UNIVERSITY OF DUISBURG ESSEN

The stability of German export demand equations
–
have German exports suffered from the strength of the euro?

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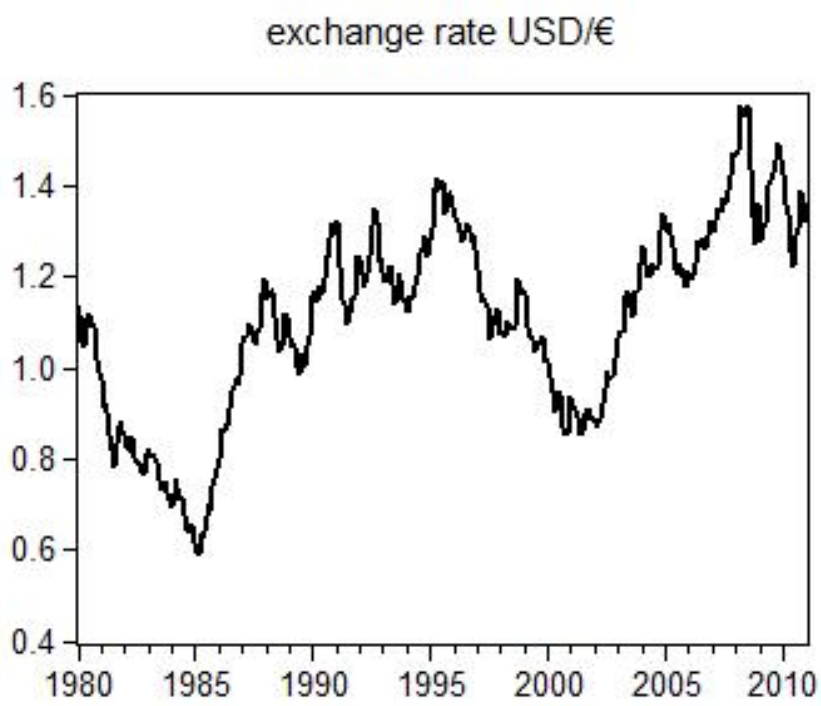
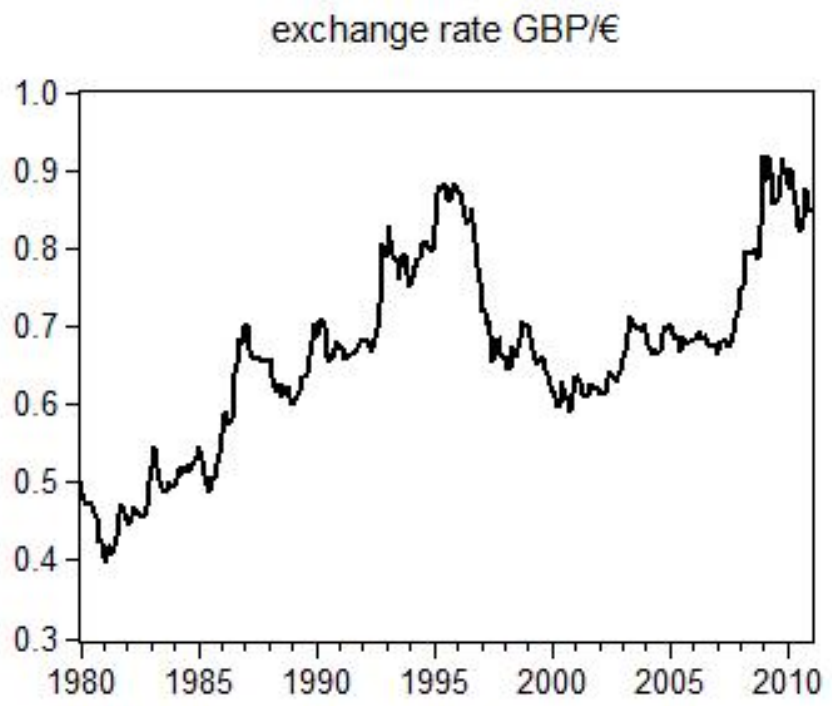
1. Motivation





