test over-identifying restrictions. General Equilibrium models including these preferences will have a chance to fit the dynamics of consumption and exchange rates only if they pass this test.

If this static condition holds in levels, then it also holds in growth rates. Define Δ as the gross growth rate operator, so that $\Delta t_x = x_t / x_{t-1}$. Then:

$$\Delta(E_{xyt}\, P_{yt} / P_{xt}) = \Delta\, [U_c(q_{yt}) / U_c(q_{xt})] \qquad \text{(B)}$$

This version, in gross growth rates, holds that ex post, intertemporal, marginal rates of substitution are equal. It is convenient for statistical inference, because the growth rates are often stationary. This stochastic singularity obviously will not hold in historical data, so the conditional forecast has been examined:

$$E_t\, \Delta(E_{xyt}\, P_{yt} / P_{xt}) = E_t\, \Delta\, [U_c(q_{yt}) / U_c(q_{xt})] \qquad \text{(C)}$$

While condition is clearly weaker from above formula then the previous of above, it is a necessary condition and so is useful for testing. As will be seen, it typically provides enough information to reject formula (B) statistically. It also is consistent with preference shocks, provided these are not persistent.

[5] Obstfeld M., and K. Rogoff (2000) "Tsix major puzzles in international macroeconomics: is there a common cause"?, NBER Macroeconomics Annual, page 354

[6] Apte P., Sercu P., Uppal R. (2001)"The exchange rate and purchasing power parity: Extending the theory and test, Working paper, London Business School

[7] Eengel C. (2000) Comments on Obsfeld and Rogoff, NBER Macroeconomics Annual, page 406

[8] Obstfeld M., and K. Rogoff (2000) "Tsix major puzzles in international macroeconomics: is there a common cause"?, NBER Macroeconomics Annual, page 357

[9] Apte P., Sercu P., Uppal R. (2001)"The exchange rate and purchasing power parity: Extending the theory and test, Working paper, London Business School

Empirical results are presented for balanced panels – with preference parameters common across countries - and for country-pairs, with the US in each case acting as the reference country “y”. Choosing instruments z_{xt} for country “x” amounts to asking which shocks is expected to be insured. Instruments include lagged endogenous variables – such as relative consumption growth or lagged residuals – which presumably reflect many shocks. But also instrument was using exogenous variables like policy changes or natural disasters. The moment conditions was adopted for estimation are:

$$E\{z_{xt-1}[\Delta(E_{xyt}\, P_{yt} / P_{xt})] - \Delta\, [U_c(q_{yt}) / U_c(q_{xt})] \qquad \text{(D)}$$

Estimation employs iterated GMM. For some country pairs the growth in relative consumption does not display strong persistence in the data, which limits the choice of relevant instruments, as discussed by Stock and Wright[10]. For this reason, the instrument set includes lagged residuals, which reflect the differential persistence in rates of real depreciation and relative consumption growth.

The findings in this paper update and extend those of Obstfeld, Backus and Smith, Kollmann and Apte, Sercu and Uppal, who studied isoelastic utility with marginal utility depending only on current consumption. Obstfeld, Kollmann and Apte, Sercu, and Uppal also were concerned to formulate the problem so that least-squares regression method could be used, whereas GMM is applied directly in this exercise. Ravn[11] in related study, also uses instrumental variable estimation, but on a logarithmic approximation to (C) holds, though (B) does not. In this research work their work has been extended by considering utility funcitonals with stochastic discount rates that are consistent with a stationary distribution of wealth when markets are exogenously incomplete. Also has been examined the implications of recent research on endogenously segmented markets.

3. BENCHMARK UTILITY MODEL

Suppose that the discount factors are constant and equal. Period utility in county “x” is of the power form:

$$u(\lambda_{xt}) = \begin{matrix} \lambda_{xt}^{1-\alpha}/(1-\alpha) & \alpha>0,\ \alpha\neq 1 \\ \ln(\lambda_{xt} & \alpha=1 \end{matrix} \qquad \text{(E)}$$

where λ_{xt} is an aggregator over private consumption c_{it} and government consumption g_{xt}. This aggregate, in turn, is of the CES form:

[10] Stock J.H., Wright J.H. (2000) “GMM with weak identification”, Econometrica 68, page 1063.
[11] Ravn M. (2001) “Consumption dynamics and real exchange rate” CEPR Discussion Paper No. 2940

$$\lambda_x = [\mu c_{xt}^{w} + (1 - \mu)\, g_{xt}^{w}]^{1/w} \tag{F}$$

Two special cases of this aggregator have been examined. In the first w-0, which yields the Cobb-Douglas case:

$$\lambda_x = c_{xt}^{\mu}\, g_{xt}^{1-\mu} \tag{G}$$

In the second special case, $\mu=1$, so that public expenditure does not directly affect utility and $\lambda_x = c_{xt}$.

