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Alternative Paths Towards EMU: Lessons from an Expanded Mundell-Fleming Model for the Accession Countries

by

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Abstract: A small expectations-expanded "Mundell-Fleming" model is built for the European Union Accession Countries and estimated to assess the optimality of different exchange rate regimes (a peg and a float) through a simple welfare function. Floating appears as the best option for most of the countries in our sample, and this conclusion is robust to changes in the weights of the welfare function. The "shock absorbing" qualities of the regimes for different types of innovations is assessed via a VAR and a structural model, and here again the float seems to outperform a harder regime, in the emergence of temporary shocks.

Keywords: Euro, Enlargement, Transition Economies, Exchange Rate Regimes, Mundell-Fleming Models.

JEL Classifications: E52, E61, F02, P33

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1. INTRODUCTION

European monetary integration will undoubtedly have a strong effect on the present and future macroeconomic policies of the Eastern European countries that are candidates for EU accession (namely Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia), the so-called Accession Countries (ACs). In particular the question which exchange rate regime the ACs should choose vis-à-vis the European Monetary Union (EMU) warrants attention. In this work, we will focus on the effects of two extreme types of exchange rate regimes: fixed and flexible exchange rates[1]. The underlying assumption is that the choice of the exchange rate regime is of considerable short run importance for further integration deepening of the ACs with the EU-15.

To study the effects of alternative economic policy regimes and of interaction with the Euroarea on the macroeconomic adjustment of individual transition economies, we use relationships derived from a traditional "Mundell-Fleming" (MF) model[2] (so called from the combination of works done independently by Marcus Fleming and Robert Mundell during the early 1960's: see Fleming 1962 and Mundell 1962), expanded with an expectations formation mechanism (see Dornbusch 1976).
This type of models has been criticised for lacking clear micro-foundations: there are no agents in the set-up and therefore no one is either openly minimising a loss function or maximising a welfare function as a guide to its actions, which, among other things, makes welfare evaluations based on the model's results somewhat

[1]The current accession linkage strategies collapse to, in essence, either a peg or a float: the remaining exception to this, Hungary, became a floater within a band in mid 2001 (for works that model this strategy, see Golinelli and Rovelli (2000), and Wollmershäuser and Bofinger (2001)).
[2]On applications of the MF model and variants of it, see Wdowinski and van Aarle (1998), Plasmans (1999), and Roberts and Tyers (2001). For extensions of Dornbusch-type models with policy rules à la Taylor, see Svensson (1997a), Leitemo and Røisland (2000) and Bergvall (2000).

difficult. Nevertheless, the expanded "MF" still remains very much the "work horse" of most macroeconomic modelling with policy aims, due to its elegance, simplicity and intuitive policy implications (see Obstfeld 2000 and Rogoff 2001). It has also been chosen here because of its small size and low data requirements, which enables individual estimations for *all* the countries in our sample. Furthermore, its tractability and flexibility and the existence of an established body of literature on its applications has influenced our choice.

2. MODELLING THE EXCHANGE RATE REGIME IN A TRANSITION ECONOMY

The model studied here consists of two versions of the standard MF-framework, one for each exchange rate regime[3]. The two standard MF model conclusions apply[4]:

i) in a fully flexible exchange rate system, the money supply is exogenous and can, in principle, enable an activist policy by the monetary authorities, while fiscal policy is not effective;

ii) in a fixed exchange rate system, the money supply is endogenous. Therefore, monetary policy is not effective, while fiscal policy is.

Following the MF set-up, we assume two regions, a small domestic country and a large foreign economy, the Euroarea. Given our focus on the ACs, this "small country" assumption is adequate (the *joint* GDP of all ACs is around 5 per cent of the EU's GDP, or a little more than 7 per cent of the Euroarea GDP), i.e., they are price

[3]See Visser and Smits, (1995), Wdowinski and van Aarle, (1998), ibid., and Bank of England (1999) for sthe models on which this one is based.

[4]They are derived under the assumption of capital mobility: this implies that, for these outcomes to be observed, the coefficient(s) α_{11} should be "large". For *actual* capital mobility indicators for the ACs, in an index from 0 to 100, where 100 indicates full liberalization (see IMF (2000)), Estonia and Latvia score 97.6, Lithuania 85.7, the Czech Republic, 73.7, Hungary 59.5 while a "larger" economy like Poland scores 55.3, Slovenia, 40.5, Bulgaria 35.3, Slovakia, 23.7 and Romania, the less liberalized in the group, a mere 12.5 the average, non-GDP weighted, is 58.1. It must be noted that the index above was computed using 1997 data –around the middle of our sample- and that now it is certainly higher, especially among the relative laggards like Bulgaria, Slovenia and Slovakia (but with the possible exception of Romania), given that capital account liberalization is a (pre)-requisite for EU membership.

takers on international goods and factor markets (i*, the world real interest rate is exogenously given, as is p*, the world price level; and they face a horizontal demand curve), so that the effects of the ACs on the large Euroarea economy are negligible.

The estimated log-linear model will assume the specification below. All series – except the interest rates- are in natural logarithms, and in deviations from the long-run trend (estimated using a Hodrick-Prescott filter (HP) upon the original series using a quarterly penalty parameter λ equal to 1.600). Additionally, due to a question of scale, the national net current account and net financial account were converted from USD into the national currencies using the average nominal quarterly exchange rate. The resulting figures were then divided by real GDP, generating series in terms of output share upon which the HP filtering process was used[5].

