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Export performance and capacity pressures in Central and Eastern Europe

Karsten Staehr[*]

Abstract

This paper investigates whether various measures of capacity pressure or available production capacity may help predict the dynamics of exports from the EU countries in Central and Eastern Europe. The analysis uses annual panel data for the 11 countries from 2001 to 2019. Reduced form estimations reveal that cost competitiveness measures have little or no predictive power. The measures of capacity pressure comprise capacity utilisation in industry, the unemployment rate and the output gap, and the measures are all robust predictors of future export dynamics. The results are robust to various changes in the time and country sample, control variables and specification, and also hold in panel vector autoregressive models.

JEL Codes: F14, F17, E32

Keywords: export, competitiveness, capacity utilisation, output gap, unemployment, Central and Eastern Europe

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Non-technical summary

Exports are a key component of GDP and so the dynamics of exports are of key importance for macroeconomic analysis. Empirical analyses of export performance often consist of estimating export equations where exports or changes in exports are regressed on the lagged dependent variable, measures of foreign demand, and various proxies of price or cost competitiveness. Many studies find however that such measures of price or cost competitiveness as the real effective exchange rate or relative unit labour costs have relatively small effects that are imprecisely estimated and sometimes have an unexpected sign.

Another line of inquiry posits that quantitative measures of capacity pressure are of importance for the performance of exports even when variables reflecting price or cost competitiveness are controlled for. This concept is sometimes labelled the *capacity pressure hypothesis*. The argument is that if ample production resources are available, firms will have an incentive to expand their exports, whereas if production resources are strained, firms will not have the same incentive. The hypothesis dates back to the period after World War II and is often rationalised by the assumption that prices or wages exhibit a degree of stickiness.

The paper examines how applicable the capacity pressure hypothesis is to the 11 EU countries from Central and Eastern Europe. The baseline estimations regress changes in exports on the lagged dependent variable, changes in foreign demand, lagged changes in cost competitiveness, and the lagged value of any one of three proxies of capacity pressure, which are capacity utilisation in industry, the unemployment rate and the output gap.

The analyses show that each of the three measures of capacity pressure is an economically and statistically significant predictor of future changes in exports. The results are robust to various changes in the sample period, country composition and the choice of control variables. When only exports of goods are considered, the capacity utilisation in industry and the unemployment rate exhibit even stronger predictive power than they do for total exports. The importance of the capacity pressure variables for the dynamics of exports is also confirmed in panel VAR estimations.

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1. Introduction

The performance of exports is of key importance for macroeconomic developments including the trade balance, output and employment. This clearly makes it pertinent to study the dynamics of exports and assess which factors drive exports. Empirical studies have in many cases found that various measures of price or cost competitiveness have effects that are small, counter-intuitive or imprecisely estimated. This has led to renewed focus on the importance of non-price or quantitative competitiveness measures for exports.

This paper seeks to assess how important measures of capacity pressure such as the availability of labour and production resources are for the export performance of the 11 EU countries from Central and Eastern Europe (CEE). The analysis uses annual panel data for the 11 countries from 1995 to 2019 and is built up in two consecutive steps. Reduced form export models are estimated using proxies of capacity pressure along with various control variables. The robustness of the results is examined with a large number of robustness checks, including a panel vector autoregressive (PVAR) model that allows for interaction between exports and the different measures of competitiveness.

Empirical analyses of export performance often estimate export equations where exports or changes in exports are regressed on the lagged dependent variable, measures of foreign demand, various measures of price or cost competitiveness, and possible control variables (Bayar 2018). The models can be specified in levels or changes and combinations of those such as error correction or autoregressive distributed lag (ARDL) models. The analyses typically use quarterly or annual data, and can be for an individual country or for a panel of countries.

Many studies find that the effect on exports of price or cost competitiveness measures such as the real effective exchange rate or relative unit labour costs are relatively small and often imprecisely estimated, sometimes with what seems to be the "wrong sign" (Christodoulopoulou & Tkacevs 2016, Bobeica et al. 2016a, Decramer et al. 2016, Fischer et al. 2018).[1] Benkovskis et al. (2019) use Bayesian model averaging to examine a large and diverse set of traditional and non-traditional competitiveness factors to ascertain which ones that drive the export market shares of European countries. Perhaps surprisingly, price competitiveness does not seem to matter for exports, and this holds for both the Western European and the Eastern European subsets of countries.

There are a number of possible explanations for the why effects of price competitiveness on exports are subdued or imprecisely estimated.[2] Arguably the most straightforward is the use of long-term contracts that fix volumes for extended periods of time so that domestic exporters and foreign importers cannot readily change volumes when relative prices change. Such quantity contracting is often considered to be behind the iconic *J*-curve effect for the balance of trade. A related explanation is the presence of value chains that lock the production planning of firms into forward and backward linkages so that relative prices are of little importance, at least in the short term (Ahmed et al. 2015, de Soyres 2018, Bayar 2018).

[1] Staehr & Vermeulen (2019) examine the effects of various measures of competitiveness on the current account balance in the euro area countries and find that the effects are modest and imprecisely estimated, and differ markedly across the countries.

[2] Bayar (2018) provides a survey of studies estimating export equations and discusses some of the complications addressed in the literature.

Another straightforward explanation for why price competitiveness has a limited effect is that the imported contents in the exports may be substantial. Higher export prices may coincide with higher prices for imported inputs, which would reduce the relative change in price or cost competitiveness. This effect will obviously be particularly large if the import contents are large. One way to account for the role of import contents is to consider only the domestic value added of exports, an exercise pursued in a number of studies (Timmer 2013, Bayar 2018).[3]

Other explanations posit that simple export equations may omit variables of importance and this may also bias the results for the price competitiveness variables. Algieri (2015) finds using Italian data that export equations with only foreign demand and price competitiveness variables leave residuals with systematic variation, suggesting that variables for non-price competitiveness may be relevant.