With this parametric utility model (E) and (F), the estimating equations (B) become:

$$\Delta(E_{xyt}\, P_{yt} / P_{xt}) = (\Delta c_{xt}/\Delta c_{yt})^{1-w}\, (\Delta\lambda_{xt}/\Delta\, \lambda_{yt})^{\alpha+w-1}. \tag{H}$$

Where the CES functional form is used for utility. The Cobb-Douglas special case, with w=0, gives:

$$\Delta(E_{xyt}\, P_{yt} / P_{xt}) = (\Delta c_{xt}/\Delta c_{yt})^{1-\mu(1-\alpha)}\, (\Delta g_{xt}/\Delta\, g_{yt})^{-(1-\mu)(1-\alpha)}. \tag{I}$$

Finally, the traditional case where $\mu=1$ and w=0, so that utility depends only on private consumption, is given by:

$$\Delta(E_{xyt}\, P_{yt} / P_{xt}) = (\Delta c_{xt}/\Delta c_{yt})^{\alpha}. \tag{J}$$

The second aggregator has also been considered:

$$\lambda_{xt} = c_{xt} + \varphi g_{xt}, \tag{K}$$

as have used by Christiano and Eichenbaum[12] in a business-cycle model. This functional form leads to the estimating equations:

$$\Delta(E_{xyt}\, P_{yt} / P_{xt}) = [(\Delta C_{xt}+\varphi g_{xt}) / (\Delta C_{yt}+\varphi g_{yt})]^{\alpha}. \tag{L}$$

4. STATISTICAL RESULTS

Data are for a set of ten countries: Canada, Denmark, Finland, France, Italy, Japan, New Zealand, Sweden, the United Kingdom, and the United States. This group was selected based on the availability of measures for private consumption excluding durables. The data run from the 1960s for Canada, the United Kingdom, and the United States; from the 1970s for Denmark, Finland, France, and Italy; and from the 1980s for Japan, Sweden, and New Zealand. The data reflect recent changes in accounting practices in many countries. For instance, the U.S. National Accounts are now constructed according to the chain-

[12] Christiano L. and Eichenbaum M. (1992), "Current real-business-cycle models and aggregate labor-market fluctuations", American Economic Review 82, page 441

weighted accounting standard. The appendix provides exact data definitions and sources.

Estimates are based on a balanced panel from 1981:II to 1999:III. The panel excludes Denmark and New Zealand, so as to include relatively long time spans for the remaining countries. We also provide estimates of country-specific preference parameters using the estimating equations (and all data) for individual countries. In all cases, the reference country "y" is the United States. This is a natural choice because the U.S. data span is greater than that for any other country. In any case, the panel results are not sensitive to the choice of reference country, for the GMM estimator - like GLS - takes into account the correlation between residual that may be caused by a U.S. shock.

The data include some observations from the Bretton Woods period o fixed exchange rates for the United States, United Kingdom and Canada. The properties of real exchange rates tend to differ across nominal exchange-rate regimes. We do not exclude these observations from the results for individual countries; for if the theory is a useful guide then the corresponding ratio of marginal utilities also should have time series properties that vary across monetary regimes.

Results from the CES functional form for utility specified by equation (H) are not reported, because the three preference parameters were not readily identifiable and $\hat{w}$ was not significant. As a result, the model is further restricted with w=0 to give the Cobb-Douglas specification with private consumption and government spending as in (I). Table 1 contains the results. The parameters include the curvature of utility and the share of private consumption in utility, μ'. The first row provides results from the panel. The instrument set consists of a constant and one-lagged, own residuals. The estimated coefficient of relative risk aversion, α', is negative, while the consumption share is a small, positive fraction. Neither is statistically significant (at conventional levels), despite the large number of instruments.

