RESEARCH

Supplementary appendix to: Shifts in euro area Beveridge curves and their determinants

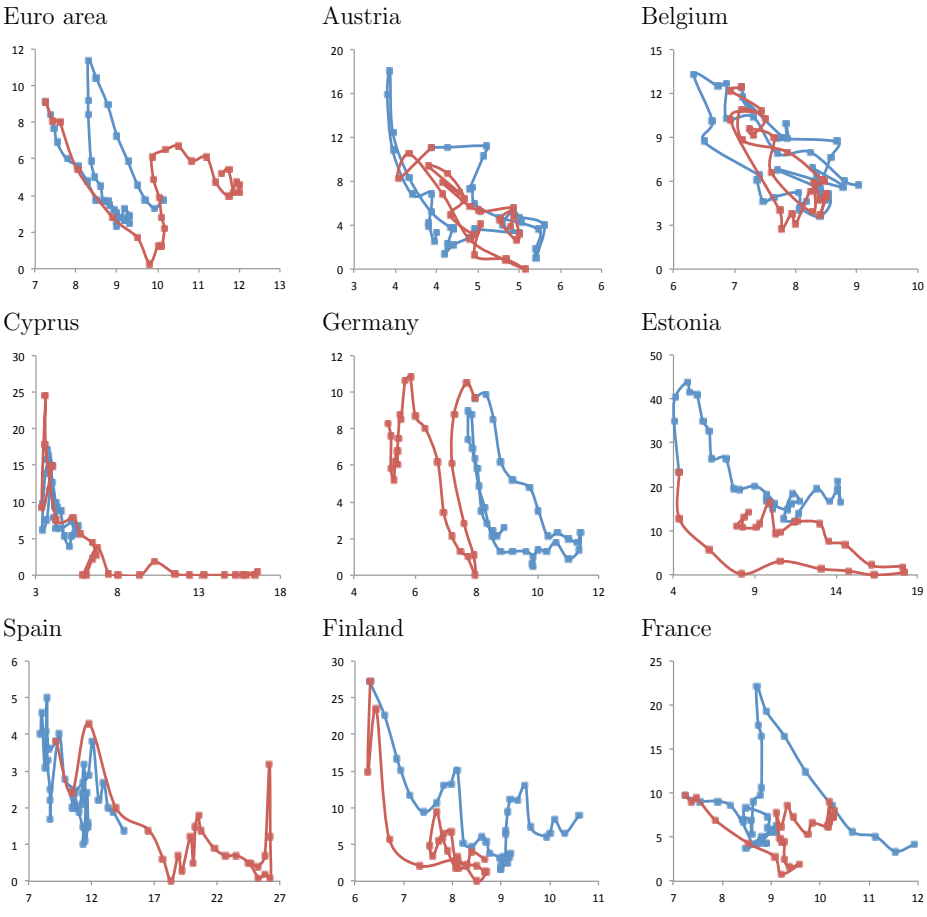

Figure 1 Beveridge curves for euro area countries over EMU part a Notes: X-axis: unemployment rate, y-axix: Labour shortages. Notes: Blue line is pre-crisis, red line is crisis. Sources: Eurostat, European Commission.