One line of inquiry focuses on the importance of quality changes in exports. A rising relative price for exports may not affect export volumes greatly if a higher price is accompanied by higher quality in the exported products. This may suggest that measures of quality may help explain export performance alongside measures of price competitiveness (Benkovskis & Wörz 2018). In practice it is difficult to construct measures of quality that are independent of prices and quantities sold, and this makes it challenging to account for quality changes in practice.[4]

Another line of inquiry posits that the constraints on production faced by firms or whole economies may affect export volumes. This conception is sometimes labelled the *capacity pressure hypothesis* (Raynold & Dunlevy 1998). The argument is that if there are ample production resources available, firms will have an incentive to expand their exports, while if production resources are strained, firms may not have the same incentive. Such arguments for the sluggish adjustment of exports are often used in policy analyses (see, for instance, Gros et al. 2014).[5]

The capacity pressure hypothesis goes back to the experience of Europe after the Second World War, when domestic reconstruction and currency accumulation through exports were competing objectives. Studies by Nurkse (1956), Ball (1961) and Rothschild (1966) noted a possible substitution effect between domestic demand and exports and sought to elucidate the reasons for such a link, typically assuming either a degree of price rigidity or large costs associated with production levels deviating from full capacity production.

Although the majority of empirical studies of the capacity pressure hypothesis consider how domestic demand or components of domestic demand affect exports, the underlying mechanism for the capacity pressure hypothesis goes through capacity utilisation in the economy. This does not in itself represent an inconsistency given that higher domestic demand may lead to higher capacity utilisation for instance, but it may be argued that using direct measures of capacity

[3] Calculations of value added in exports can be complicated and imprecise in practice as they typically use input-output tables with fixed coefficients. Moreover, the statistical measures used for monitoring, risk assessment and forecasting are usually headline figures such as the trade balance and the current account balance, not value added figures.

[4] Quality changes should in principle be reflected in price indexes, though this is seldom realised fully in practice. A related complication stems from the emergence of new varieties that may only gradually be included in price indexes and where price changes are almost impossible to compute. The inclusion in export regressions of measures capturing changes in quality or variety may be seen as a rough way to compensate for prices not fully accounting for changes in quality over time.

[5] It is also notable that measures of capacity utilisation, unemployment and output gaps are used in very many contexts in macroeconomic analysis, including studies of business cycle dynamics, inflation and fiscal policy.

utilisation would provide a more direct test of the hypothesis and would also allow for effects on capacity pressures that do not stem from changes in domestic demand (Dunlevy 1980).

The capacity pressure hypothesis is an effect that comes on top of or in addition to the effect of standard price or cost competitiveness (Dunlevy 1980). This would suggest that capacity pressure should be included as an additional variable in the standard specification of an export equation. The estimation of simple reduced-form export equations implies that demand and supply factors driving exports are not individually identified (Goldstein & Khan 1978, Haynes & Stone 1983, Bayar 2018). In the standard export equation the foreign demand is of course a demand variable, but measures of price or cost competiveness may capture both demand and supply factors. A capacity pressure variable may be seen as a supply side proxy if it is included.

A number of studies using either microeconomic or macroeconomic data have found evidence of domestic demand affecting exports. An early study by Ball et al. (1966) uses macroeconomic data for the UK and finds evidence that capacity pressure measures such capacity utilisation and changes in the unemployment rate had statistically and economically significant effects on exports. Likewise, Dunlevy (1980) finds that capacity utilisation was of importance for exports from the USA and the UK. Faini (1994) also identifies a direct effect from available production capacity on the export performance of Turkey and Morocco. Onitsuka (1994) uses changes in production capacity and changes in inventories as pressure measures and finds that both matter for exports from Japan to the USA.[6] Raynold & Dunlevy (1998) estimate vector autoregressive models for the US economy and conclude that their findings are "fully consistent with a broad interpretation of the capacity pressure hypothesis" (p. 164).

A number of recent studies have investigated the effect of demand changes on exports using macroeconomic data. These include Esteves & Rua (2015) and Rua et al. (2018), who both analyse Portuguese exports, and Bobeica et al. (2016b), who consider a panel of euro area countries. Christodoulopoulou & Tkacevs (2016) estimate export equations for individual euro area countries and find domestic demand affects exports for Portugal and a few other countries, but find little or no evidence of any effect for most of the countries in the sample. Finally, Belke et al. (2015) posit that the effect of changes in domestic demand is likely to depend on whether or not there is available production capacity in the economy. They find supportive evidence for that hypothesis using macroeconomic data for a few euro area economies.

Studies that use firm-level data include Cooper et al. (1970), Bughin (1996), Berman et al. (2015), Almunia et al. (2018) and Gul (2019). Bugamelli et al. (2015) use firm-level data for Italy and find that domestic demand has a time-varying effect on exports and may be negative as well as positive. Crespo & Muñoz-Sepulveda (2015) use firm-level data for Spain and similarly find that a term interacting available production capacity and domestic demand are important for the dynamics of exports.

This paper relates most directly to the empirical literature that uses macroeconomic data and direct measures of production capacity pressures. We estimate export equations for the 11 CEE countries using annual data for the period 2001–2019. Changes in export volumes are regressed

[6] See also Onitsuka (1994) for additional early studies testing the capacity pressure hypothesis using macroeconomic data.

on the lagged dependent variable for changes in measures of foreign demand and competitiveness, and also on three proxies of the production capacity, which are capacity utilisation in manufacturing, the unemployment rate and the output gap.

The paper contributes to the literature in several ways. First, it is the first to estimate the predictive effect of quantitative measures of competiveness on exports for the EU countries in Central and Eastern Europe. These countries may be particularly interesting in this context given their rapid growth in exports and pronounced business cycle dynamics. Second, it considers the effect of three quantitative measures of competiveness on exports, specifically capacity utilisation in industry, the output gap and the unemployment rate. Third, the paper estimates simple panel VAR models to account for possible interactions between price measures and quantitative measures of competiveness.

The rest of the paper is organised as follows. Section 2 presents the data used. Section 3 shows the baseline estimations with capacity pressure variables. Section 4 provides some robustness checks and extensions of the baseline estimations. Finally, Section 5 summarises the findings of the paper.

2. Data

We use a panel of annual data from the 11 EU countries. Annual data are less susceptible to noise from individual export orders and reporting delays. Moreover, it means that the analyses can also be done using only publicly available data since the Ameco database of the European Commission publishes data on export demand and output gaps. Annual data have also been used in a large number of other studies investigating export dynamics; see for instance Funke & Ruhwedel (2001, 2002), He (2012), Ahmed et al. (2015) and Vieira & MacDonald (2016).

The time sample for the estimations is generally 2001–2019, which needs data for 1999–2000 to be used to compute the differenced and lagged variables used in the estimations. Data are in many cases available from as early as 1995 but some variables are missing for some of the sample countries. Moreover, there were large structural and economic changes in the CEE countries in the 1990s that could affect the estimations results quite substantially.