Table 1.
Power/Cobb-Douglas utility in consumption and government spending[13]

Country	T	α' (s.e.)	μ' (s.e.)	λ^2(d.f.) (p-value)
Panel	511	-0.85 0.56	0.32 0.19	(12)9.77 0.64
Canada	158	-0.05 0.22	0.96 0.11	(2)9.72 0.01
Denmark	50	-1.18 1.44	0.81 0.25	(2)2.16 0.34
Finland	102	0.49 0.94	1.69 2.17	(2)4.84 0.09
France	82	-1.11 0.85	1.23 0.28	(2)5.80 0.06
Italy	113	-0.09 2.57	1.10 0.83	(1)5.55 0.02
Japan	75	2.91 5.13	0.59 0.75	(1)4.08 0.04
New Zealand	68	-1.00 0.53	1.03 0.08	(2)2.96 0.23
Sweden	74	-0.38 1.19	1.40 0.66	(1)4.94 0.026
U.K.	166	-0.22 0.33	1.15 0.26	(2)7.48 0.02

(Used formula: $\Delta(E_{xyt}\, P_{yt} / P_{xt}) = (\Delta c_{xt}/\Delta c_{yt})^{1-\mu(1-\alpha)}\, (\Delta g_{xt}/\Delta\, g_{yt})^{-(1-\mu)(1-\alpha)}$)

Table 1 also shows the results of estimation country by country. The parameters are over-identified with four instruments, which include a constant growth in lagged relative consumption, lagged relative government spending, and the lagged residual. The estimated coefficient of relative risk aversion, α', is negative for seven of the nine countries. In the remaining two countries - Japan and Finland – the estimate is positive but smaller than its standard error. Estimates of the share of consumption in utility, μ', are within a range centered on unity, where six of nine estimates are significantly different from zero. The p-values for the y-test of over identifying restrictions range from 1% to 34%, and in five of the nine cases yield rejections at the 5% level of significance.

[13] The United States is the reference country "y" in each case. The panel excludes Denmark and New Zealand, runs from 1981:II to 1999:III, and adopts a constant and lagged own-residuals as instruments. The instrument set for individual country estimates includes a vector of ones, the lagged growth rate of relative consumption, the lagged growth rate of relative government spending, and the lagged residual. The Italian, Japanese, and Swedish cases exclude lagged relative consumption.

When was considered the alternative aggregator (K) over consumption and government spending, it was impossible to find significant role for government spending in the marginal utility model. Estimates of "α" were generally negative, while those of "φ" were statistically insignificant.

Table 2 specializes the utility function with the restriction μ=1, which yields equation (J), the gross-growth rate version of the relationship studied by some economists[14]. Table 2 suggests that there is no statistical relationship between the growth in this measure of marginal utility and the real exchange rate. The panel estimated of "α" is again in an insignificant, negative number. The value p-value for j-test is 0.39, so that the over-identifying restrictions cannot be rejected. The picture that emerges is that the difference between the growth in the real exchange rate and the growth in relative consumption scaled by "α" is essentially unpredictable – as required by theory - but involves a value of "α" that is zero or slightly negative.

In the remaining rows of table 2, the estimated coefficients α' also are negative for five of the nine country pairs, contradicting the concavity of utility. Only for Italy α' was positive and significant at conventional levels of significance. The "p" values for the "j" test of the over-identifying restrictions range from 2% to 22% and yield rejections at the 5% level in about half the cases.

It was also examined the possibility of weak identification, as studied by Stock and Wright (200)[15]. First, as already noted, by including a lagged residual in the instruments set in table 2 (and other tables), has been made identification stronger than if lagged, relative consumption growth was the only instrument. Second, also has been estimated α using only a constant term as an instrument, since in that case the parameter clearly is identified. The results (not shown) were very similar to those in table 2: six-point estimates were negative, and no estimate was positive and larger than its estimated standard error. Third, sensitivity of the findings has been also examined to the choice of weighting matrix, since weak identification is a function of the combination of this matrix, the moment condition, and the instrument set. Again, the results did not change. Conclusion was that the findings probably are due not to weak identification but rather to the choice of functional form or to the risk-sharing condition's failure.

To summarize, there is little evidence to support the real exchange rate model when utility is defined over private consumption and government spending. Although the "j" test statistics sometimes are small, the estimated coefficients of relative risk aversion are often negative and insignificant.

[14] Backus D., and G.W. Smith (1993), "Consumption and real exchange rates in dynamic economies with non-traded goods", Journal of International Economics 35, page 304.

[15] Stock J.H., and Wright J.H. (2000), "GMM with weak identification", Econometrica 68, page 1077.

Table 2.