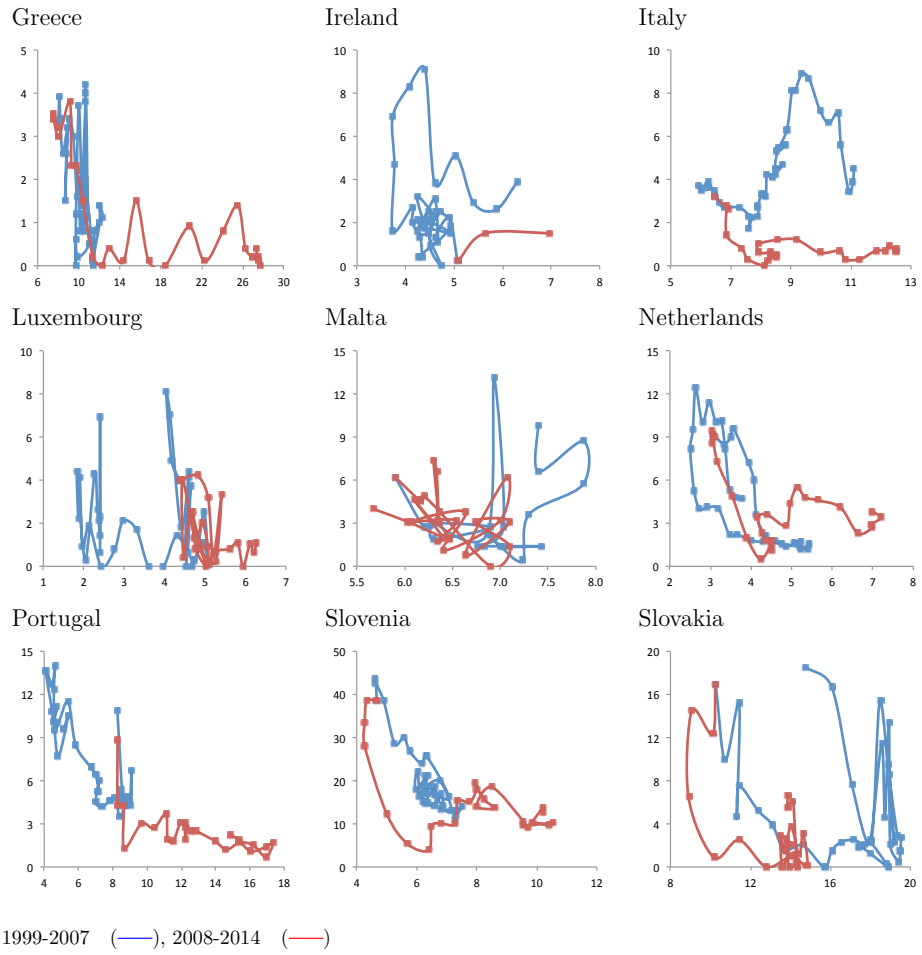

Figure 2 Beveridge curves for euro area countries over EMU part b Notes: X-axis: unemployment rate, y-axix: Labour shortages. Notes: Blue line is pre-crisis, red line is crisis. Sources: Eurostat, European Commission.

Table 1 Correlation vacancies and labour shortages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VR_t	EA	AT	BE	BE bb	BE ab	CY	DE	DE bb	DE ab	EE
LS_t	0.69	0.67	0.09	0.11	0.61	0.83	0.49	0.69	0.82	0.89
LS_{t-1}	0.58	0.44	0.29	0.22	0.75	0.73	0.43	0.57	0.77	0.93
LS_{t-2}	0.42	0.07	0.30	0.23	0.19	0.71	0.34	0.42	0.69	0.92
LS_{t-3}	0.20	-0.26	0.37	0.24	0.06	0.65	0.21	0.24	0.56	0.87
LS_{t-4}	-0.01	-0.52	0.42	0.25	0.18	0.55	0.09	0.09	0.40	0.76
VR_t	ES	ES bb	ES ab	FI	FR	FR bb	FR ab	GR	IT	LU
LS_t	-0.20	0.45	0.40	0.37	0.75	0.83	0.11	0.52	0.87	0.33
LS_{t-1}	-0.28	0.38	0.22	0.30	0.58	0.68	-0.06	0.45	0.82	0.30
LS_{t-2}	-0.40	0.25	-0.18	0.20	0.36	0.45	-0.47	0.46	0.69	0.27
LS_{t-3}	-0.52	0.03	-0.43	0.11	0.09	0.19	-0.57	0.44	0.49	0.20
LS_{t-4}	-0.50	0.01	-0.24	0.06	-0.18	-0.04	-0.81	0.40	0.33	0.04
VR_t	MT	MT bb	MT ab	NL	PT	PT bb	PT ab	SI	SK	
LS_t	-0.08	-0.81	-0.48	0.68	0.69	0.51	-0.12	0.70	0.80	
LS_{t-1}	-0.01	-0.27	-0.22	0.56	0.65	0.45	0.03	0.70	0.78	
LS_{t-2}	-0.20	0.66	-0.54	0.44	0.57	0.31	-0.03	0.56	0.84	
LS_{t-3}	-0.21	0.89	0.23	0.32	0.61	0.35	0.13	0.44	0.66	
LS_{t-4}	-0.52	-0.56	-0.07	0.19	0.53	0.18	0.22	0.29	0.56	

Eurostat reports breaks in the vacancy series for some countries. For those countries we test both the entire sample as well as before and after the break. bb = before break, ab=after break. Breaks occur in Belgium in 2012, Germany in 2010, Spain in 2010, France in 2011, Malta in 2010 and Portugal in 2010.