In equation (1), we have the IS schedule for the real goods market, defined as real domestic income in the transition economy (nominal GDP deflated by the CPI index), which is assumed to be a function of lagged domestic real GDP, the real interest rate (defined as the nominal interest rate in time *t* –the annualised lending interest rate series are set to quarterly rates before that- minus the realised CPI inflation rate in time *t*), the level of real government consumption (the nominal series deflated by the CPI index), a competitiveness parameter defined as the real exchange rate, the external balance (defined as the net current account) and an external demand shock (the real GDP of the Euroarea, the most important trade partner of all the ACs).

$$(1)\quad Y_{ti} = \alpha_1 y_{it-1} - \alpha_2 r_{it} + \alpha_3 g_{it} + \alpha_4 c_{it} + \alpha_5 b_{it} + \alpha_6 y^*_{it-1} + \mu$$

As indicated above, the competitiveness parameter *c* is defined as the real effective exchange rate (REER), or the difference of the log nominal exchange rate ***s***

[5]Another specification, using net current and financial accounts in log levels was tested and discarded.

and the domestic price level from the external, one the p and p*, respectively, given by

$$(2)\ C_{it} \equiv s_{it} - p_{it} + p^{*}_{it}$$

The REER series above, for a peg regime, will be estimated with the nominal exchange rate set at *t=0*, i.e., its level at the beginning of the sample, or $E(\dot{s})=0$.

In equation (3), we have the LM schedule, where current money stock is a function of the real GDP level, the opportunity cost of holding money (the nominal interest rate) and the inflation level, and, in the case of the fixed regime, the change in international reserves held at the monetary authority (the sum of the reserves in hard currencies and gold at national valuation, converted to domestic currency using the nominal exchange rate, and in logs).

$$(3)\ M_{it} = \alpha_7 y_{it-1} - \alpha_8 i_{it-1} + \alpha_9 p_{it-1} + \alpha_{10} re_{it} + \mu$$

In (4), we have the BP schedule, where, in a fixed exchange rate regime, the net external balance is defined as, again, the sum of the net current and financial accounts, is given by the difference of the nominal domestic and external interest rate (net capital flows are, therefore, assumed to be determined by the differential returns), a competitiveness parameter *c* (the REER series for a fixed exchange rate regime is calculated in the same way as described above), lagged domestic activity and lagged external activity.

$$(4)\ B_{it} = \alpha_{11}\left(i_{it-1} - i^{*}_{it-1}\right) + \alpha_{12} c_{it} + \alpha_{13} y_{it-1} + \alpha_{14} y^{*}_{it-1} + \mu$$

As the free floating is assumed to keep the balance of payments in equilibrium (B=0), the equation above, in a floating exchange rate regime becomes (5) below

$$(5)\ E(\dot{s}) = \alpha_{11}\left(i_{it-1} - i^{*}_{it-1}\right) + \alpha_{12} c_{it} + \alpha_{13} y_{it-1} - \alpha_{14} y^{*}_{it-1} + \mu$$

We assume rational exchange rate expectations, which, in the absence of uncertainty, implies perfect foresight and therefore,

$$(6)\quad E(\dot{s}) = \dot{s}$$

Of course, this not a realistic assumption even for mature market economies, and is much less for the ACs in our sample that are introducing market institutions *and* new currencies, while being subject, at the same time, to both country specific and common shocks. Nevertheless, given that we do not have adequate proxy series for the exchange rate expectations (as expectations are not directly observable), we use the series of the realisations of the nominal exchange rate in time *t*.

In (7), we have a Phillips Curve Equation, linking inflation with past and future prices (this may be understood as representing an economy with overlapping wage contracts, some set with backward looking expectations concerning prices and some forward looking: see Bank of England 1999, ibid.) and with lagged GDP.

$$(7)\quad P_{it} = \alpha_{15} p_{it-1} + \alpha_{16} p_{it+1} + \alpha_{17} y_{it-1} + \mu$$

A straightforward way to evaluate the comparative optimality of the two possible regimes in our estimations can be derived from a simple loss function, that enables a "policy maker" to compare the welfare derived from the alternative regimes. The loss function is defined as (8) below

$$(8)\quad U = \left(\beta_1 \sum_{t=1}^{n} (Y_t) - \beta_2 \sum_{t=1}^{n} (P_t) \right)$$

where is ***Y*** the GDP series generated by Equation (1) and ***P*** is the dependent variable of equation (7), the Phillips Curve relationship, the "inflation bias" of each regime. The *βs* are the weights assigned by the policy-maker to growth and inflation.

With such a model, we will also test the different effects of domestic and external "shocks" to key variables of the ACs' economies. For the external shock, an additional equation will be estimated, given by (9) below

$$(9)\ Y_t^* = -\alpha_{18} i_{t-1}^* + \mu$$

which gives the effects in external demand from an increase in Euroarea interest rate.

3. DATA AND PROCEDURES

Quarterly data series taken from the IMF/IFS database were used for all 10 Central and Eastern European countries in our sample. Quarterly GDP was proxied by Industrial Production for Romania in the following manner: yearly GDP figures were divided in quarters and regressed on the available quarterly industrial production series. Again for Romania, government consumption was proxied by total government expenditures multiplied by the average share of the yearly government consumption in total government expenditures. A similar procedure was used for the missing parts of Polish and Hungarian government consumption series. M1 was used for money. The nominal exchange rate series are the nominal national rates to the Euro. The REER series were also taken from the IMF, with the exception of Estonia and Lithuania, which were kindly provided by the domestic central banks, and for Latvia, which was calculated using the nominal exchange rate and CPI price index series, minus the Euroarea CPI index series constructed as indicated below.

The sample period goes from 1993:3 until 2001:4, not only to avoid the know problems associated with the earlier years of transition, but to assure a sample period in which all necessary data would be available for *all countries*, including the newly independent ones. This does not mean that all the countries here have the data for the full sample above: some of them only have data for a considerable shorter sample).

For the Euroarea, the data was taken from the IMF/IFS series for the period 1993-1997 and from the ECB for 1998 onwards. For the 1993-1997 period, Euroarea GDP was built by aggregating the national quarterly GDP of the Euroarea member states (excluding Belgium, Greece, Ireland and Luxembourg, who do not produce quarterly GDP series: this implies an average loss of, roughly speaking, 5.25 per cent of the Euroarea GDP). GDP-weighted average lending rates were built. For the same period, the CPI inflation rates were used for the construction of the -also GDP-weighted- Euroarea inflation (the later part of the sample uses the HIPC series produced by Eurostat).