Power of utility in consumption[16]

Country	T	α' (s.e.)	λ^2(d.f.) (p-value)
Panel	511	-0.20 (0.51)	13.7 (13) (0.39)
Canada	158	0.01 (0.17)	8.69 (2) (0.13)
Denmark	50	-164 (1.52)	1.37 (1) (0.24)
Finland	102	0.04 (0.48)	6.04 (2) (0.05)
France	82	-0.21 (3.63)	5.36 (1) (0.02)
Italy	113	2.05 (0.65)	6.68 (2) (0.04)
Japan	75	1.79 (3.22)	2.71 (1) (0.10)
New Zealand	68	-1.03 (0.51)	3.04 (2) (0.22)
Sweden	74	-0.83 (1.33)	4.42 (1) (0.04)
U.K.	166	-0.39 (0.31)	7.44 (2) (0.02)

(Used formula: $\Delta(E_{xyt}\ P_{yt} / P_{xt}) = (\Delta c_{xt}/\Delta c_{yt})^{\alpha}$)

5. EXTENDING THE UTILITY MODEL

Given the weak results so far, the next step is to examine other models of marginal utility that have been used in international macroeconomics. These models include utility functions that are non-separable between private consumption and either real money balances or leisure. In addition, environments with external habit persistence have proved successful at replicating aspects of asset prices and business cycles. Most of these models imply that a multiplicative factor - in relative employment, money, or lagged consumption – is missing from the benchmark, risk-sharing condition. The omission of these variables might therefore account for the negative findings from tables 1 and 2.

[16] The United States is the reference country "y" in each case. The panel excludes Denmark and New Zealand, runs from 1981:II to 1999:III, and adopts a constant and lagged own-residuals as instruments. The instrument set for individual country estimates includes a vector of ones, the lagged growth rate of relative consumption, and the lagged residual. The Italy-U.S. model substitutes lagged relative consumption growth with lagged relative employment growth.

5.1. Leisure

First, consider a non-separability between consumption and leisure. The period utility function is again of power form:

$$u(d_{xt}) = \begin{cases} d_{xt}^{1-\alpha}/(1-\alpha) & \alpha>0, \alpha\neq 1 \\ \ln d_{xt} & \alpha=1 \end{cases} \qquad \text{(M)}$$

where d_{xt} combines the CES aggregate λ_{xt}, of private and public consumption with a measure of employment l_{xt}.

$$d_{it} \equiv \lambda_{xt} - \delta l_{xt}^{\eta} \qquad \text{(N)}$$ [17]

As an example, consider the case in which $\lambda_{xt}=c_{xt}$, as was found in section 4. Then the estimating equations are:

$$\Delta(E_{xyt}\, P_{yt} / P_{xt}) = [(\Delta C_{xt}-\delta l_{xt}^{\eta}) / (\Delta C_{yt}-\delta l_{xt}^{\eta})]^{\alpha}. \qquad \text{(O)}$$

The relative growth of marginal utility across countries now contains labor supply measures. International employment differences tend to be positively auto correlated, so this addition to the statistical model may produce persistence that more closely matches the persistence in the real exchange rate.

Equation (O) is estimated with l_{xt} measured as the OECD's index of total employment. The results were entirely negative. Parameters often could not be identified, and for those country-pairs yielding results, the estimates δ' had the wrong sign and α' was negative. As a result, the evidence does not provide support for the time series correlation between relative employment and relative prices to match the restrictions of this marginal utility model.

5.2. Money

A number o recent research paper in international finance has included real money balances in utility function. That is why in this research has been followed Chari, Kehoe and McGrattan[18] who incorporated a non-separability between real balances, m_{xt} and private consumption. Their period utility function is:

$$U(c_{xt},m_{xt}) = 1/(1-\alpha)[\mu c_{xt}^{w} + (1-\mu)m_{xt}^{w})^{1/w}]^{1-\alpha}, \qquad \text{(P)}$$

[17] This form is chosen to nest the case studied by Greenwood, Hercowithz and Huffman 1988, Hercowithz and Sampson 1991, Devereux, Gregory and Smith 1992 and Correia, Neves and Rebelo 1995. Those authors set α=1 and $\lambda=c_{xt}$ for analytical tractability.

[18] Chari V.V., Kehoe P. and McGratten E (2000), "Can sticky price models generate volatile and persistent real exchange rates", Federal Reserve Bank of Minneapolis Staff Report No. 277, page 834.

Which gives rise to the following marginal utility with respect to consumption:

$$u_c = \mu c_{xt}^{w-1} [\mu c_{xt}^{w} + (1-\mu)m_{xt}^{w}]^{(1-\alpha-w)/w} . \qquad \text{(R)}$$

Real balances are measured as broad money (generally M3) divided by the consumption deflator. The equations for the real exchange rte are estimated using both the CES and Cobb-Douglas aggregators over private consumption and real balances. The CES model does not yield statistically significant parameter estimates for W'. The necessary condition for the specialized, Cobb-Douglas version is:

$$\Delta(E_{xyt}\, P_{yt} / P_{xt}) = (\Delta C_{xt}/\Delta C_{yt})^{1-\mu(1-\alpha)} (\Delta m_{xt}/\Delta m_{yt})^{-(1-\mu)(1-\alpha)}. \qquad \text{(S)}$$

Results are shown in table 3. In the panel, the estimated weight on consumption is $\mu' = 0.867$ so that the weight on real balances is 0.133. this value is estimated with some precision and seems plausible given the theory. The curvature of the utility function now also is clearly significant (at conventional levels), but again it is negative.

