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By Thomas H.W. Ziesemer

Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)
email: info@merit.unu.edu | website: http://www.merit.unu.edu

Maastricht Graduate School of Governance (MGSoG)
email: info-governance@maastrichtuniversity.nl | website: http://mgsog.merit.unu.edu

Keizer Karelplein 19, 6211 TC Maastricht, The Netherlands
Tel: (31) (43) 388 4400, Fax: (31) (43) 388 4499

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Country terms of trade: Trends, unit roots, over-differencing, endogeneity, time dummies, and heterogeneity

Thomas H.W. Ziesemer, *Department of Economics, Maastricht University, and UNU-MERIT, P.O.Box 616, 6200 MD Maastricht, The Netherlands.* T.Ziesemer@maastrichtuniversity.nl.[1]
Phone: ++31-43-3883872. Fax: ++31-43-3884105.

Abstract. The debate about the Prebisch-Singer thesis has focussed on primary commodities with some extensions to manufactures. As we think that the link between the terms of trade and long-run development, growth and convergence is the ability of exports to enhance investment through importing capital goods we analyse trends in country terms-of-trade for goods and services rather than those for commodities. Whenever terms of trade are not constant open rather than closed economy growth models should be used. We therefore consider trends in terms of trade for country groups according to the World Bank income classification. We find that all groups but the poorest have common unit roots, but none has individual unit roots. As low-income countries have no unit roots over-differencing is inefficient and biases significance levels in first differences against the fall in the terms of trade. For the low-income countries the terms of trade of goods and services are falling at a rate that is significantly negative without and with endogeneity treatment by system GMM. A comprehensive analysis of the effects of time dummies supports the result of falling terms of trade for low-income countries. When all coefficients are country-specific 50% of all low-income countries have falling terms of trade in a simultaneous equation estimation using the SUR method.

Key words: country terms of trade; Prebisch-Singer thesis; long-run development; World Bank income classification.
JEL-code: F43, O19.

1. Introduction

Prebisch and Singer found a fall in the prices of developing countries' primary commodities relative to those of British manufactured goods. From their work three branches of literature emerged. First, a statistical debate did arise in regard to the question whether or not developing country terms of trade or indirect indicators for them are really falling. Second, a series of theoretical models were developed in which terms of trade changes over time could be explained. Third, the policy consequences of falling terms of trade were discussed, mainly the question whether a fall in the terms of trade should lead to industrialization policies. Our

[1] I grateful for comments obtained from Alexis Habiyaremye, Huub Meijers, Bart Verspagen and Adriaan van Zon.

paper tries to contribute to the first branch of literature, because the prominent use of closed economy models for developing countries is misleading when terms of trade are not constant.

There are two widespread versions of the Prebisch-Singer thesis (Singer 1999). The narrow one is a statistical view on the hypothesis of a time trend in the relation between primary commodities and manufactured goods, also called Prebisch-Singer hypothesis (PSH). The broader one is called Prebisch-Singer thesis (PST). It is interested in developing countries' terms of trade because they are related to exports and exports are related to growth and welfare as well as questions like convergence versus divergence. The special aspect here is that trade and growth are linked through developing countries' imports of capital goods (Prebisch 1950; 1962, p.2). In this broader perspective, the commodity terms of trade were the most relevant indicator around 1950 when commodities had a larger share in exports than they had later.[2] Moreover, other data were not available for a long time. The crucial question then is whether or not the country rather than the commodity terms of trade fall in the long-run average, but not necessarily in the form of a time trend doing better than other forms.

The empirical literature on the long-run development in the terms of trade, once put into this broader perspective, indicates that what is needed are not only *commodity* terms of trade or those of *manufactures*, but also terms of trade analyses on the *country* level for all goods and services. From a theoretical point of view, what matters for growth is investment; and capital goods of developing countries are mainly imported. Exports are required to pay for imported capital goods. But export growth depends on the terms of trade (see the model by Bardhan and Lewis 1970). Solow type models with imported inputs paid for by exports and endogenous terms of trade generate Solow-type results under those conditions where they generate constant terms of trade with respect to time (see Mutz and Ziesemer 2008). Therefore it is important to get to know whether terms of trade are falling or not. When terms

[2] Part of the mirror image is the share of manufactures in exports. It grew from about to 10% to about 65% in the period 1960-1995. See Chakraborty (2012), Fig.1a.

of trade change, open economy growth models will not be observationally equivalent to closed economy Solow models.