- Nominal appreciation against USD of 85% from 2000-2008
- Nominal appreciation against GB Pound of 56% from 2000-2009

2. Literature review

- At least since Orcutt (1950), there has been a debate about price and income elasticities in international trade
- Goldstein and Khan (1985) have claimed that foreign trade flows are within the best-studied topics in international economics
- No up-to-date study that investigates the trade elasticities of bilateral export demand relationships for Germany.
- Carporale and Chui (1999): income elasticity of German exports is 2.06 and price elasticity -0.64
- Bahmani-Oskooee and Kara (2003): income elasticity is 1.01, price and exchange rate elasticity both had the correct negative sign but are insignificant

3. Empirical methodology

- Data
  - Bilateral export data from Germany to US and UK
  - Nominal bilateral exchange rates USD/€ and GBP/€
  - Relative prices (German export price index/foreign export price index)
  - Index of industrial production for US and UK
  - January 1980 to December 2010

- Export demand equation: $x_t = \pi_0 + \pi_1 e_t + \pi_2 y_t + \pi_3 p_t + u_t$
  - Stability is checked by Bai/Perron structural break tests
  - ARDL bounds testing approach for cointegration (Pesaran et al. (2001))

3. Empirical methodology

- ARDL bounds testing
  - Reformulation of export demand function as ECM

$$\Delta x_t = \theta_0 + \theta_1 x_{t-1} + \theta_2 e_{t-1} + \theta_3 y_{t-1} + \theta_4 p_{t-1} + \sum_{i=1}^{m} \beta_i \Delta x_{t-i} + \sum_{j=0}^{n} \gamma_j \Delta e_{t-j} + \sum_{k=0}^{p} \delta_k \Delta y_{t-k} + \sum_{l=0}^{q} \varphi_l \Delta p_{t-l} + \varepsilon_t$$

  - Bounds test for cointegration: $H_0 : \theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$
  - If cointegration is supported, normalization on exports to obtain long-run elasticities

4. Results

Selected Breakpoints

	1	2	3	4	5	6
USA	1991:04	1987:07	1987:07	1986:04	1986:03	1986:03
		2000:12	2000:12	1990:10	1990:10	1987:12
			2009:07	2000:12	2000:12	1990:08
				2009:07	2009:07	2000:12
					2010:02	2009:07
						2010:02
UK	2001:03	1995:04	1985:06	1985:06	1984:07	1984:07
		2003:01	1995:04	1995:02	1988:04	1988:04
			2003:01	2000:09	1995:04	1995:04
				2003:08	2000:09	2000:09
					2003:08	2003:08
						2006:11

Selected break points according the procedure of Bai and Perron (1998, 2003) separated by the maximum number of break points allowed.

- US: two sub-samples: 1990:11-2000:12 and 2001:01-2009:07
- UK: three sub-samples 1988:05-1995:04, 1995:05-2000:09 and 2003:09-2010:12

4. Results

Export demand elasticities USA

USA	*constant*	*e*	*y*	*p*	cointegration	adj. R^2	LM	ARCH
1990:11 – 2009:07	-4.54	-0.33	2.48	0.67	9.55	0.53	0.03	0.39
	(-5.17)	(-2.03)	(5.73)	(1.24)	(5.61)			
1990:11 - 2000:12	-2.76	-0.53	2.12	0.29	9.57	0.66	0.05	0.45
	(-5.01)	(-3.83)	(5.77)	(0.67)	(5.61)			
2001:01 - 2009:07	-2.98	-0.48	2.18	-0.05	10.39	0.52	0.62	0.65
	(-2.46)	(-3.95)	(5.30)	(-0.15)	(5.61)			

Values in parentheses are t-values for coefficients and 1% critical value for test of no cointegration taken from Pesaran et al. (2001), respectively. LM refers to Breusch-Godfrey test for serial correlation and gives the p-value of the null hypothesis of no serial correlation up to lag 12. ARCH shows the p-value of a test for ARCH effects up to lag 12.