Before any estimation, the stationarity of the time series was analysed with Augmented Dickey-Fuller tests (without intercept and trend, with intercept, with intercept and trend, for 1 lag) for both level and first differenced data. Partial autocorrelation graphs and the original series' plots were also used as an aid to the diagnosis process. The residuals of the log HP filtered original series are level stationary (with the exception of 4 series, which are stationary after one differentiation)[6].

4. ESTIMATION RESULTS

The main initial estimation procedure to be used will be as follows: firstly, the two simultaneous equations systems above will be estimated by a heteroskedasticity-consistent OLS procedure. Afterwards, the estimated series by this procedure will be used for the estimation of comparative welfare and the VAR simulation of shocks.

4.1 Estimated coefficients for both versions of the model

The main estimated coefficients and their standard errors (indicated as S.E), plus their significance levels (* for 1 per cent, ** for 5 per cent and *** for 10 per cent) for

[6]Tables with all the estimated ADF statistics are available upon request.

the float and peg specifications are given below, in Tables 1 and 2, respectively. The name of the country is indicated in the first row, the second shows the time sample used in the regression, the third the number of observations per equation, and the fourth the total number of observations in the system. The coefficients do not have the same values for individual countries in different regimes, but they fall within the intervals defined by their respective standard errors and they tend to have the same signs.

Concentrating on the BP schedule, there are some indications that the *significance* of the coefficients for each specification seems to be related to the actual exchange rate regime followed by the country in question: when the country passed through a period of actual greater exchange rate flexibility, at least one coefficient was significant. This seems to be confirmed by the estimations of coefficients from regime-specific samples for countries with clearly defined peg and float periods (as some of the samples here are rather short –one with only 9 observations- those results must be taken with care) showed in Table-3 below. Nevertheless, there are no systematic indications of this for actual pegs, as only Estonia had any significant variables on its peg BP equation among the three "classical" CBA (Currency Board Arrangement) Baltic countries[7].

[7]A possible explanation for this may be that, given that the Lithuanian Currency Board Arrangement was linked to the USD during the whole sample used and the Latvian hard peg is linked to the SDR, they effectively behaved as *floating currencies towards the Euro d*uring the period in question, the Estonian Kroon fluctuated ±2.16 per cent towards the Euro, while the Litas varied by ±8.86 per cent and the Lats by ±13.37 per cent. Those two last values are greater than the ones showed by the Czech and Slovak Korunas during their *float* periods (namely, ±5.49 per cent and ±3.36 per cent respectively), or the Polish Zloty (±6.60 per cent), and closer to the variability showed by the Slovenian Tolar (±14.02 per cent). The only currencies clearly above them in terms of nominal variability are the Bulgarian Lev, during its float period (±93.04 per cent) and the Romanian Leu (±83.66 per cent).

Table 1: Estimated Coefficients for the Float Specification

		BUFLOAT	CZFLOAT	ESFLOAT	HUFLOAT	LAFLOAT	LIFLOAT	PLFLOAT	ROFLOAT	SAFLOAT	SEFLOAT
		94:2 00:2	93:3 00:4	93:3 01:1	96:2 01:2	94:1 01:2	93:3 00:4	95:2 00:1	95:4 00:4	93:3 00:4	93:3 00:4
		obs: 25	obs: 30	obs: 31	obs: 21	obs: 30	obs: 30	obs: 20	obs: 21	obs: 30	obs: 30
		sys obs. 125	sys obs. 150	sys obs. 155	sys obs. 105	sys obs. 150	sys obs. 150	sys obs. 100	sys obs. 105	sys obs. 150	sys obs. 150
IS	α_1	0.125	0.391**	-0.118	0.335	0.482***	0.012	0.403**	1.152***	0.324*	0.535**
	S.E.	0.185	0.220	0.237	0.209	0.140	0.221	0.174	0.049	0.199	0.240
	α_2	-0.040***	0.045	-0.004	-0.009	0.014	0.016	0.003	0.006	-0.002	-0.009*
	S.E.	0.007	0.065	0.023	0.053	0.009	0.015	0.033	0.020	0.021	0.005
	α_3	-0.201	-0.087	-0.211	-0.486	-0.460***	-0.143	0.654	-0.453	-0.280**	-0.264
	S.E.	0.149	0.088	0.151	0.476	0.076	0.129	0.428	0.372	0.114	0.067
	α_4	-1.839***	0.180	-0.152	-0.546	-0.078	-0.098	-0.686*	-0.055	-0.190	-0.201
	S.E.	0.476	0.378	0.181	0.450	0.184	0.313	0.381	0.591	0.214	0.242
	α_5	1.330***	0.000	0.198	0.001*	-0.169**	0.175	-0.060	0.001	-0.115	0.195
	S.E.	0.377	0.000	0.210	0.000	0.084	0.222	0.746	0.002	0.166	0.132
	α_6	0.092**	0.030	-0.032	0.000	0.001	-0.041	-0.036	-0.131	-0.035**	0.001
	S.E.	0.045	0.026	0.021	0.018	0.012	0.031	0.027	0.106	0.018	0.008
LM	α_7	0.524***	0.861***	0.081	-0.015	0.251	0.322**	0.167	-0.018	0.793***	-1.411***
	S.E.	0.130	0.270	0.169	0.187	0.201	0.140	0.127	0.026	0.281	0.427
	α_8	-0.010**	-0.229***	-0.059***	-0.070**	-0.036**	-0.012	-0.097***	-0.015	-0.089***	-0.032***
	S.E.	0.004	0.081	0.020	0.032	0.016	0.012	0.025	0.010	0.020	0.010
	α_9	0.882***	0.483	0.040	0.009	-0.447	0.360	1.486***	0.296	1.050*	-0.738
	S.E.	0.037	1.173	0.187	0.372	0.420	0.235	0.399	0.206	0.591	0.546
	α_{10}	0.392***	0.055	0.049	0.266***	0.186	0.173*	0.350**	0.239	-0.176***	-0.198**
	S.E.	0.072	0.154	0.108	0.099	0.143	0.102	0.167	0.170	0.060	0.088
BP	α_{11}	0.017***	0.000	-0.005	0.001	-0.004	-0.002	-0.000	-0.010	-0.002	-0.002
(S)	S.E.	0.005	0.026	0.003	0.013	0.005	0.005	0.011	0.007	0.007	0.002
	α_{12}	2.210***	0.365**	0.027	0.300***	0.580	-0.145	0.333*	0.482**	0.413**	0.380***
	S.E.	0.356	0.165	0.049	0.103	0.948	0.178	0.174	0.212	0.110	0.090
	α_{13}	0.545***	0.050	0.009	-0.009	0.105	0.165**	-0.059	-0.003	0.044	0.096
	S.E.	0.196	0.079	0.026	0.052	0.069	0.083	0.064	0.021	0.090	0.086
	α_{14}	-0.152***	-0.011	-0.003	-0.013***	0.000	-0.005	-0.013	-0.052	-0.003	0.000
	S.E.	0.052	0.009	0.003	0.005	0.007	0.012	0.010	0.042	0.006	0.004