For individual countries, the estimated curvature of utility, α', is negative for all but the Japan-U.S. case, and standard errors are larger than the estimates for all but the New Zealand-U.S. case. There is some evidence that μ is a fraction – implying that real balances join consumption in the utility function - but only for New Zealand is μ' estimated precisely and below 1 at conventional significance levels. In seven of the nine cases, the j-test rejects the over-identifying restrictions at the 5% level. Overall, including real money balances in the model of marginal utility does not lead to a statistical improvement or to interpretable preference parameters.

Table 3.
Power/Cobb-Douglas utility in consumption and real balances[19]

Country	T	α' (s.e.)	μ' (s.e.)	λ^2(d.f.) (p-value)
Panel	511	-1.18 (0.51	0.87 (0.11)	13.54(12) (0.33)
Canada	130	-0.09 (0.26)	1.00 (0.20)	10.25(2) (0.01)
Denmark	50	-1.16 (1.13)	0.98 (0.05)	2.01(2) (0.37)
Finland	94	-0.74 (3.52)	0.53 (0.69)	4.25(1) (0.04)
France	82	-0.96 (0.87)	0.98 (0.25)	7.97(2) (0.02)
Italy	93	-0.45 (2.07)	1.48 (0.73)	6.18(2) (0.05)
Japan	75	1.21 (1.36)	-5.15 (37.80)	8.84(2) (0.01)
New Zealand	68	-1.52 (0.64)	0.88 (0.05)	3.59(2) (0.17)
Sweden	74	-0.77 (1.25)	1.03 (022)	4.58(1) (0.03)
U.K.	150	-0.54 (1.879	0.96 (1.18)	7.22(2) (0.01)

(Used formula: $\Delta(E_{xyt}\, P_{yt} / P_{xt}) = (\Delta C_{xt}/\Delta C_{yt})^{1-\mu(1-\alpha)}\, (\Delta m_{xt}/\Delta m_{yt})^{-(1-\mu)(1-\alpha)}$)

5.3. External habit

The final extension of the utility model adopts external habit persistence. External habit has proved successful in explaining aspects of the equity premium puzzle. The utility model follows Abel (1990,1999)[20]. The period utility function is related to a benchmark level of utility, s_{xt}, in country x that is treated exogenous to the numerous identical households:

$$u(c_{xt},s_{xt}) = [1 / (1-\alpha)]\, [(c_{xt}/s_{xt})^{1-\alpha}] \quad . \qquad (T)$$

The benchmark utility level is:

[19]The United States is the reference country “y” in each case. The panel excludes Denmark and New Zealand, runs from 1981:II to 1999:III, and adopts a constant and lagged own-residuals as instruments. The instrument set for individual country estimates includes a vector of ones, the lagged growth rate of relative consumption, the lagged growth rate of relative balances, and the lagged residual. The Finnish and Swedish cases exclude lagged relative consumption growth.

[20] Abel A.B. (1990), “Asset prices under habit formation and catching up with the Joneses”, American Economic Review 80, page 41.

$$Sxt = c_{xt}^{\delta 0}\, c_{xt-1}^{\delta 1}\, (\xi_x^{\;1})^{\delta 2} \quad , \tag{U}$$

Where C is aggregate consumption; $\xi_x \geq 1$, so the benchmark consumption level grows exogenously over time; and the other parameters satisfy $0 \leq \delta_0, \delta_1, \delta_2 \leq 1$. Not all of the preference parameters in (T) and (20) are identifiable. Specifically, define ∂, Ω, and k_{xy} as

$$\partial = \alpha - \delta_0(\alpha-1)>0$$

$$\Omega = \delta_1(\alpha-1)$$

$$\text{(V)}$$

$$k_{xy} = (\xi_x/\xi_y)^{\;\delta 2(\alpha-1)}$$

which are linear combinations of the underlying preference parameters. Applying the external habit persistence model to an international environment the, yields the following relationship between consumption and the real exchange rate,

$$\Delta(E_{xyt}\, P_{yt} / P_{xt}) = (\Delta C_{xt}/\Delta C_{yt})^{\partial}\, (\Delta c_{xt}/\Delta c_{yt})^{-\Omega}\, k_{xy} \tag{W}$$

Where k_{xy} reflect the potentially different growth rates of reference utility.