4. Results

Export demand elasticities UK

UK	*constant*	*e*	*y*	*p*	cointegration	adj. R^2	LM	ARCH
1988:05 – 2010:12	-20.25	-11.88	4.21	-17.08	1.18	0.54	0.09	0.59
	(-0.81)	(-1.68)	(0.67)	(-1.73)	(5.61)			
1988:05 - 1995:04	-5.63	-0.28	2.80	0.91	8.96	0.64	0.08	0.99
	(-4.19)	(-1.55)	(5.44)	(2.87)	(5.61)			
1995:05 - 2000:09	4.50	-0.49	0.73	1.29	8.47	0.69	0.04	0.21
	(2.73)	(-3.22)	(2.12)	(4.12)	(5.61)			
2003:09 - 2010:12	11.24	-1.50	-0.77	-0.57	5.14	0.63	0.89	0.80
	(3.60)	(-2.68)	(-1.07)	(-0.89)	(5.61)			

Values in parentheses are t-values for coefficients and 1% critical value for test of no cointegration taken from Pesaran et al. (2001), respectively. LM refers to Breusch-Godfrey test for serial correlation and gives the p-value of the null hypothesis of no serial correlation up to lag 12. ARCH shows the p-value of a test for ARCH effects up to lag 12.

4. Results

Error correction model USA

	1990:11 - 2000:12		2001:01 - 2009:07	
ect	-0.95	(-6.44)	-0.75	(-5.93)
Δx_{t-1}	-0.29	(-2.48)	-0.19	(-2.07)
Δx_{t-2}	-0.33	(-4.31)		
Δe_t	-0.22	(-1.00)	-0.61	(-2.47)
Δe_{t-1}	-0.08	(-0.35)	-0.03	(-0.14)
Δe_{t-2}			-0.57	(-2.32)
Δy_t	0.78	(0.93)	2.32	(3.28)
Δy_{t-1}	-1.26	(-1.35)	-1.73	(-2.39)
Δp_t	-0.92	(-0.55)	-1.94	(-1.61)
Δp_{t-1}	-0.68	(-0.41)	0.50	(0.40)
Δp_{t-2}			-4.30	(-3.72)

Values in parentheses are t-values.