Table 2: Estimated Coefficients for the Peg Specification

		BUPEG	CZPEG	ESPEG	HUPEG	LAPEG	LIPEG	PLPEG	ROPEG	SAPEG	SEPEG
		94:2 00:2	93:3 00:4	93:3 01:2	96:2 01:2	94:1 01:2	93:3 01:1	95:2 00:1	95:4 00:4	93:3 00:4	93:3 00:4
		obs: 25	obs: 30	obs: 32	obs: 21	obs: 30	obs: 31	obs: 20	obs: 21	obs: 30	obs: 30
		sys obs 125	sys obs 150	sys obs 160	sys obs 105	sys obs 150	sys obs 155	sys obs 100	sys obs 105	sys obs 150	sys obs 150
IS	α_1	-0.097	0.422**	-0.052	-0.270	0.418***	0.015	0.181	1.157***	0.198	-0.096
	S.E.	0.205	0.218	0.229	0.233	0.138	0.213	0.211	0.049	0.184	0.212
	α_2	-0.012***	0.076	-0.005	0.000	0.002	-0.005	-0.013	0.013	-0.010	0.002
	S.E.	0.004	0.071	0.023	0.039	0.011	0.020	0.029	0.022	0.017	0.005
	α_3	-0.052	-0.083	-0.286**	-0.113	-0.441***	-0.135	0.465	-0.436	-0.247**	-0.158***
	S.E.	0.155	0.088	0.139	0.356	0.073	0.124	0.423	0.367	0.099	0.053
	α_4	-0.136***	-0.216	-0.094	-1.018***	-0.210*	-0.254	-0.715**	-0.172	-0.549**	-0.490***
	S.E.	0.040	0.365	0.102	0.266	0.126	0.176	0.307	0.286	0.212	0.103
	α_5	1.116***	0.000	0.103	0.000*	-0.127	0.067	-0.009	0.001	-0.027	0.097
	S.E.	0.379	0.000	0.205	0.000	0.084	0.221	0.701	0.002	0.146	0.097
	α_6	-0.057	0.031	-0.023	-0.046**	-0.001	-0.044	-0.057**	-0.181	-0.020	0.004
	S.E.	0.071	0.025	0.018	0.018	0.011	0.030	0.028	0.124	0.015	0.005
LM	α_7	0.524***	0.861***	0.067	-0.015	0.251	0.328**	0.167	-0.018	0.793***	-1.411***
	S.E.	0.130	0.270	0.162	0.187	0.201	0.143	0.127	0.026	0.281	0.427
	α_8	-0.010**	-0.229***	-0.059***	-0.070**	-0.036**	-0.012	-0.097***	-0.015*	-0.089***	-0.032***
	S.E.	0.004	0.081	0.020	0.032	0.016	0.013	0.025	0.010	0.020	0.010
	α_9	0.882***	0.483	0.031	0.009	-0.447	0.384*	1.486***	0.296	1.050*	-0.738
	S.E.	0.037	1.173	0.183	0.372	0.420	0.239	0.399	0.206	0.591	0.546
	α_{10}	0.392***	0.055	0.045	0.266***	0.186	0.163*	0.350**	0.239	-0.176***	-0.198**
	S.E.	0.072	0.154	0.106	0.099	0.143	0.104	0.167	0.170	0.060	0.088
BP	α_{11}	0.004	70.615	-0.046*	-43.784	-0.004	0.009	0.022	4.225	0.066**	0.006
(B)	S.E.	0.007	107.889	0.026	68.923	0.021	0.018	0.014	5.431	0.027	0.017
	α_{12}	0.023	683.153	-0.266**	71.617	-0.154	-0.077	0.030	29.882	0.668	0.126
	S.E.	0.062	644.008	0.133	458.709	0.252	0.191	0.150	85.736	0.480	0.437
	α_{13}	-0.139	-203.307	0.011	417.440	-0.207	-0.062	-0.216**	3.528	0.396	-0.465
	S.E.	0.248	271.151	0.233	344.457	0.248	0.204	0.104	14.851	0.380	0.629
	α_{14}	0.005	97.799***	-0.011	16.319	0.027	0.004	0.005	5.168	0.059*	0.004
	S.E.	0.110	31.083	0.022	36.658	0.023	0.030	0.014	37.670	0.032	0.025