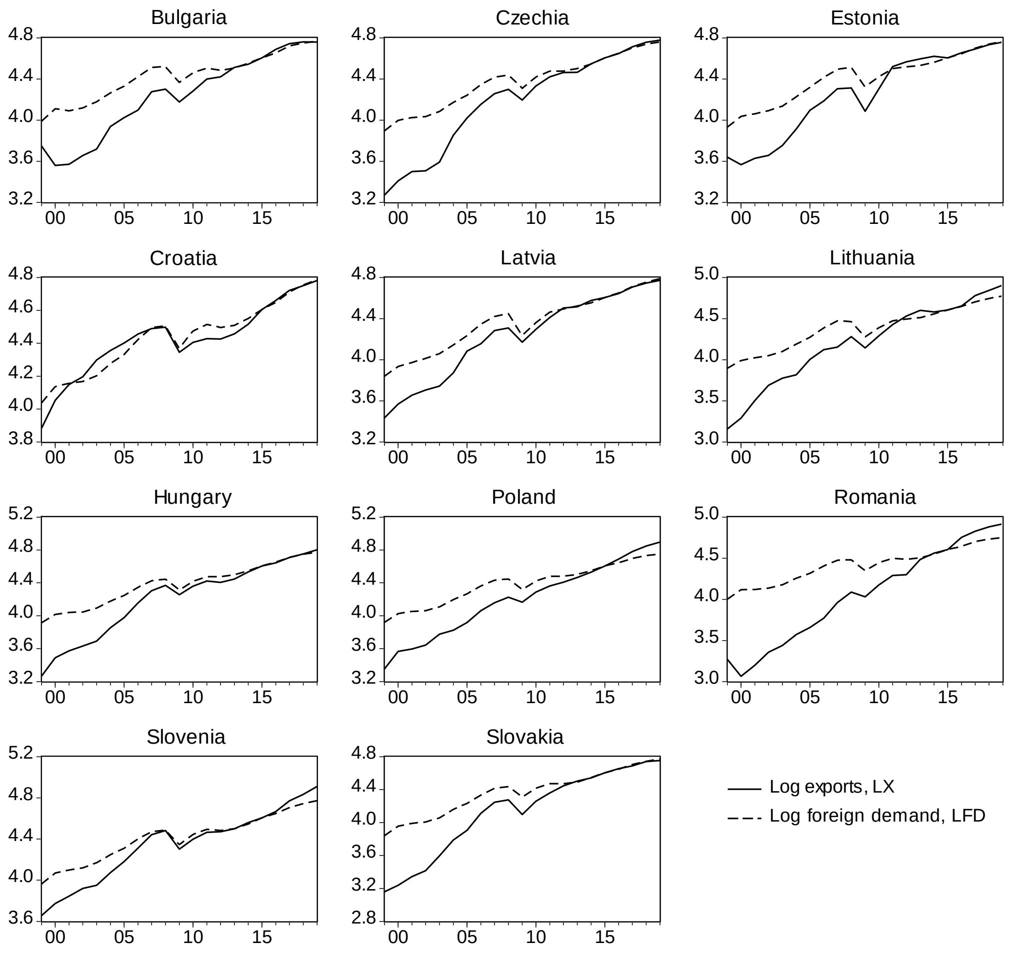
The variable X is an index of total real exports and takes the value 100 in 2015 (Ameco, code: *OXGS*).[7] The prefix L indicates the natural logarithm and the prefix D indicates the first difference operator. This means that DLX is the relative change or growth in real exports in a given year. In some estimations we consider exports of goods and services separately; the variable XG denotes real exports of goods (Ameco 2020, *OXG*).

The variable FD is an index of real foreign demand or demand for the exports of a given country and takes the value 100 in 2015 (Ameco 2020, *VMGSW*). It is computed as the real imports of a given country's various trading partners weighted by the shares of exports to those trading partners *in the previous year*. The variable DLFD depicts the logarithmic growth rate of real demand for exports. The foreign demand variable, or changes in foreign demand, is often used in export estimations since it is a convenient summary measure for the dynamics of demand in existing export markets.

[7] All variables were downloaded on 15 June 2020.

To assess the dynamics of exports and foreign demand, Figure 1 shows the logarithm of exports, LX, and the logarithm of foreign demand, LFD. Several observations apply to the dynamics in virtually all 11 countries. First, both exports and foreign demand have generally exhibited rapid trend growth in all the countries. Second, exports generally increased faster than foreign demand throughout the sample period, suggesting that the CEE countries gained market share in their exports markets. Third, most countries saw large declines in both exports and foreign demand in 2008–2009 at the height of the global financial crisis. Figure 1 suggests that foreign demand is a key factor in the dynamics of exports but other factors may obviously also be of importance.

Figure 1: Logarithm of exports, LX, and foreign demand, LFD, 1999–2019



Source: Ameco; see text.

The choice of measures of cost competitiveness has been debated and is contentious in the literature on export estimations (Christodoulopoulou & Tkacevs 2016, Fischer 2018, Bayar 2018). We therefore run the estimations with two competitiveness variables that are conceptually very different. The variable REER is the real effect exchange rate computed relative to a double export weighted average for 37 industrialised countries using unit labour costs as the deflator (Ameco: *XUNRQ*). The variable RULC depicts the relative real unit labour costs defined as real unit labour costs in the country considered relative to a double export weighted average for the countries of the former EU15, where the real unit labour costs for each country are computed as the compensation per employee relative to nominal GDP per person employed (Ameco: *QLCDQ*).

Notice that the calculation of the real effective exchange rate REER involves the nominal exchange rates of a country, while the nominal exchange rate does not directly enter the calculation of the relative real unit labour costs. The real effective exchange rate REER generally exhibits greater variability than the relative real unit labour costs RULC.

We use three different proxies for capacity pressure. The variable CU is the capacity utilisation in industry (Eurostat, code: *ei_bsin_q_r2*). The variable is constructed from the following question in a survey of managers in industrial enterprises: "What is your current rate of operation as a percentage of full capacity?"; see Eurostat (2017) for further information. Data for Croatia are only available from 2007 and data for Romania from 2001. The data are quarterly and the annual variable CU is computed by taking the average over the four quarters of the year. The variable CU ranges from 0.540 for Latvia in 2009 to 0.892 for Czechia in 2007.