4. Results

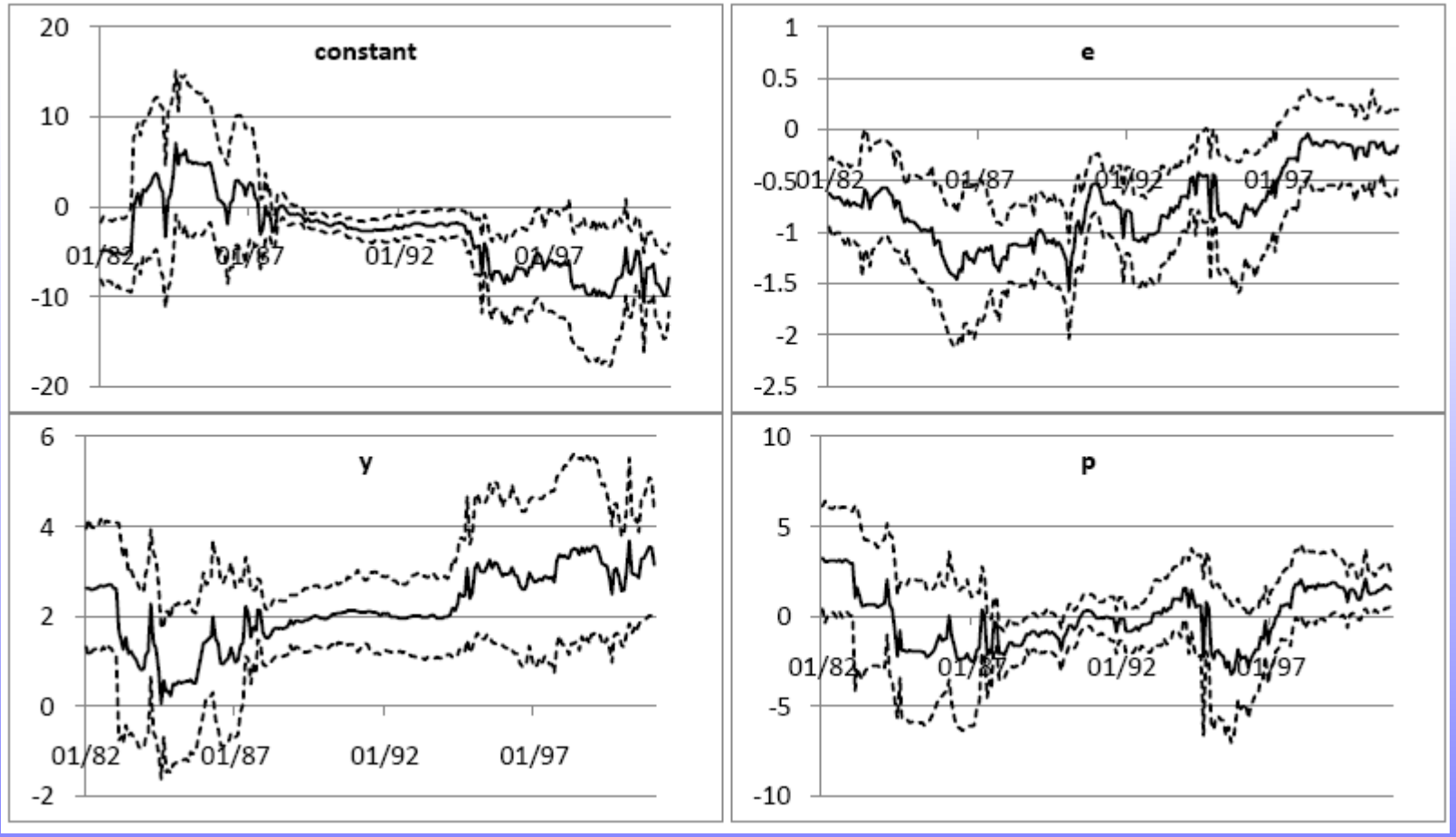
Error correction model UK

	1988:05 - 1995:04		1995:05 - 2000:09		2003:09 - 2010:12	
ect	-0.85	(-5.88)	-1.06	(-5.60)	-0.29	(-4.44)
Δx_{t-1}	-0.09	(-0.88)	0.06	(0.42)	-0.35	(-3.75)
Δe_t	0.39	(1.61)	-0.34	(-1.03)	-0.51	(-2.45)
Δe_{t-1}	0.03	(0.11)	-0.08	(-0.23)	-0.05	(-0.23)
Δy_t	1.71	(8.30)	0.94	(5.53)	0.78	(6.23)
Δy_{t-1}	-0.08	(-0.28)	0.05	(0.26)	0.35	(2.23)
Δp_t	1.15	(2.54)	1.28	(1.51)	-0.73	(-1.57)
Δp_{t-1}	-0.17	(-0.37)	0.35	(0.42)	-0.18	(-0.39)
Δp_{t-2}					-1.16	(-2.91)

Values in parentheses are t-values.