Table 2 Beveridge curve estimation part a

Dependent var.: U_t	*(1)* *EA*	*(2)* *AT*	*(3)* *BE*	*(4)* *CY*	*(5)* *DE*	*(6)* *EE*
U_{t-1}	1.53***	0.97***	0.90***	1.13***	1.99***	1.11***
	(0.11)	(0.11)	(0.03)	(0.15)	(0.10)	(0.15)
U_{t-2}	-0.57***	0.19		0.05	-1.38***	-0.14
	(0.20)	(0.16)		(0.23)	(0.18)	(0.22)
U_{t-3}	0.20	-0.22		-0.29**	0.36***	-0.07
	(0.20)	(0.16)		(0.14)	(0.09)	(0.22)
U_{t-4}	-0.42**	-0.40**				-0.04
	(0.19)	(0.16)				(0.14)
U_{t-5}	0.20**	0.40***				
	(0.09)	(0.11)				
LS_t	-0.02***	-0.02**	-0.07***	0.00	-0.03*	-0.03*
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
LS_{t-1}				0.01	-0.01	
				(0.02)	(0.02)	
LS_{t-2}				-0.03	0.02	
				(0.02)	(0.02)	
LS_{t-3}				0.02	-0.00	
				(0.02)	(0.01)	
LS_{t-4}				-0.02		
				(0.02)		
$D_t^{cri} LS_t$	0.02*	-0.01	0.04**	0.10	0.02	-0.01
	(0.01)	(0.02)	(0.02)	(0.07)	(0.01)	(0.06)
$D_{t-1}^{cri} LS_{t-1}$				-0.04	-0.03	
				(0.08)	(0.02)	
$D_{t-2}^{cri} LS_{t-2}$				-0.12	0.05***	
				(0.08)	(0.02)	
$D_{t-3}^{cri} LS_{t-3}$				0.05	-0.03**	
				(0.07)	(0.01)	
$D_{t-4}^{cri} LS_{t-4}$				-0.08		
				(0.07)		
D_t^{emu}	-0.07***	0.02	-0.01	-0.11	0.02	-0.77
	(0.03)	(0.07)	(0.06)	(0.29)	(0.03)	(0.70)
D_t^{cri}	0.09**	0.07	0.00	0.31	-0.10**	0.52
	(0.04)	(0.05)	(0.06)	(0.36)	(0.04)	(0.81)
D_t^{rec}	0.12**	0.08	0.20**	0.47**	0.04	0.29
	(0.05)	(0.10)	(0.08)	(0.23)	(0.03)	(0.40)
$Cons.$	0.51***	0.30	0.86***	0.52***	0.22**	1.24***
	(0.10)	(0.23)	(0.22)	(0.18)	(0.09)	(0.44)
$Obs.$	104	80	104	54	97	60
$Adj - R^2$	0.99	0.90	0.95	0.99	1.00	0.96
$RMSE$	0.10	0.19	0.22	0.37	0.10	0.69