Table 4 contains the results from estimating equation (W). It has to be focused first on the panel results. The point estimates ∂' and Ω' imply various, plausible combinations of preference parameters via the restrictions (V). For example, $\alpha=3$, $\delta_0=0.58$ and $\delta_1=0.76$ are possible, in addition k' is precisely estimated and indistinguishable from 1, so that the benchmarks for consumption grow at the same rate in all countries. Finally, the j-test statistics has p-value of 0.85, indication a non-rejection of the over-identifying restrictions.

These results stand in contrast to those for individual countries, where in each case both preference parameters are not significantly different from zero at conventional levels of significance. Notice that the panel estimates do not appear to be weighted averages of those from individual countries; that is because the panel uses a different sample so as to include all but two countries. Thus, it omits some Japanese and U.K. data for example.

According to the habit-persistence model, the benchmark model with consumption alone may lead to an inconsistent estimator of α because the expression for marginal utility omits lagged consumption growth. Comparing the panel results in tables 2 and 4 shows that the estimated preference parameters are significant, and accord with theory, once lagged consumption is included in the model of marginal utility.

According to the habit-persistence model, the benchmark model with consumption alone may lead to an inconsistent estimator of α because the expression for marginal utility omits lagged consumption growth. Comparing the panel results in tables 2 and 4 shows that the estimated preference parameters are

significant, and in accord with theory, once lagged consumption is included in the model of marginal utility.

Table 4.

External habit persistence[21]

Country	T	∂' (s.e.)	Ω' (s.e.)	K' (s.e)	λ^2(d.f.) (p-value)
Panel	504	1.84 (0.44)	1.52 (0.40)	1.00 (0.01)	6.36(11) (0.85)
Canada	156	-0.06 (0.19)	0.07 (0.15)	1.00 (0.01)	7.57(1) (0.01)
Denmark	48	-0.61 (1.45)	-0.65 (1.53)	1.01 (0.02)	1.82(1) (0.18)
Finland	100	0.06 (0.71)	0.22 (0.62)	1.00 (0.01)	4.07(1) (0.04)
France	80	-1.01 (0.92)	-0.67 (0.86)	1.00 (0.01)	5.77(1) (0.02)
Italy	111	-1.18 (1.16)	0.37 (1.10)	0.99 (0.01)	4.14(1) (0.04)
Japan	73	1.39 (1.35)	-1.76 (1.39)	1.01 (0.01)	2.53(1) (0.12)
New Zealand	66	-1.12 (1.15)	0.12 (1.26)	1.00 (0.01)	5.99(1) (0.01)
Sweden	72	-2.58 (1.87)	(0.79) (1.59)	0.98 (0.02)	3.17(1) (0.08)
U.K.	164	-1.08 (0.55)	0.89 (0.46)	0.99 (0.01)	4.84(1) (0.03)

(Used formula: $\Delta(E_{xyt}\, P_{yt} / P_{xt}) = (\Delta C_{xt}/\Delta C_{yt})^{\partial}\, (\Delta c_{xt}/\Delta c_{yt})^{-\Omega}\, k_{xy}$)

6. INCOMPLETE ASSET MARKETS

Several studies of international business cycles have worked with exogenously incomplete asset markets, in which there is trade only in non-contingent bonds. This approach also breaks the period-by-period connection between the real exchange rate and relative consumption; the real exchange rate deviates from the stochastic singularity given by equation (B) because financial assets do not span all contingencies. But, without further modification, such incomplete asset markets imply a non-stationary distribution of wealth across countries. As a result, a stable equilibrium is no longer well defined. An endogenous, discount factor that evolves stochastically alleviates this problem. The endogenous

[21]The United States is the reference country "y" in each case. The panel excludes Denmark and New Zealand, runs from 1981:II to 1999:III, and adopts a constant and lagged own-residuals as instruments. The instrument set for individual country estimates includes a vector of ones, the lagged residual, and the lagged growth rate in the real exchange rate.

discount rate increase marginal “impatience” as the economy accumulates net foreign assets, so that the distribution of wealth evolves along a stationary path[22].

The utility model incorporating an endogenous discount rate is Schmitt-Grohe and Uribe model[23] which uses modified Uzawa[24] preferences. This model includes power utility in consumption and a discount factor that also depends on consumption:

$$\beta(c_{xt}) = (1+c_{xt})^{-\vartheta}, \ \vartheta \geq 0 \qquad (X)$$

so that impatience rises as consumption rises. It is important that households do not internalize the fact that the discount factor depends on consumption. Alternatively, imagine that β depends on per capita consumption, which the household takes as exogenous. Schmitt-Grohhe and Uribe show that an open economy model with this feature behaves identically to one in which households internalize the effect of consumption on impatience. It also behaves very similarly to other models of incomplete markets with stationary wealth distributions, such as those with a debt-elastic, international, interest-rate differential.