Table 3: Coefficients for Regime-Specific Samples

		BUFLOAT	CZFLOAT	SAFLOAT	BUPEG	CZPEG	SAPEG
		94:2 97:1	97:4 00:4	98:4 00:4	97:2 00:2	93:3 97:1	93:3 98:3
		obs: 12	obs: 13	obs: 9	obs: 13	obs: 15	obs: 21
		sys obs. 60	sys obs. 65	sys obs. 45	sys obs 65	sys obs 75	sys obs 105
IS	α_1	1.105*	0.257	0.088	-0.452**	0.266	0.154
	S.E.	0.599	0.374	0.254	0.205	0.342	0.298
	α_2	-0.059***	0.094	-0.031	-0.055***	-0.076	-0.012
	S.E.	0.017	0.149	0.035	0.012	0.138	0.029
	α_3	-0.999	0.006	-0.272**	-0.158	-0.266*	-0.182
	S.E.	0.635	0.120	0.130	0.105	0.152	0.190
	α_4	-2.639***	-0.060	-0.422	-0.288***	1.049	-0.595*
	S.E.	0.940	0.827	0.379	0.068	0.724	0.331
	α_5	0.582	0.001	-0.350	2.470***	0.000	0.052
	S.E.	0.638	0.001	0.408	0.562	0.000	0.235
	α_6	0.063	0.067	-0.058	-0.021	0.049	-0.019
	S.E.	0.105	0.067	0.050	0.100	0.039	0.020
LM	α_7	0.320	0.370	-0.193	0.552***	0.446	1.070***
	S.E.	0.275	0.382	0.633	0.120	0.357	0.349
	α_8	-0.002	-0.046	-0.150***	-0.015***	-0.971***	-0.074***
	S.E.	0.008	0.102	0.042	0.004	0.242	0.026
	α_9	0.931***	-1.868	-0.997	0.846***	-0.142	1.242*
	S.E.	0.077	1.461	1.323	0.028	2.542	0.704
	α_{10}	0.274**	0.076	-0.162	0.585***	-0.235	-0.156**
	S.E.	0.126	0.254	0.336	0.140	0.187	0.064
BP	α_{11}	0.035***	0.051	-0.030**	0.007*	314.615	0.106**
	S.E.	0.008	0.062	0.013	0.004	305.186	0.041
	α_{12}	1.406***	0.438	0.942***	-0.041	1578.601	0.918
	S.E.	0.418	0.331	0.301	0.053	1652.058	0.659
	α_{13}	0.263	0.061	-0.198	-0.157	-382.432	0.752
	S.E.	0.264	0.155	0.178	0.141	643.051	0.531
	α_{14}	-0.239***	0.017	0.029	-0.110	136.718*	0.058*
	S.E.	0.078	0.025	0.039	0.090	75.652	0.037
PC	α_{15}	0.548***	0.482**	0.509	0.402***	0.478**	0.462***
	S.E.	0.194	0.220	0.363	0.045	0.201	0.084
	α_{16}	0.528***	0.491**	0.352	0.659***	0.477**	0.538***
	S.E.	0.130	0.213	0.374	0.063	0.224	0.076
	α_{17}	-0.181	-0.013	0.018	-0.020	-0.016	-0.034
	S.E.	0.617	0.069	0.180	0.045	0.025	0.037
Y*	α_{18}	-4.613*	-2.489	-2.015**	-3.183	-5.213**	-7.412***
	S.E.	2.806	1.571	1.006	2.062	2.303	2.585

We may observe from Tables 2 and 3 above that the values of the coefficients of the BP schedule in the peg for Hungary and the Czech Republic are rather large (even after the GDP share correction done to this series). This is explained by the fact that those countries were the ones that attracted –by far- the largest inflows of capital among the ones in our sample, by their positions as “early reformers”. During some periods in our sample, the positive inflow of capital surpassed 30 per cent of the quarterly Czech GDP; after the collapse of its peg regime in 1997, the inflows quickly reversed, reaching as low as –10 per cent of its GDP.

In Table 4 below we show the average values for the coefficients and their standard deviations (no weighting for number of observations on the regressions or the GDP of the country was done for the figures below). The same procedure was applied to the coefficients generated by regime-specific regressions (not shown here), but the signs of the coefficients produced by the full sample regressions conform better to the ones expected from theory and the values themselves are of more intuitive interpretation. Under the guise of comparison, we also show on Table 4 the coefficients used in Wdowinski and van Aarle 1998, Ibiden., Leitemo and Røisland 2000, Ibiden., Bergvall 2000, Ibiden., Roberts and Tyers 2001, ibid.

We must caution that their models are not identical: That the series are treated in a different manner and that they refer to a single, specific country[8], and finally that they use models with imposed coefficients (Wdowinski and van Aarle, Roberts and Tyers), estimated coefficients (Leitemo and Røisland) or a mix of the two (Bergvall). Therefore, any comparison can only be of *indicative* nature.

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[8] Wdowinski and van Aarle deal with Poland –a small, relatively closed “transition” economy, Leitemo and Røsland with Norway –an energy-exporting developed economy, Bergvall with Sweden –an industrial, developed, small open economy, Roberts and Tyers, with China –a large, closed “transition” economy.

Table 4: Comparative Coefficients

		Peg		Bergvall	Leitemo & Røisland		Roberts & Tyers	Wdowinski & van Aarle	Float		Bergvall	Leitemo & Røisland		Roberts & Tyers	Wdowinski & van Aarle
		Avg.	S.E.	Coef.	Coef.	S.E.	Coef.	Coef.	Avg.	S.E.	Coef.	Coef.	S.E.	Coef.	Coef.
IS	α_1	0.19	0.41		0.48 0.41	0.120.0.09		0.60	0.36	0.35		0.48 0.41	0.12 0.09		0.60
	α_2	0.00	0.03	0.32	-0.41		0.10	1.00	0.00	0.02	0.32	-0.40		0.10	1.00
	α_3	-0.15	0.26					0.50	-0.19	0.33					0.50
	α_4	-0.39	0.30					0.10	-0.37	0.57	-0.46	-0.72		0.75	0.10
	α_5	0.12	0.36		0.13			-	0.16	0.43		0.13			-
	α_6	-0.04	0.06					0.30	-0.02	0.06					0.30
LM	α_7	0.15	0.63				0.50	-	0.16	0.63				0.50	-
	α_8	-0.06	0.07				0.10	0.50	-0.06	0.07				0.10	0.50
	α_9	0.34	0.68					0.50	0.34	0.68					-
	α_{10}	0.13	0.20					0.05	0.13	0.20					-
BP	α_{11}	3.11	27.54				4.60	0.30	0.00	0.01					-
	α_{12}	78.50	213.72					0.40	0.49	0.64					0.05
	α_{13}	21.70	153.08					-	0.09	0.17					0.15
	α_{14}	11.94	30.61					-	-0.03	0.05					0.20
PC	α_{15}	0.48	0.06	0.37	0.18			0.20	0.48	0.06	0.37	0.18			-
	α_{16}	0.54	0.05					-	0.54	0.05					-
	α_{17}	-0.02	0.03					-	-0.02	0.03					0.20
Y*	α_{18}	-2.64	1.23		-0.24	0.06		-	-2.86	1.24		-0.24	0.06		-