Table 3 Beveridge curve estimation part b

Dependent var.: U_t	*(7)* *ES*	*(8)* *FI*	*(9)* *FR*	*(10)* *GR*	*(11)* *IE*	*(12)* *IT*
U_{t-1}	1.57***	2.12***	1.25***	1.34***	1.29***	1.03***
	(0.07)	(0.10)	(0.10)	(0.11)	(0.13)	(0.10)
U_{t-2}	-0.63***	-1.64***	-0.36***	-0.07	0.05	-0.06
	(0.07)	(0.23)	(0.09)	(0.20)	(0.21)	(0.10)
U_{t-3}		0.74***		-0.31***	-0.30	
		(0.28)		(0.11)	(0.22)	
U_{t-4}		-0.40*			-0.04	
		(0.23)			(0.13)	
U_{t-5}		0.15				
		(0.09)				
LS_t	-0.05	-0.01**	-0.02***	-0.01	-0.03	-0.02*
	(0.05)	(0.00)	(0.01)	(0.05)	(0.02)	(0.01)
LS_{t-1}	-0.07			-0.08	-0.02	
	(0.05)			(0.05)	(0.02)	
LS_{t-2}	-0.00				0.02	
	(0.05)				(0.02)	
LS_{t-3}	-0.03					
	(0.05)					
$D_t^{cri} LS_t$	0.06	0.01	0.02	0.21*	-35.19	-0.07
	(0.07)	(0.01)	(0.02)	(0.10)	(25.51)	(0.08)
$D_{t-1}^{cri} LS_{t-1}$	0.11			-0.27**	-6.39	
	(0.08)			(0.10)	(4.55)	
$D_{t-2}^{cri} LS_{t-2}$	0.10				36.86	
	(0.08)				(26.85)	
$D_{t-3}^{cri} LS_{t-3}$	-0.13*					
	(0.07)					
D_t^{emu}	-0.28***	-0.24***	-0.15**	0.15	0.01	-0.19***
	(0.10)	(0.08)	(0.07)	(0.16)	(0.19)	(0.07)
D_t^{cri}	0.53***	-0.05	0.14**	0.27	35.32	-0.02
	(0.16)	(0.04)	(0.05)	(0.21)	(25.61)	(0.21)
D_t^{rec}	0.33***	0.11**	0.10	0.30*	-72.18	0.18***
	(0.12)	(0.05)	(0.07)	(0.17)	(52.29)	(0.06)
$Cons.$	1.05***	0.62***	1.09***	0.27	0.03	0.32*
	(0.25)	(0.19)	(0.30)	(0.20)	(0.29)	(0.17)
$Obs.$	104	96	96	68	74	104
$Adj - R^2$	1.00	1.00	0.97	1.00	1.00	0.98
$RMSE$	0.27	0.14	0.17	0.35	0.26	0.25

For the entire sample starting in 1990 we find that the null-hypothesis of poolability is rejected for all euro area countries, all countries with a significantly downward sloping Beveridge Curve in the long run and all original euro area countries with a downward sloping Beveridge Curve. Restricting the sample period to the EMU period improves the results for countries with a downward sloping Beveridge Curve, particularly if we restrict this sample to the original euro area countries. We therefore restrict ourselves to Austria, Belgium, Germany, Spain, Finland, France, Greece, the Netherlands and Portugal. We find however that our results are robust to including Estonia and Slovenia.

Table 4 Beveridge curve estimation part c

Dependent var.: U_t	*(13) LU*	*(14) MT*	*(15) NL*	*(16) PT*	*(17) SI*	*(18) SK*
U_{t-1}	1.70***	0.80***	1.69***	1.32***	0.88***	1.52***
	(0.10)	(0.10)	(0.07)	(0.09)	(0.12)	(0.11)
U_{t-2}	-0.73***		-0.73***	-0.40***	-0.22	-0.54***
	(0.20)		(0.07)	(0.08)	(0.16)	(0.12)
U_{t-3}	0.14				0.40**	
	(0.21)				(0.15)	
U_{t-4}	-0.38*				-0.31*	
	(0.20)				(0.16)	
U_{t-5}	0.26**				0.12	
	(0.10)				(0.11)	
LS_t	-0.00	0.01	-0.01*	-0.04**	-0.03**	-0.04**
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
LS_{t-1}						0.01
						(0.02)
LS_{t-2}						0.03
						(0.02)
$D_t^{cri} LS_t$	0.02	-0.03*	0.01	-0.07**	-0.01	
	(0.02)	(0.02)	(0.02)	(0.03)	(0.01)	
D_t^{emu}	0.04	-0.14	-0.04	0.04	0.22	0.13
	(0.03)	(0.22)	(0.04)	(0.08)	(0.27)	(0.19)
D_t^{cri}	0.02	-0.15	0.05	-0.14	-0.13	
	(0.04)	(0.21)	(0.05)	(0.15)	(0.29)	
D_t^{rec}	-0.04	0.02	0.09	0.34***	0.28**	
	(0.05)	(0.14)	(0.06)	(0.10)	(0.12)	
$Cons.$	0.04	1.43**	0.22***	0.50***	0.79***	0.31
	(0.04)	(0.71)	(0.08)	(0.15)	(0.21)	(0.43)
$Obs.$	104	63	104	104	75	55
$Adj - R^2$	0.99	0.78	0.99	0.99	0.96	0.98
$RMSE$	0.12	0.31	0.13	0.31	0.30	0.42

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Sample period: 1990Q1-2014Q1