The unemployment rate may contain information on the availability of labour for production activities and so may be seen as a proxy of capacity pressure. The unemployment rate U is the share of the unemployed in the total active population (Ameco, *ZUTN*). It ranges from 0.021 for Czechia in 2019 to 0.200 for Bulgaria in 2002.

Finally, the output gap YGAP denotes the relative difference between GDP and potential GDP and is computed as log GDP minus log potential GDP (Ameco, *AVGDGP*). Data for Croatia are only available from 2001. The output gap YGAP ranges from –0.128 for Latvia in 2010 to 0.124 for Estonia in 2007.

We generally include changes in the two cost competitiveness variables in the export estimations. The variable DLREER is the log differenced real effective exchange rate while the variable DLRULC is the log differenced relative unit labour costs. Both of these are panel stationary. A positive value for DLREER denotes a real appreciation, while a positive value for DLRULC indicates that relative real unit labour costs are increasing faster than in the EU15. We do not transform the three capacity pressure variables CU, U and YGAP since they are generally bound within a relatively narrow interval and each of them may be seen to depict deviation from a level of centrality. Panel unit root tests indicate that each of the three capacity pressure variables are panel stationary (not shown).

Table 1 shows the contemporaneous correlation coefficients for the two log differenced cost competitiveness variables and the three capacity pressure variables for the sample period 2001–2019. The log differenced cost competitiveness measures are quite closely correlated with each other but less correlated with the capacity pressure variables. The numerical correlation coefficients between the three capacity pressure variables vary between 0.390 and 0.596. The relatively large numerical correlation coefficients are to be expected given that the three variables depict the availability of productive resources in the economy. The correlations also suggest that it would be advisable to include the variables one by one in the export estimations.

Table 1. Correlation between competitiveness measures, 2001–2019

	DLREER	DLRULC	CU	U	YGAP
DLREER	1.000	..	..	..	..
DLRRULC	0.715	1.000	..	..	..
CU	0.143	0.055	1.000	..	..
U	–0.259	–0.235	–0.538	1.000	..
YGAP	0.440	0.211	0.409	–0.593	1.000

Figure 1 revealed that the dynamics of exports were very unusual during the global financial crisis, so we will present a number of export estimations in Section 3 with the data for 2007–2010 left out. Table A1 in Appendix A shows the correlation between the various measures of competitiveness for the sample period 2001–2019 without the years 2007–2010. The correlations are smaller in numerical terms but the differences between the correlation patterns for the full sample and those for the sample without the crisis period are nevertheless relatively small.

3. Estimation results

3.1 Only cost competitiveness measures

We start by estimating single-equation panel data models. The dependent variable is the relative change in exports DLX, while the covariates are limited to the lagged dependent variable DLX(–1), the relative change in foreign demand DLFD, and the lagged value of either of the cost-based competitiveness measures, DLREER or DLRULC. The cost competitiveness variables are lagged one year to allow for some adjustment time and to reduce the risk of reverse causality affecting the results unduly. This specification bears close resemblance to export equations in, for example, Esteves & Rua (2015), Bobeica et al. (2016b) and Christodoulopoulou & Tkacevs (2016); see also Bayar (2018).

All the panel data models include country fixed effects so that the coefficient estimates are identified from the variation of the variables over time. A complication in the choice of estimation method is that including the lagged dependent variable could bias the coefficient estimates through the Nickell bias (Nickell 1981). In this case the coefficient of the lagged dependent variable is typically small, which reduces this problem. GMM estimators such as the Arellano-Bond GMM or System GMM estimators may address this problem but their asymptotics are derived for the number of cross sections going to infinity. Simulation studies have shown that the fixed effect estimator performs as well as, and in many cases better than, the GMM estimators in panels with few cross sections (Bun & Kiviet 2001, Judson & Owen 1999). We estimate the dynamic panel data models using standard fixed effect estimation.[8]

[8] Experiments where we estimated the dynamic panel with System GMM showed that the results in almost all cases are qualitatively similar to those obtained using fixed effects estimation although they are somewhat sensitive to the specification of the instruments and weighting matrices (not shown).

Table 2 shows the estimation results for various specifications of the dynamic export equation. Column (2.1) presents the results for the full time sample 2001–2019 when the cost competitiveness variable is the real effective exchange rate. The coefficient of the lagged dependent variable is small and statistically insignificant, while the coefficient of changes in foreign demand is very close to 1 and is precisely estimated. This nearly one-to-one relationship between changes in foreign demand and changes in exports is found in many other studies (Bayar 2018). The coefficient of DLREER(–1) is neither economically nor statistically significant. Column (2.2) shows the results when the relative real unit labour costs are included. The coefficient of DLRULC(–1) attains a negative sign as expected, but the coefficient is small in numerical terms and the coefficient is statistically insignificant.

Table 2. Only cost competitiveness measures

	(2.1)	(2.2)	(2.3)	(2.4)
DLX(–1)	0.060 (0.039)	0.052 (0.039)	0.104* (0.059)	0.093 (0.061)
DLFD	1.039*** (0.057)	1.032*** (0.055)	0.954*** (0.132)	0.964*** (0.133)
DLREER(–1)	–0.001 (0.050)	..	0.012 (0.062)	..
DLRULC(–1)	..	–0.111 (0.083)	..	–0.048 (0.098)
R^2	0.663	0.666	0.367	0.390
DW	1.78	1.81	1.81	1.82
Time	01–19	01–19	No crisis	No crisis
Obs.	209	209	164	164

Notes: Fixed effect estimations with DLX as dependent variable. Standard errors are shown in brackets. Superscripts ***, **, * denote that the estimated coefficient is statistically significant at the 1, 5 and 10 per cent levels respectively.

We saw from Figure 1 that exports exhibited large declines during the global financial crisis. Columns (2.3) and (2.4) show the results when the years 2007–2010 are excluded from the sample. The persistence is slightly larger and the coefficient of the changes in foreign demand is slightly smaller, but the results are overall little affected when the years around the global financial crisis are excluded.

The results in Table 2 are broadly consistent with the findings in the literature estimating export equations discussed in Section 1. The persistence of the changes in exports is generally small, there is a one-to-one relationship between changes in export demand and changes in exports, and the effect of various cost competitiveness measures is often statistically or economically insignificant. The results for the CEE countries and the data sample used in this study are thus overall in line with those in the literature, and this is a useful starting point for the introduction of capacity pressure variables.