As can be seen from above, most of the works either implicitly or explicitly assume that some key variables are not endogenous to the policy decision concerning the exchange rate arrangement (which is, after all, only a nominal arrangement), or that, in other terms, they are structurally stable and that the nominal regime choice affect only specific nominal variables. This is explicitly stated in Leitemo and Røisland (2000), Ibiden, and in Bergvall (2000), Ibiden, which conditions the validity of their results to such an assumption; Wdowinski and van Aarle (1998), Ibiden and Roberts and Tyers (2001), Ibiden, bypass this "Lucas Critique" argument by simply imposing coefficients, which are assumed as reasonable and representative.

The Lucas-critique is also an important question concerning this work. If we would assume the coefficients of the fundamental variables to be conditional on the policy choice, as they are derived from the actual data series, it would imply that they would be determined by the current exchange rate regime. It would not be possible to derive two sets of series characterizing different regimes from the same data generating process.

As it turns out, our own estimated coefficients are quite similar for all key variables (and all differences fall within the range defined by the standard errors), with the exception of the BP schedule, but this is due to the fact that the BP schedule is generated by a different equation for each regime. We will, therefore, proceed simply assuming that the "Lucas Critique" argument does not apply here, namely, that the coefficients would be structurally stable within the used estimation sample, and use the series generated by those estimated coefficients from the full samples in the welfare comparisons and shock simulations below.

4.2 Welfare effects of exchange rate regime choices

The country-specific results of the estimated welfare-functions are shown in Table 5 below.

Table 5: The Loss-Function Outcomes

Country	Regime	$\beta_1$1.00	$\beta_1$0.75	$\beta_1$0.67	$\beta_1$0.50	$\beta_1$0.33	$\beta_1$0.25	$\beta_1$0.00
Bulgaria	FLOAT	*0,208*	*0,163*	*0,149*	*0,119*	*0,088*	*0,074*	*0,030*
	PEG	-0,136	-0,113	-0,105	-0,089	-0,072	-0,065	-0,041
Czech Rep.	FLOAT	*0,006*	*0,004*	*0,003*	*0,002*	*0,000*	*-0,001*	*-0,003*
	PEG	-0,005	-0,005	-0,005	-0,004	-0,004	-0,004	*-0,003*
Estonia	FLOAT	*0,054*	*0,024*	*0,015*	*-0,005*	-0,025	-0,035	-0,064
	PEG	0,046	0,020	0,012	*-0,006*	*-0,023*	*-0,031*	*-0,057*
Hungary	FLOAT	*0,257*	*0,198*	*0,180*	*0,140*	*0,101*	*0,082*	0,024
	PEG	-0,077	-0,055	-0,048	-0,033	-0,018	-0,011	*0,011*
Latvia	FLOAT	*-0,111*	*-0,069*	*-0,056*	*-0,027*	*0,002*	*0,015*	*0,057*
	PEG	-0,211	-0,145	-0,124	-0,079	-0,035	-0,014	0,052
Lithuania	FLOAT	-0,306	-0,230	-0,206	-0,154	-0,102	-0,078	*-0,002*
	PEG	*-0,242*	*-0,183*	*-0,164*	*-0,124*	*-0,085*	*-0,066*	-0,007
Poland	FLOAT	*0,248*	*0,182*	*0,161*	*0,117*	*0,072*	*0,051*	-0,015
	PEG	-0,413	-0,311	-0,279	-0,209	-0,139	-0,107	*-0,005*
Romania	FLOAT	-83,120	-62,460	-55,849	-41,800	-27,752	-21,140	-0,480
	PEG	*-62,515*	*-46,973*	*-41,999*	*-31,430*	*-20,861*	*-15,887*	*-0,345*
Slovakia	FLOAT	-0,137	-0,100	-0,088	-0,063	-0,037	*-0,025*	*0,012*
	PEG	*-0,133*	*-0,097*	*-0,085*	*-0,061*	*-0,036*	*-0,025*	*0,012*
Slovenia	FLOAT	*0,124*	*0,093*	*0,084*	*0,063*	*0,042*	*0,032*	*0,001*
	PEG	0,019	0,014	0,013	0,009	0,006	0,004	-0,001

The weights given to output and inflation by the policy-maker were set to vary between 1.00-0.00, 0.75-0.25, 0.67-0.33, 0.50-0.50, 0.33-0.67, 0.25-0.75 and 0.00-1.00. The regimes that perform better in each combination are indicated in italic. As an exchange rate strategy, the float seems to dominate the peg: six out of ten countries are better off with it, and even apparently obvious candidates for a harder regime, due to size or stabilisation considerations, like Bulgaria or Latvia, would seem to fare better under a more flexible regime. The peg only seems to produce superior results in economies still in need of macro stabilisation, and therefore of an external nominal anchor with credibility problems for their monetary and/or fiscal authorities, or with some shaky fundamentals (Lithuania, Romania and Slovakia). More than that, the "optimal" exchange rate strategy is *stable* to different combinations of the parameter weights in the loss function for most countries. Switching –and even here in a few cases- to the other regime is only observed in the extreme of the distribution (if a zero weight is attributed to growth in the welfare function, while all weight is given to inflation stabilisation: the "inflation nutter" scenario). Estonia is the only exception, favouring either regime within a credible range of parameters, and being indifferent to regime choice in the mid-point of the distribution (equivalent weights of 0.50 for both parameters).