In aggregate data with power sub-utility, marginal utility then is

$$U_{cx} = (1+ c_{xt})^{-\vartheta} c_{xt}^{-\alpha} \quad . \qquad (Y)$$

The real exchange rate condition with an endogenous discount rate is

$$\Delta(E_{xyt} P_{yt} / P_{xt}) = (\Delta C_{xt}/\Delta C_{yt})^{\alpha} [(\Delta(1+c_{xt-1}) / \Delta(1+c_{yt-1})]^{\vartheta} \qquad (Z)$$

The results for the endogenous discount model are reported in table 5. In the panel, the coefficient of relative risk aversion is 1.53, with a small standard error. The J-test cannot reject the over identifying restrictions, as the p-value is 0.73. As in table 4, therefore, the addition of higher-order dynamics in consumption allows us to identify a positive value for α’. In this case, though the additional parameter ϑ is estimated to be a significant, negative number, which is inconsistent with the theory (X), where in impatience rises with consumption.

In the results for individual countries relative to the U.S., standard errors again are too large to allow drawing conclusions about the parameters. Also noteworthy is the observations that the p-value for the j-test tend to be quite low (four of nine are less than 0.10), which suggests that adding instruments to try to improve precision might well lead to rejection of the moment restrictions.

Final extension for the estimating equation involves a change in the constraints, rather than the utility function, Alvarez, Atkeson and Kehoe (2002) study

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[22] Stokey J.H., and J.H. Wright (2000), “GMM with weak identification”, Econometrica 68, pages 181-192.

[23] Schmitt-Grohe, S., and M. Uribe (2003), “Closing small open economy models”, Journal of International Economics 61, pages 172-174.

[24] Uzawa H. (1968), “Time preference, the consumption function and optimum asset holdings, in value capital growth: Papers in Honor of Sir John Hicks, ed.”, J.N. Wolfe (Chicago: Aldine), pages 145-157.

a cash-in-advance economy in which household are subject to an additional cost to transfer money in or out of the asset market. With this friction, they show that the real exchange rate is equal to the ration of international marginal utilities of households that are active in asset markets. Consumption by those households id denoted with the subscript "Π", so that

$$E_{xyt}\, P_{yt} / P_{xt} = U_c(\rho_{\Pi yt}) / U_c(\rho_{\Pi xt}) \,. \qquad (Z_a)$$

This conditional differs for it depends not on aggregate consumption but rather on the consumption of households that are active in asset markets.

Table 4.

Endogenous Discount Rate[25]

Country	T	α' (s.e.)	ρ' (s.e.)	λ^2(d.f.) (p-value)
Panel	504	1.53 (0.374)	-2.05 (0.350)	8.63(12) (0.73)
Canada	157	-0.10 (0.22)	-1.28 (0.95)	8.36(1) (0.00)
Denmark	49	0.26 (0.66)	-1.68 (1.64)	2.13(1) (0.36)
Finland	101	-1.20 (2.64)	-0.54 (1.54)	2.93(1) (0.09)
France	81	-0.32 (0.84)	-3.91 (2.85)	4.29(1) (0.04)
Italy	112	9.94 (6.18)	-8.42 (3.45)	0.50(1) (0.48)
Japan	74	-1.18 (1.86)	3.53 (3.15)	2.17(1) (0.14)
New Zealand	67	-2.29 (1.06)	-0.32 (0.62)	2.13(1) (0.14)
Sweden	73	-0.59 (0.62)	0.05 (0.51)	2.53(1) (0.11)
U.K.	165	0.49 (0.83)	-0.59 (0.65)	3.87(1) (0.05)

(Used formula: $E_{xyt}\, P_{yt} / P_{xt} = U_c(\rho_{\Pi yt}) / U_c(\rho_{\Pi xt})$)

Condition (Z_a) is not directly testable because the λ^2 are not observed and so Alvarez, Atkenson and Kehoe discuss ways to test it indirectly. For example, they study the implications of this endogenous market incompleteness for the correlation between real and nominal exchange rates, using data for high-inflation countries such

[25]The United States is the reference country "y" in each case. The panel excludes Denmark and New Zealand, runs from 1981:II to 1999:III, and adopts a constant and lagged own-residuals as instruments. The instrument set for individual country estimates consists of vector of ones, the lagged residual, and the lagged growth rate in the real exchange rate.

as Turkey, Israel, Mexico, and several countries in Latin America. One implication of their modeling of endogenous market incompleteness is that the consumption of active households will be more closely approximated by aggregate consumption when the inflation rate is high. In fact, at high enough inflation rates all households will be active and the usual condition (A) will hold. Unfortunately, measures of consumption excluding durables (or even total consumption for long time spans) typically are unavailable for high-inflation countries. There is also explored the implications of endogenous segmentation for the OECD real exchange rate.