3.2 Capacity pressure variables

We augment the parsimonious estimations in Table 2 by adding the three capacity pressure variables one by one. The results for these baseline models when the effective exchange rate index is the cost competitiveness variable are shown in Table 3. Columns (3.1) to (3.3) show the results for the full time sample 2001–2019. The coefficient estimates for the lagged dependent variable, the changes in foreign demand, and the changes in the lagged real effective exchange rate are very close to those obtained for the parsimonious model in column (2.1) in Table 2. More importantly, the coefficients of each of the capacity pressure variables attain statistical significance and also represent economically relevant effects with the expected signs.[9] Increasing capacity pressure as measured by a rise in capacity utilisation, lower unemployment, or a widening of the output gap is associated with lower exports the following year.

Table 3. Real effective exchange rate as capacity pressure

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)
DLX(–1)	0.126*** (0.042)	0.045 (0.037)	0.088** (0.040)	0.132** (0.061)	0.081 (0.056)	0.111* (0.058)
DLFD	1.013*** (0.056)	0.996*** (0.056)	1.004*** (0.058)	1.025*** (0.131)	0.930*** (0.126)	1.002*** (0.130)
DLREER(–1)	0.012 (0.052)	0.054 (0.050)	0.049 (0.053)	0.001 (0.065)	0.062 (0.061)	0.070 (0.065)
CU(–1)	–0.244*** (0.073)	..	..	–0.278*** (0.085)	..	..
U(–1)	..	0.382*** (0.094)	..	..	0.409*** (0.104)	..
YGAP(–1)	..	..	–0.251** (0.099)	..	..	–0.391** (0.140)
R^2	0.694	0.690	0.678	0.442	0.426	0.404
DW	2.04	1.90	1.88	2.06	1.95	1.88
Time	01–19	01–19	01–19	No crisis	No crisis	No crisis
Obs.	200	209	208	157	164	163

Notes: Fixed effect estimations with DLX as dependent variable. Standard errors are shown in brackets. Superscripts ***, **, * denote that the estimated coefficient is statistically significant at the 1, 5 and 10 per cent levels respectively.

Columns (3.4) to (3.6) show the results when the crisis years 2007–2010 are excluded from sample. The exclusion of the volatile crisis years changes surprisingly little with the partial exception that the coefficient of the lagged output gap becomes larger in numerical terms when the crisis years are removed. Another change is that the coefficient of determination is much smaller in the sample without the global financial crisis than in the full sample. This is due to the very large changes in the exports variable no longer being part of the sample.

[9] The unemployment rate is the indicator of capacity pressure stemming from the labour market. We have tried instead to use the employment rate (Eurostat: *lfsi_emp_a*) but the results obtained corresponded closely to those for the unemployment rate in both statistical and economic terms.

As discussed in Section 1, the specific choice of the measure of cost or price competitiveness in export estimations has been investigated in a number of empirical studies without any one measure standing out as having particularly strong predictive properties (Christodoulopoulou & Tkacevs 2016, Decramer et al. 2016, Fischer et al. 2018). This leads us to repeat the estimations in Table 3 but this time using the changes in the relative real unit labour costs, DLRULC, as the cost competitiveness variable. The results are presented in Table 4.

Table 4. Relative real unit labour costs as capacity pressure

	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)
DLX(–1)	0.118*** (0.042)	0.047 (0.037)	0.077* (0.041)	0.126** (0.062)	0.085 (0.058)	0.101* (0.061)
DLFD	1.007*** (0.055)	0.984*** (0.055)	0.996*** (0.057)	1.032*** (0.131)	0.926*** (0.127)	1.007*** (0.131)
DLRULC(–1)	–0.116 (0.087)	–0.013 (0.084)	–0.074 (0.084)	–0.052 (0.102)	0.075 (0.099)	0.005 (0.099)
CU(–1)	–0.218*** (0.073)	..	..	–0.267*** (0.073)	..	..
U(–1)	..	0.350*** (0.096)	..	..	0.413*** (0.108)	..
YGAP(–1)	..	..	–0.197** (0.095)	..	..	–0.342** (0.137)
R^2	0.697	0.688	0.678	0.443	0.425	0.400
DW	2.08	1.89	1.86	2.08	1.92	1.84
Time	01–19	01–19	01–19	No crisis	No crisis	No crisis
Obs.	200	209	208	157	164	163

Notes: Fixed effect estimations with DLX as dependent variable. Standard errors are shown in brackets. Superscripts ***, **, * denote that the estimated coefficient is statistically significant at the 1, 5 and 10 per cent levels respectively.

Columns (4.1) to (4.3) show the results for the full sample. Although the correlation between DLREER and DLRULC is only 0.718, the results for the two models with either of the variables are very similar. The coefficients of DLRULC are negative as would be expected but they are small in numerical terms and not statistically significant in any of the specifications. The coefficients of the lagged capacity utilisation, the unemployment rate, and the output gap are statistically significant and of broadly the same magnitudes as those reported in columns (3.1) to (3.3).

Columns (4.4) to (4.6) show the results for the sample when the crisis years 2007–2010 are excluded. In line with the findings in Table 3, the results are broadly unchanged in the shorter sample. The coefficients of the capacity pressure variables are all statistically significant and they are numerically of the same size or larger when compared to the case where the full sample is used. Moreover, including the capacity pressure variables seems to reduce the very modest predictive ability of the cost competitiveness variable DLRULC.

The capacity pressure hypothesis posits that measures of capacity help predict export performance even when included alongside standard measures of price or cost competitiveness (Dunlevy 1980). Tables 3 and 4 report the results of estimations where the covariates include cost competitiveness measures. The lagged capacity pressure variables exhibit substantial predictive power in all cases, irrespective of the choice of cost competitiveness variable and sample period. In this way the results provide some support for the capacity pressure hypothesis in the case of the EU countries from Central and Eastern Europe. The findings are also in line with the small number of earlier studies that use macroeconomic data and comparable proxies of capacity pressure; see Ball et al. (1966), Dunlevy (1980), Faini (1994) and Onitsuka (1994).

4. Robustness and extensions

The estimations in Section 3 showed that the three measures of capacity pressure in the economy are useful predictors of future exports from the 11 EU countries in Central and Eastern Europe. This section presents analysis that assesses the robustness and broader applicability of these results.