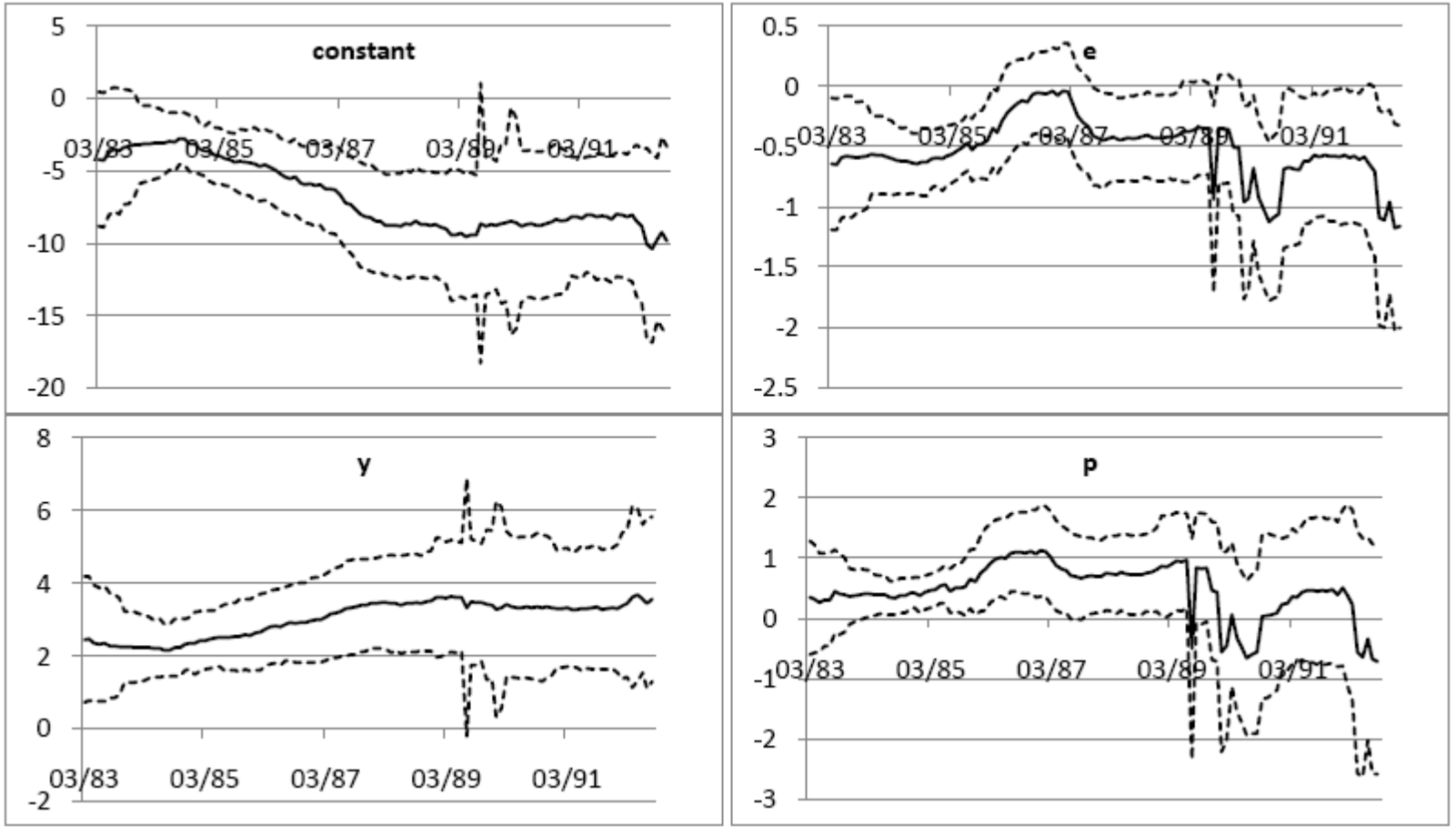
4. Results

Rolling coefficients (10 year window), USA



4. Results

Rolling coefficients (10 year window), UK



5. Conclusion

- The export demand equation for the US is more stable than the one for the UK
- The coefficient estimates do not support the view that the strong appreciation of the euro both against the USD and GBP have harmed German exports to a significant degree
- German exports are mainly determined by foreign demand
- Changes are found especially in the short-run dynamics

- Further research could address this issue to even more disaggregated trade flows