Denote the inflation rate in country x by τ_{xt}. Then the revised condition is

$$E_{xyt} P_{yt} / P_{xt} = (\Delta c_{xt}/\Delta c_{yt})^{\alpha} \ \{1\text{-}\exp [-\Upsilon(\tau_{xt}+\tau_{yt})]\} \qquad (Z_b)$$

Thus, if inflation rates are zero, the added term is 0 and there is no connection between the real exchange rate and the ratio of marginal utilities measured in aggregate consumption. Negative inflation rates are not observed in our sample. In contrast, as the inflation rates rise, the new weighting term goes to one at a rate estimated via the parameter Υ. In that case, there will be connection between the real exchange rate and the ratio of marginal utilities, as predicted by the simplest case of the benchmark theory. The revised estimating equations (Z_b) imply that the standard versions should fit better during period when both countries have high inflation – such as the – 1970s – than during period of shared, low inflation such as the 1990s.

The results (not shown in a table) did not support equations (Z_b) for these OECD countries. Estimates of Υ were positive estimates of α remained generally negative. Thus, the addition of this weighting factor did not yield a readily interpretable relation between real exchanges rates and measured, marginal utility. Perhaps this market segmentation holds in less developed countries with higher inflation rates, but consumption data typically are not available for long time spans for those countries.

7. CONCLUSION

In this paper extended empirical work investigating the link between relative, international marginal utilities and the real exchange rate. The models were studied of marginal utility that include government spending, leisure, real balances, or external habit. Also allowed for incomplete asset markets with a stochastic discount rate or for endogenous market segmentation.

Country-by-country estimation generally does not yield precise estimates of the preference parameters, while panel estimation does so. Real exchange rates tend to be quite persistent, so that their growth rates are difficult to predict. Consumption tend to roughly follow a random walk, so that growth rate also is difficult to predict. Thus, identifying the parameters is difficult without international panels.

In the panels, in turn, the results are negative with one, conspicuous exception. The model with external habit yields significant coefficients, with signs accord with theory. For example, one identification gives a coefficient of relative risk aversion of 3, a weight of 0.58 on current consumption and a weight of 0.76 on lagged consumption. This specification of marginal utility also passes the j-test of over-identification. It implies that the benchmark model including only current consumption may suffer from omitted-variables bias. Our brief investigation thus serves as a first step, before going on to study a fully solved model with external habit.

Recently, Corsetti, Dedola, and Leduc (2001) and Durate and Stockman (2001) have modeled real exchange rates in environments with both goods market segmentation and incomplete asset markets. While these two studies may have distinct features, they each find that the combination of these two market imperfections potentially can break the link between the real exchange rate and relative consumption. Testing these real exchange rate models requires measuring shocks to productivity and money growth, and so these models do not lend themselves to direct estimation by GMM. Nevertheless, the calibrated example of Corsetti, Dedola and Leduc shows that the correlation between the real exchange rate and relative consumption can be zero or negative, as was found in tables 1 and 2 for example Historical sample paths predicted from these models remain to be studied. Negative results on many of the alternatives reinforce the idea that these models with two frictions also are worthy of further investigation.

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Dr. sc. Tihomir Janjiček
Odjel za ekonomiju I poslovnu ekonomiju
Sveučilište u Dubrovniku

KRETANJE DEVIZNOG TEČAJA OD 1961. – 2001.

Sažetak

U ovom sam radu pokušao otkriti spone između granične korisnosti s jedne strane i državne potrošnje, realne novčane bilance s druge strane. U tome su mi poslužila dva pristupa. Prvi je egzogeno tržište koje ne funkcionira ali koje ima endogenu diskontnu stopu i koje zauzdava rspodjelu bogatstva. Drugi je pristup onaj koji ima obilježja endogene tržišne segmentacije. Niti jedan od ovih pristupa ne poklapa se s teorijom niti s naglašeno prepoznatim restrikcijama pojedine zemlje. Tek su se sistemi koji su imali stalne eksterne navike najbolje podudarali sa stvarnim tečajnim kretanjima za OECD zemlje između 1961. – 2001.

Ključne riječi: devizni tečaj; granična korisnost; državna potrošnja

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