4.1 Robustness analyses

The choice of cost or price competitiveness measures in export equations is often seen as contentious (Christodoulopoulou & Tkacevs 2016, Bayar 2018). For this reason we presented the baseline results in Subsection 3.2 using two cost competitiveness measures that are conceptually different and that exhibit diverging dynamics. We have however experimented with other measures as well. One alternative is the real effective exchange rate computed using the consumer price index (Eurostat, *ert_eff_ic_a*). This variable has less predictive power than the variables used in Section 3 though, and the results for the capacity pressure variables become even stronger (not shown). Another measure is simple real unit labour costs (Ameco: *QLCD*), but the results with this variable are very similar to those found by using the relative real unit labour costs (not shown). The upshot is that the specific choice of cost or price competitiveness variable is unlikely to affect the results for the capacity pressure variables.

The results in Tables 3 and 4 are derived for all 11 EU countries from Central and Eastern Europe but the results are fairly robust to changes in the composition of countries. Table A.1 in Appendix A reports the results when the real effective exchange rate is used as the cost competitiveness variable and various subgroups of countries are removed from the sample. Columns (A1.1) to (A1.3) show the results when Bulgaria, Croatia and Romania, the three countries with the lowest GDP per capita PPP in 2019 (Ameco: *HVGDPR*), are removed from the sample. Columns (A1.4)–(A1.6) show the results when Czechia, Estonia and Slovenia, the three countries with the highest GDP per capita PPP in 2019, are removed from the sample. It follows from a comparison of Table A.1 with the first three columns in Table 3 that the changes in country composition have only little effect on the results.

Table 5 shows the results of another robustness check where time fixed effects are included in the estimations. Including time fixed effects implies that the coefficients of the capacity pressure variable only capture the effects of changes in capacity pressure that are specific to each of the countries in the sample. Exports and the capacity pressure variables exhibit substantial cross-country synchronisation so the inclusion of time fixed effects is likely to affect results. Nevertheless, the estimated coefficients of the three capacity pressure variables broadly retain their size and only the coefficient of the capacity utilisation CU becomes statistically insignificant. The conclusion is that the results are also fairly robust to the inclusion of time fixed effects.

Table 5. Real effective exchange as capacity pressure, including time fixed effects

	(5.1)	(5.2)	(5.36)
DLX(–1)	0.028 (0.066)	0.015 (0.059)	0.038 (0.060)
DLFD	1.041*** (0.285)	0.915*** (0.291)	0.892*** (0.284)
DLREER(–1)	–0.018 (0.057)	0.017 (0.056)	0.018 (0.055)
CU(–1)	–0.160 (0.100)	..	..
U(–1)	..	0.258** (0.131)	..
YGAP(–1)	..	..	–0.411*** (0.142)
R^2	0.736	0.731	0.738
DW	0.00	1.95	1.98
Time	01–19	01–19	01–19
Obs.	200	209	208

Notes: Two-ways fixed effect estimations with DLX as dependent variable. Standard errors are shown in brackets. Superscripts ***, **, * denote that the estimated coefficient is statistically significant at the 1, 5 and 10 per cent levels respectively.

The estimations in this paper are carried out using annual data, as this reduces difficulties with the lag structures and allows all the analyses to use official data from the European Commission. However, as a robustness check we used non-official quarterly data from the European Central Bank on foreign demand and the output gaps for the five CEE countries that are euro area members. The rest of the data were obtained from Eurostat. We used this small quarterly panel dataset with only five countries to estimate export equations along the lines of the baseline estimations in Subsection 3.2. The results corresponded closely to those of the baseline estimations (available upon request). The key difference lies with the difficulties in establishing the appropriate lag structures in the quarterly models.

4.2 Goods exports

We have so far considered total exports but it might be argued that capacity utilisation *in industry* is only appropriate as a capacity pressure variable for goods exports and not for exports of services. As discussed in Section 2, separate data on exports of goods are available; goods exports are around three quarters of total exports on average across the countries and over time. We repeat the baseline estimations in Table 3 for goods separately to ascertain how the predictive power of the various capacity pressure proxies changes. It should however be noted that the foreign demand variable FD is computed for total exports and not for goods separately. Table 6 shows the results.

Table 6. Fixed effect estimations for goods exports

	(6.1)	(6.2)	(6.3)
DLXG(–1)	0.074 (0.045)	0.013 (0.040)	0.054 (0.043)
DLFD	1.096*** (0.082)	1.085*** (0.081)	1.110*** (0.085)
DLREER(–1)	0.029 (0.076)	0.024 (0.072)	–0.008 (0.078)
CU(–1)	–0.452*** (0.103)	..	..
U(–1)	..	0.580*** (0.136)	..
YGAP(–1)	..	..	–0.250* (0.144)
R^2	0.591	0.582	0.545
DW	1.81	1.84	1.73
Time	01–19	01–19	01–19
Obs.	200	209	208

Notes: Fixed effect estimations with DLXG as dependent variable. Standard errors are shown in brackets. Superscripts ***, **, * denote that the estimated coefficient is statistically significant at the 1, 5 and 10 per cent levels respectively.

It follows from columns (6.1) and (6.2) that the coefficients of capacity utilisation in industry and of the unemployment rate are larger in numerical terms than they are in the models for total exports, and they are very precisely estimated. This suggests that capacity utilisation in industry and the unemployment rate are particularly strong predictors for goods exports. The coefficient of the output gap in column (6.3) is of the same magnitude as in the model for total exports but it is imprecisely estimated and only statistically significant at the 10 per cent level in this case. The overall conclusion is that the results from Subsection 3.2 are robust to a narrowing of the export variable to only goods exports.