5. NON-STRUCTURAL ESTIMATION OF THE EFFECTS OF DOMESTIC AND FOREIGN SHOCKS

The effects of different shocks under each exchange rate arrangement will be simulated via a non-structural approach, namely, through a VAR (vector auto-regression) procedure upon the arrangement-specific estimated series. In the VAR, three types of shocks are simulated for the countries in our sample:

i) a domestic fiscal shock (a 1 standard deviation unexpected shock to the government consumption expenditures);

ii) a domestic monetary shock (a 1 standard deviation unexpected shock to the nominal interest rate)[9];

iii) a external monetary shock (a 1 standard deviation unexpected shock to the Euroarea nominal interest rate).

The extend of the last shock mirrors the degree of integration (and vulnerability) of these economies to Euroarea economic events.

In Table 6 below, we present an overview of the effects of the VAR simulated shocks into the two variables that we used to define our welfare function, GDP and CPI inflation. In general, as we will see in the next section, a float regime, besides being optimal under normal conditions according to our welfare function, also outperforms a harder regime as a "shock absorber" for most countries, namely for Bulgaria, the Czech Republic, Estonia, Hungary and Slovenia (the clear exceptions are Lithuania and Poland, while for Latvia and Slovakia both regimes seem to perform similar cushioning functions, and for Romania shocks have "explosive" effects under both regimes, but less under a float), as most shocks not only have smaller GDP and CPI effects under a float, but they also converge faster to the mean (the most consistent exception to this stylised picture is the external monetary shock).

In the Table 6 below we can also observe what we may call "non-Keynesian"[10], or non-"MF" results, from monetary policies that are effective under a peg to fiscal ones that are effective under a float, to expansionary fiscal and monetary contractions. GDP expansions under fiscal contraction were estimated for the Bulgaria and Slovenia, and GDP expansions under tighter domestic monetary conditions were

[9]Both these two domestic shocks can be seen in terms of the effects of a nominal convergence process, i.e., as part of an attempt by the country to fulfill the Maastricht criteria.

[10]One could explain these "non-Keynesian" outcomes by a situation where a contractionary stance by the Central Bank or by the government is seen as an indication of a more sustainable policy by the markets (see Giavazzi and Paganno (1990)).

estimated for the Bulgaria, the Czech Republic, Lithuania, Poland, Romania, Slovakia and Slovenia (some of those outcomes are regime-dependent).

Table 6: Overview of Initial Effects of Shocks per Country and Regime:Temporary Shocks (non-structural model)

Shock		**Fiscal**		**Monetary**		**External**	
Country		**GDP**	**CPI**	**GDP**	**CPI**	**GDP**	**CPI**
Bulgaria	Peg	+	-	+	-	-	++
	Float	-	-	-	+	-	+
Czech Rep.	Peg	-	-	+	+	+	+
	Float	-	+	-	+	+	+
Estonia	Peg	--	+	-	-	+	-
	Float	-	+	-	-	+	++
Hungary	Peg	-	-	-	-	+	++
	Float	-	+	-	-	+	++
Latvia	Peg	--	-	-	-	+	+
	Float	--	-	-	-	+	+
Lithuania	Peg	-	--	+	+	-	-
	Float	-	-	+	+	+	+
Poland	Peg	0	0	+	-	+	+
	Float	+	-	++	-	+	+
Romania	Peg	--	--	++	++	--	--
	Float	--	--	++	++	--	--
Slovakia	Peg	--	-	+	+	-	-
	Float	--	-	+	+	-	-
Slovenia	Peg	+	+	++	-	+	--
	Float	--	+	+	+	-	++

5.1 Structural estimation of the effects of domestic and foreign shocks

As an additional exercise, a similar set of permanent shocks where modelled using the coefficients derived from the structural model. An overview of the results of those simulations is presented in Table 7 below.

Table 7: Overview of Initial Effects of Shocks per Country and Regime:Permanent Shocks (structural model).

Shock		Fiscal		Monetary		External	
Country		**GDP**	**CPI**	**GDP**	**CPI**	**GDP**	**CPI**
Bulgaria	Peg	0	0	0	0	-	+
	Float	--	-	-	+	+	-
Czech Rep.	Peg	-	0	--	++	-	-
	Float	-	0	-	+	-	-
Estonia	Peg	--	++	--	++	+	-
	Float	-	+	-	+	++	++
Hungary	Peg	0	0	-	+	+	-
	Float	-	+	0	0	0	0
Latvia	Peg	+	-	0	0	-	+
	Float	+	-	+	-	0	0
Lithuania	Peg	-	+	0	0	+	-
	Float	-	+	+	-	+	-
Poland	Peg	-	+	-	--	-	--
	Float	-	++	0	+	-	-
Romania	Peg	++	--	--	++	++	--
	Float	++	--	--	++	++	--
Slovakia	Peg	+	-	+	-	+	-
	Float	++	--	0	0	++	--
Slovenia	Peg	-	-	-	0	-	++
	Float	--	--	+	0	0	+

From the table above, we can observe that, in several instances, the shocks have an opposite sign to the outcomes of the temporary, non-structural estimations (in three-quarters of them, in the case of the GDP effects of the external shock). Again, classic "Keynesian" results are observed only in some of the estimations, from monetary policies that are non (or less) effective under a peg (Bulgaria, Latvia, Lithuania) to fiscal ones that are (more) effective under a peg (only in Estonia). For Romania, shocks still have "explosive" effects under any regime. An analysis of the amplitude and duration of the effects of the shocks shows furthermore that a float regime no longer acts as a more effective "shocks absorber" for those *permanent* shocks, which is a natural result, given that adjustment to permanent shocks should involve real adjustment, and all that a nominal framework like the exchange rate can be expected to realistically provide is a cushion towards the necessary real adjustment.

Part of those results –for both temporary and permanent shocks- can be explained by the less than perfect degree of capital mobility in the countries in our sample during the period in question. It is a common result in "MF" models that, under less than complete capital mobility, both types of policy can be partially effective under both regimes, and that is indeed the case for most of the ACs. The estimated coefficients that would in principle capture capital mobility in our models are, on average, rather low and several are even negative. A possible explanation for this could be the adverse reaction of capital inflows –especially the short-term ones- observed during the 1997 Asian Crisis and the 1998 Russian one. Contractionary fiscal and monetary policies with observed positive growth effects could be a sign of a "rational expectations" channel in operation in some of those countries.