Table 5 Beveridge curve estimation long run coefficients

Dependent var.: U_t	*(1) EA*	*(2) AT*	*(3) BE*	*(4) CY*	*(5) DE*	*(6) EE*	*(7) ES*	*(8) FI*	*(9) FR*
$\overline{LS}$	-0.339	-0.147	-0.566	0.023	-0.576	-0.200	-2.158	-0.238	-0.142
	0.006	0.073	0.000	0.951	0.034	0.027	0.002	0.000	0.010
$\overline{D^{cri} LS}$	0.702	-0.029	0.273	-1.137	0.391	0.027	2.159	0.193	0.173
	0.007	0.832	0.103	0.191	0.305	0.951	0.243	0.058	0.177
$\overline{D^{cri}}$	2.837	0.475	0.208	7.514	-3.324	4.709	11.359	-0.267	1.391
	0.000	0.268	0.667	0.123	0.005	0.425	0.000	0.698	0.001
$\overline{D^{emu}}$	-1.363	0.174	0.007	-1.548	0.740	-5.795	-4.535	-5.335	-1.534
	0.012	0.734	0.989	0.658	0.434	0.286	0.001	0.000	0.001
$\overline{Cons.}$	9.854	4.212	8.306	4.404	7.980	9.244	16.662	13.800	10.393
	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000

Dependent var.: U_t	*(10) GR*	*(11) IE*	*(12) IT*	*(13) LU*	*(14) MT*	*(15) NL*	*(16) PT*	*(17) SI*	*(18) SK*
$\overline{LS}$	-2.093	-2.406	-3.020	-0.135	0.052	-0.235	-0.510	-0.245	-0.316
	0.126	0.738	0.577	0.854	0.170	0.027	0.011	0.023	0.608
$\overline{D^{cri} LS}$	-1.165	-43.248	0.276	0.741	-0.063	0.429	-0.639	-0.036	
	0.634	0.783	0.972	0.723	0.446	0.146	0.107	0.773	
$\overline{D^{cri}}$	10.284	-4.967	24.786	0.473	0.032	1.860	1.098	0.517	
	0.001	0.936	0.604	0.869	0.973	0.011	0.532	0.831	
$\overline{D^{emu}}$	2.806	1.552	-16.720	3.235	-0.789	-1.079	0.935	1.737	4.286
	0.447	0.961	0.505	0.375	0.322	0.085	0.353	0.463	0.654
$\overline{Cons.}$	8.561	3.931	16.269	3.023	7.199	5.166	6.542	6.404	10.908
	0.004	0.894	0.136	0.083	0.000	0.000	0.000	0.000	0.054

P-values in parentheses. Long run coefficient calculated as: $\frac{\sum_j X_{t-j}}{1-\sum_i U_{t-i}}$

Table 6 Beveridge curve estimation with yearly dummies long run coefficients

Dependent var.: U_t	*(1) EA*	*(2) AT*	*(3) BE*	*(4) CY*	*(5) DE*	*(6) EE*	*(7) ES*	*(8) FI*	*(9) FR*
$\overline{LS}$	-0.335	-0.149	-0.584	-0.146	-0.422	-0.215	-2.571	-0.234	-0.151
	0.003	0.031	0.000	0.031	0.034	0.000	0.000	0.001	0.001
$\overline{D^{cri}LS}$	1.028	-0.199	0.492	0.114	1.003	-0.041	2.885	0.164	0.539
	0.037	0.368	0.067	0.685	0.042	0.844	0.059	0.311	0.020
$\overline{Y_{2008}}$	0.257	0.592	0.666	-0.047	-1.942	-3.089	9.479	0.180	-1.061
	0.846	0.506	0.556	0.937	0.373	0.136	0.000	0.932	0.121
$\overline{Y_{2009}}$	3.986	-0.600	0.796	1.842	-4.237	-0.328	6.759	-0.331	3.873
	0.041	0.583	0.517	0.016	0.101	0.921	0.004	0.844	0.004
$\overline{Y_{2010}}$	3.252	-0.885	-0.327	0.761	0.325	-1.590	8.413	-1.155	1.463
	0.026	0.300	0.735	0.598	0.863	0.616	0.000	0.495	0.092
$\overline{Y_{2011}}$	2.465	0.547	-1.889	3.601	-4.209	2.792	12.520	-1.078	0.655
	0.045	0.534	0.168	0.041	0.093	0.203	0.000	0.437	0.285
$\overline{Y_{2012}}$	3.260	0.597	0.873	7.858	-7.581	-0.631	15.025	-0.344	2.165
	0.007	0.398	0.402	0.001	0.009	0.710	0.000	0.804	0.001
$\overline{Y_{2013}}$	2.678	1.595	0.991	11.668	-6.013	-1.962	12.333	0.265	0.407
	0.014	0.072	0.327	0.000	0.002	0.212	0.000	0.869	0.549
$\overline{Y_{2014}}$	1.978	0.823	0.341	10.992	-5.044	-4.244	10.692	0.253	1.300
	0.068	0.375	0.726	0.000	0.017	0.008	0.000	0.861	0.053
$\overline{D^{emu}}$	-1.276	0.158	-0.014		1.015		-4.246	-5.315	-1.429
	0.008	0.701	0.977		0.124		0.000	0.000	0.000
$\overline{Cons.}$	9.817	4.254	8.296	4.906	7.907	10.614	16.588	13.782	10.375
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$Obs.$	100	74	100	50	93	56	100	92	92
$Adj-R^2$	0.995	0.892	0.957	0.997	0.997	0.971	0.998	0.998	0.976