4.3 Panel VAR estimations

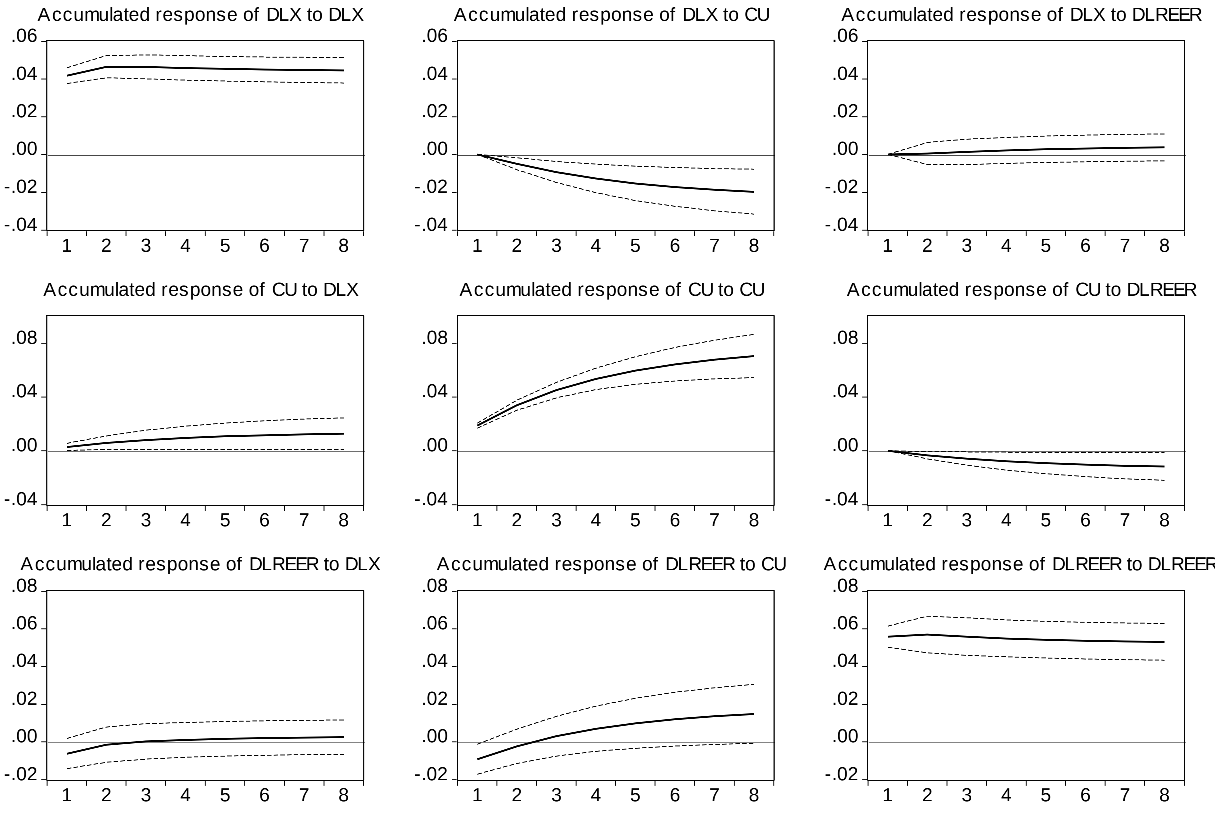
The analysis in Subsection 3.2 showed that the capacity pressure variables help predict changes in exports even when changes in cost competitiveness variables such as the real effective exchange rate and relative real unit labour costs are controlled for. The capacity pressure variables and the cost variables may however be related over time, and it may thus be valuable to investigate in more detail the dynamic relationship between the variables and their effects on changes in exports.

We estimate a simple panel vector autoregressive (PVAR) model to ascertain the dynamic adjustment of various shocks; see also Raynold & Dunlevy (1998). The model treats changes in exports (DLX), changes in the real effective exchange rate (DLREER) and capacity utilisation in industry (CU) as endogenous variables, while the changes in foreign demand (DLFD) are treated as an exogenous variable along with the dummies for the country fixed effects.

The estimation period is 2001–2019 and we use only one-year lags to economise on the degrees of freedom.[10] The model is estimated with OLS so the results for the DLX equation are those presented in column (3.1) in Table 3.

Figure 2 shows the impulse responses from the structural panel VAR model where the innovations have been identified using Cholesky decomposition with DLX ordered first, then CU and then DLREER. The ordering implies that exports adjust to innovations in the other variables with a one-year lag and also that the real effective exchange rate adjusts to innovations in capacity utilisation with a one-year lag. The impulse responses in Figure 2 are accumulated so that they can be interpreted as the deviation between the levels given the innovation considered and the level of the counterfactual with no innovation.

Figure 2: Accumulated responses to innovations of one standard deviation



Note: The bold schedule denotes the impulse response while the interval dashed lines denote ± 2 standard deviations.

It follows from Figure 2 that a positive innovation in capacity utilisation has a persistent effect on export levels. It also follows that whereas a positive innovation in capacity utilisation leads to a higher real effective exchange rate and so to deteriorating cost competitiveness, the effect is subdued for several years. A positive innovation in the real effective exchange rate

[10] The resulting impulse responses are very similar if two lags are used in the estimation of the PVAR model but the confidence intervals are slightly larger.

REER has little effect on export levels but does lead to lower capacity utilisation over time. Overall, the effects of innovations in the two main variables of interest, CU and REER, are close to those uncovered in the baseline estimation in Column (3.1).

We have estimated panel VAR models with the unemployment rate and output as capacity pressure variables instead of capacity utilisation. Overall, the results do not contradict those of the export equations. However, in line with the results for the export equations, the specific results of the structural panel VAR models tend to be somewhat dependent on the time sample. The choice of identification scheme also matters in some cases. Nevertheless, the *capacity pressure hypothesis* receives support in virtually all the structural panel VAR models considered.

4.4 Non-linear effects

This subsection investigates whether the capacity pressure variables may have non-linear effects on the dynamics of exports. Arguably the most interesting question in this context is whether an abundance of capacity has the same effects on exports that a lack of capacity does. The capacity pressure hypothesis does not offer any insights into this issue but it is still a potentially important one, so we seek to address it in the panel data setting of this model.

We examine whether negative and positive capacity pressure gaps exert the same predictive effects on the dynamics of exports. We define positive and negative gaps for each of the three capacity pressure variables. For capacity utilisation, CUPOS is a variable that takes the value of CU when CU is at or above its country average and is otherwise 0; meanwhile CUNEG takes the value of CU when CU is below its country average and is otherwise 0. This means that CUPOS takes values different from 0 when capacity in industry is tight, while CUNEG takes a value different from 0 when capacity is abundant.

For unemployment, the variable UPOS takes the value of U when U is at or above its country average and is otherwise 0, while UNEG takes the value of U when U is below its country average and is otherwise 0. Finally, the variable YGAPPOS is equal to YGAP when YGAP is non-negative and is otherwise 0, while YGAPNEG is equal to YGAP when YGAP is negative and is otherwise 0.

Table 7 shows the results when the negative and positive capacity gaps are included in the baseline specification in columns (3.1) to (3.3) in Table 3. The results should be interpreted with care since the negative and positive variables are clustered over time. For most countries the variable CUPOS mainly takes non-zero values during the boom years before the global financial crisis for instance and at the end of the sample, while CUNEG takes non-zero values at the beginning of the sample and after the crisis. Similar patterns appear for the positive and negative values of the unemployment rate and the output gap.