On the other hand, the large standard errors, lack of significance of several coefficients and average low explanatory power of the BP schedule equation, do suggest care in interpreting those results. Those caveats are possibly caused by some short-run features of the "transition" economies present on the limited data series used and captured by the estimated coefficients (for instance, the characteristic reduction of inflation parallel to a resumption of growth after the end of the "transitional recession", and the reaction to shocks and even episodes of "contagion" during the sample period).

6. CONCLUSIONS

We aimed in this paper to describe the optimal exchange rate strategy for integration of the ACs into the common European currency zone using the MF framework. The results from a formal modeling exercise of alternative exchange rate regimes for pre-EMU accession for all Eastern European ACs seem to indicate that a float regime would bring about, as a rule, a greater degree of aggregate welfare and would also be a better “shock absorber” for temporary shocks. Harder regimes would be indicated for countries with weaker credibility and macroeconomic foundations. The welfare results seem to be robust to changes in the policy-maker’s preferences, as expressed in the weights given to the parameters of the welfare function.

The practical policy implications seems to be that different regimes should be allowed to remain until ERM-2 (European Exchange Rate Mechanism) entry, instead of trying to impose a single framework. Such framework might be welfare reducing for at least some of the countries in question would be a rather perverse policy outcome.

Bibliography

Bank of England (1999). "Economic Models at the Bank of England", Bank of England, United Kingdom.

Bergvall, A. (2000). "Exchange Rate Regimes and Macroeconomic Stability: The Case of Sweden, 1972-1996", mimeo, Uppsala University, Sweden.

de Vries, C. and Ivo Arnold (1998). "The EURO, Prudent Coherence?" 98-070/2, Tinbergen Institute, The Netherlands.

Dornbusch, R. (1976) "Expectations and Exchange Rate Dynamics", Journal of Political Economy, vol. 84, pp. 1161–76.

Fleming, M. (1962). "Domestic Financial Policies under Fixed and under Floating Exchange Rates", IMF Staff Papers, n° 9, pp. 369–80.

Giavazzi, F. and Marco Pagano (1990). "Can Severe Fiscal Contractions be Expansionary? Tales of Two Small European Countries", NBER Working Paper W3372.

Golinelli, R. and Ricardo Rovelli (2000). "Painless Disinflation? Monetary Policy Rules in Hungary, 1991-1999", mimeo, University of Bologna, Italy.

IMF (2000), World Economic Outlook 2000, Washington DC.

Leitemo, K. and Øistein Røisland (2000). "The Choice of Monetary Policy Regime for Small Open Economies", Working Paper n° 2000/05, Central Bank of Norway, Oslo.

Lucas, R. (1976). "Econometric Policy Evaluation: A Critique", in Brunner, K., and Meltzer, A., (eds.), *The Phillips Curve and Labor Markets*, Carnegie-Rochester Conference Series Public Policy, pp. 19–46.

Matousek, R. (2001). "Market Reactions to the CNB's Interest Rate Decision", Prague, mimeo.

Mundell, R. (1997). "Updating the Agenda for Monetary Reform", in Optimum Currency Areas (Blejer, M., Frenkel, J., Leiderman, L. and Razin, A., eds.), IMF.

—(1962). "The Appropriate Use of Monetary and Fiscal Policy for Internal and External Stability", IMF Staff Papers, n° 9, pp. 70-79.

Obstfeld, M. (2000). "International Macroeconomics: Beyond The Mundell-Fleming Model", IMF, 1st Annual Research Conference, Mundell-Fleming Lecture.

Orlowski, L. (2002). "Direct Inflation Targeting and Transparency of Monetary Policies in Central Europe's Transition Economies", mimeo, American Economic Association Meeting, Boston.

—(2001). "From Inflation Targeting to the Euro-Peg: A Model for Monetary Convergence for Transition Economies", mimeo.

Plasmans, J. (1999). "Towards a Strategic Multi-Country Model for Trade and Employment in The Baltics", mimeo, UFSIA, Antwerp, Belgium.

Roberts, I. and Rob Tyers (2001). "China's Exchange Rate Policy: The Case for Greater Flexibility", mimeo, Reserve Bank of Australia, Canberra.

Rogoff, K. (2001). "Dornbusch's Overshooting Model after Twenty-Five Years", IMF, 2nd Annual Research Conference, Mundell-Fleming Lecture.

Svensson, L. (1997a). "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets", European Economic Review, n° 41, pp. 1111-1146.

—(1997b). "Optimal Inflation Targets, Conservative Central Banks and Linear Inflation Contracts", American Economic Review, 87(1), pp 98-114.

van Aarle, B., Plasmans, J. and Bruno Merlevede (2001). "A Multi-Country Model for The Accession Countries", mimeo, Catholic University of Leuven.

van Foreest, P. and Casper de Vries (2001). "Endogenous Response to Monetary Integration", mimeo, Erasmus University Rotterdam.

Vinhas de Souza, L. (2002). "Integrated Monetary and Exchange Rate Frameworks: Are There Empirical Differences?", "Working Paper Series", 2002/2, Bank of Estonia, Tallinn.

Vinhas de Souza, L. and Jens Hölscher (2001a). "Exchange Rate Strategies of New EU Entrants", in Pentecost, E. and Van Poeck, A. (eds.), *European Monetary Integration: Past, Present and Future*, Edward Elgar, UK, 2001(a), pp 185-203.

—(2001b). "Exchange Rates Links and Strategies of New EU Entrants", in The Journal of European Integration, 23(1), pp. 1-28, United Kingdom, 2001(b).

Visser, H. and Willem Smits (1995). *A Guide to International Monetary Economics: Exchange Rate Systems and Exchange Rate Theories*, Edward Elgar, United Kingdom.

Wdowinski, P. and Bas van Aarle (1998). "EMU and its Effects: The Case of Poland. A Study for Fixed and Flexible Exchange Rates", mimeo.

Wollmerhäuser, T. and Peter Bofinger (2001). "Is There a Third Way to EMU for the EU Accession Countries?", mimeo, Würzburg University, Germany.