Dependent var.: U_t	*(10) GR*	*(11) IT*	*(12) LU*	*(13) MT*	*(14) NL*	*(15) PT*	*(16) SI*	*(17) SK*
$\overline{LS}$	-4.048	-4.851	-0.025	0.044	-0.254	-0.562	-0.101	-0.211
	0.610	0.747	0.942	0.115	0.000	0.001	0.005	0.844
$\overline{D^{cri}LS}$	6.036	33.053	0.337	0.039	0.361	0.064	-0.028	
	0.694	0.744	0.728	0.619	0.123	0.895	0.556	
$\overline{Y_{2008}}$	2.085	58.957	2.329	-0.762	-0.112	1.436	-0.419	-1.730
	0.846	0.746	0.361	0.161	0.898	0.415	0.561	0.905
$\overline{Y_{2009}}$	18.019	149.564	-1.178	0.716	1.285	5.393	-0.985	-59.352
	0.645	0.741	0.682	0.441	0.188	0.059	0.404	0.423
$\overline{Y_{2010}}$	38.057	99.914	2.875	0.384	-0.261	3.837	1.013	-6.124
	0.611	0.742	0.275	0.614	0.785	0.152	0.383	0.579
$\overline{Y_{2011}}$	58.850	113.098	-2.308	-0.273	2.152	7.347	2.140	-15.492
	0.584	0.740	0.500	0.721	0.037	0.009	0.032	0.432
$\overline{Y_{2012}}$	57.167	178.042	4.169	-0.131	1.456	10.225	2.262	-15.234
	0.535	0.736	0.149	0.869	0.092	0.002	0.026	0.421
$\overline{Y_{2013}}$	29.934	134.449	2.946	-0.272	5.140	1.882	2.988	-11.091
	0.336	0.733	0.245	0.690	0.000	0.629	0.012	0.457
$\overline{Y_{2014}}$	2.755	111.942	3.333	-1.414	1.466	1.607	2.495	4.384
	0.923	0.731	0.170	0.010	0.136	0.631	0.015	0.836
$\overline{D^{emu}}$	3.248	-26.916	1.700		-1.088	0.872	-0.114	
	0.767	0.720	0.151		0.006	0.284	0.880	
$\overline{Cons.}$	6.951	19.790	2.678	7.206	5.176	6.627	6.593	26.043
	0.494	0.499	0.001	0.000	0.000	0.000	0.000	0.060
$Obs.$	64	100	100	59	100	100	71	55
$Adj-R^2$	0.998	0.985	0.994	0.770	0.993	0.994	0.970	0.987

P-values in parentheses. Long run coefficient calculated as: $\frac{\sum_j X_{t-j}}{1-\sum_i U_{t-i}}$

Table 7 Appendix Poolability test

Start sample	All EA	Significant BC	Sign. BC excl. SI & EE
1990	F(160,792) = 2.55	F(100,526) = 2.47	F(80,474) = 2.47
	0.00	0.00	0.00
1999	F(160,435) = 1.73	F(100,277) = 1.28	F(80,232) = 1.28
	0.00	0.06	0.29