It follows from column (7.1) that the estimated coefficients of the variables CUPOS and CUNEG are nearly identical, suggesting that tight capacity utilisation and abundant capacity utilisation have the same predictive effect for exports.

Table 7. Positive and negative capacity pressure gaps

	(7.1)	(7.2)	(7.3)
DLX(–1)	0.129*** (0.042)	0.044 (0.040)	0.092** (0.040)
DLFD	1.006*** (0.082)	1.085*** (0.081)	1.011*** (0.058)
DLREER(–1)	0.003 (0.053)	0.053 (0.050)	0.050 (0.053)
CUPOS(–1)	–0.323*** (0.098)	..	..
CUNEG(–1)	–0.337*** (0.107)	..	..
UPOS(–1)	..	0.260** (0.127)	..
UNEG(–1)	..	0.114 (0.213)	..
YGAPPOS(–1)	..		–0.124 (0.161)
YGAPNEG(–1)	..	..	–0.386** (0.168)
R^2	0.696	0.693	0.679
DW	0.09	1.90	1.89
Time	01–19	01–19	01–19
Obs.	200	209	208

Notes: Fixed effect estimations with DLX as dependent variable. Standard errors are shown in brackets. Superscripts ***, **, * denote that the estimated coefficient is statistically significant at the 1, 5 and 10 per cent levels respectively.

The results for the unemployment variables are reported in column (7.2). The coefficient of the positive unemployment variable UPOS is somewhat larger than that of the negative unemployment variable UNEG, suggesting that the effect is larger during downturns that have high unemployment. However, the coefficient of UNEG is imprecisely estimated and a Wald test cannot reject the hypothesis that the two coefficients are identical (*p*-value = 0.162).

A similar picture emerges for the output gap in column (7.3). The coefficient of the negative output gap variable YGAPNEG is much larger in numerical terms than the coefficient of the positive output gap YGAPPOS, again suggesting that the predictive effect is larger during downturns than during booms. However, a Wald test cannot reject the two coefficients being identical (*p*-value = 0.317).

The conclusion from this exercise where the negative and positive gaps of the capacity pressure variables are included separately is that there are non-linearities that are not easy to identify. The coefficients of the negative and positive gaps always have the same sign and they are not significantly different in statistical terms. However, the number of observations is relatively small and the estimation results are somewhat conflicting so the conclusions may be seen as tentative.

5. Final comments

The capacity pressure hypothesis posits that quantitative measures of capacity pressure are of importance for the performance of exports even when variables reflecting price or cost competitiveness are controlled for. The hypothesis dates back to the period after World War II and is often rationalised by the assumption that prices or wages exhibit a degree of stickiness.

The paper examines how applicable the capacity pressure hypothesis is to the 11 EU countries from Central and Eastern Europe. The baseline estimations regress changes in exports on the lagged dependent variable, changes in foreign demand, lagged changes in cost competitiveness and any one of three lagged proxies of capacity pressure, which are capacity utilisation in industry, the unemployment rate and the output gap.

The analyses show that each of the measures of capacity pressure can function as a predictor of future changes in exports. The results are robust to various changes in the sample period, country composition and the choice of control variables. When only exports of goods are considered, the capacity utilisation in industry and the unemployment rate exhibit even stronger predictive power than they do for total exports. The importance of the capacity pressure variables is also confirmed in panel VAR estimations.

This study has some implications for the understanding of the adjustment channels and dynamics following large fluctuations in the economy. Exports are often seen as a source or channel of adjustment that may help dampen business cycle fluctuations (Ahmed et al. 2015). One channel involves changes in cost or price competitiveness. Recessions may lead to lower costs, which may strengthen exports and generate additional demand. However, in cases where the capacity pressure hypothesis applies, exports may function as an automatic stabiliser that does not necessarily require adjustments of costs or prices.

This study considered the EU countries from Central and Eastern Europe but it would also be valuable to test the capacity pressure hypothesis on other country groups and on individual countries for which data are available. It would also be insightful to investigate the predictive properties of a broader set of proxies of capacity pressure. Finally, estimations using more fine-grained measures of exports and capacity pressure, for instance measures reflecting the dynamics in specific sectors, may provide additional insights and allow a firmer causal identification. These lines of investigation are left for future studies.

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Data

Ameco: “Macro-economic database AMECO”, European Commission, https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm.

Eurostat: “Eurostat database”, https://ec.europa.eu/eurostat/data/database.

Appendix A

Table A1. Correlation between competitiveness measures,
2001–2019 without the crisis years 2007–2010

	DLREER	DLRRULC	CU	U	YGAP
DLREER	1.000	..	..	..	..
DLRRULC	0.727	1.000	..	..	..
CU	0.060	0.061	1.000	..	..
U	–0.181	–0.213	–0.549	1.000	..
YGAP	0.325	0.187	0.262	–0.572	1.000

Appendix B

Table B1. Fixed effect estimations with capacity pressure variables, different country samples

	(B1.1)	(B1.2)	(B1.3)	(B1.4)	(B1.5)	(B1.6)
DLX(–1)	0.152*** (0.048)	0.077* (0.046)	0.129*** (0.048)	0.109** (0.051)	0.031 (0.046)	0.065 (0.048)
DLFD	1.051*** (0.065)	1.039*** (0.066)	1.043*** (0.068)	0.915*** (0.067)	0.901*** (0.066)	0.909*** (0.068)
DLREER(–1)	0.047 (0.066)	0.056 (0.069)	0.059 (0.074)	0.013 (0.057)	0.052 (0.054)	0.048 (0.057)
CU(–1)	–0.299*** (0.086)	..	..	–0.229*** (0.080)	..	..
U(–1)	..	0.343*** (0.111)	..	..	0.330*** (0.103)	..
YGAP(–1)	..	..	–0.257** (0.115)	..	..	–0.226* (0.119)
R^2	0.704	0.699	0.690	0.656	0.646	0.635
DW	1.96	1.88	1.89	2.13	1.94	1.92
Time	01–19	01–19	01–19	01–19	01–19	01–19
Obs.	152	152	152	143	152	151

Notes: The dependent variable is DLX. Standard errors are shown in brackets. Superscripts ***, **, * denote that the estimated coefficient is statistically significant at the 1, 5 and 10 per cent levels respectively.

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