Especially if the empirical problem once was in the commodity terms of trade, the more or less strong diversification of the economies then may have mitigated the problem unless developing countries specialize also on industrial goods and services with low income and price elasticities.[3] Therefore we look at the country terms of trade in this paper, for developed and developing countries. We are therefore not mainly interested in primary commodities (the traditional approach) or in manufactures or their cointegration in this paper.[4] Bleaney and Greenaway (1993) have shown that commodity price changes of 1% induce a change in net barter term of trade of 0.3%. Powell (1991) and Lutz (1999a) find a value about 0.5%. But even this aspect of the terms of trade debate is not uncontroversial. Aggregate commodity indices and country-level terms of trade are found to be unrelated by Cashin and Pattillo (2006) for Sub-Saharan Africa. These papers do not provide results for trends in country terms of trade though. Bidarkota and Crucini (2000) report trends in country terms of trade, which are negative throughout but insignificantly so. They group countries according to volatility in terms of trade, not income or poverty. Ram (2004) looked at net barter terms of trade at the country level and found that 16 of 26 countries investigated had significantly negative trends (5 others had insignificantly negative trends). We will look at a larger set of countries classified according to their per capita income. Whether the changes come in the form of trends shifting up and down, in a few steps, swings, cycles or other forms, what matters for long-run development is the long-run average trend. Supply (factor accumulation and technical progress) and demand forces (and the implied income and price elasticities of

[3] Keesing (1979) and Sarkar and Singer (1991) broadened the literature to include the analysis of manufactures. Chakraborty (2012) reviews and extends this literature.

[4] For papers, which are interested in resource scarcity, it is of course meaningful to look at primary commodity prices. For papers interested in industrialization strategies it is of course meaningful to look at prices of manufactures and their terms of trade (see Chakraborty 2012).

export demand) are assumed to determine these developments.[5] Many of these developments (including speculation and buffer stocks) behind the terms of trade may take forms other than smooth trends of course. Cuddington and Urzua (1989) correctly argue that one should not talk of a secular deterioration if statistical analysis can replace it by a one-time jump without a trend being left over. However, their sample ended in 1983 and they discuss only a one-time jump in 1921. Powell (1991) suggests drops also for 1938 and 1975 and Bleaney and Greenaway (1993) find another one for the early 1980s. These drops may be a reaction to a postponed smooth adjustment due to preceding extraordinary events (Powell 1991). WWI demand may have kept prices high before 1921, and resource booms before 1938 and 1975 and the Latin American debt crisis, mainly caused by a world recession in 1981-82 together with the 1982 drop. With several jumps the difference with a trend is not so big anymore. What matters, is not mainly the form but how countries are affected. Other than smooth developments may be harder to anticipate and probably cause more severe adjustment costs. From a welfare point of view this is worse than a negative time trend, as was already pointed out by Powell (1991), and therefore should not be interpreted as argument against Prebisch and Singer. Refinements are interesting but not the issue of this paper. We will limit ourselves to the analysis of time trends and the consequences of the introduction of time dummies. A major result for poor countries is that the coefficients of time dummies reflect falling country terms of trade as well as time trends do. Other results will become clearer once the model is explained.

2. The Model

The long-run trend is obtained from a regression of the natural logarithm of the terms of trade, p, on a time trend. Straightforward additional regressors from the time-series literature are one

[5] See Bloch and Sapsford (2000) and Mutz and Ziesemer (2008) for formal models.

or more lagged dependent variables. We write this basic model per observation for country *i* at time *t* as follows.

$$log\ p_{it} = c_i + \gamma_i log\ p_{i,\ t-1} + \beta_i\ t + u_{it} \qquad (1)$$

Taking first differences (making the lagged version of this equation and subtracting it from the equation above) it yields:

$$d(log(p_{it})) = \gamma_i d(log(p_{i,\ t-1})) + \beta_i + u_{it} - u_{it-1} \qquad (2)$$

If we take expected values error terms drop out, and if $b < 1$ this equation is stable in growth rates. The expected long-run growth rate then is:[6]

$$d(log(p_i)) = \beta_i/(1-\gamma_i) \qquad (3)$$

Ram (2004) presents a special case of this model where $\gamma_i = 0$. Without lagged dependent variable one might run into an omitted variable bias, because lagged dependent variables tend to be highly significant. Moreover, the use of lagged dependent variables reduces serial correlation and the bias possibly caused by it. This can be seen as follows. Suppose the basic idea is captured by

$$lnp_t = c + \beta t + u_t \qquad (1')$$

[6] Bleaney and Greenaway (1993) and Erten (2011) discuss this model at greater length with all its possible outcomes.

We have dropped all cross-section indices. Next, assume that there is second order serial correlation

$$u = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \varepsilon_t \qquad (4)$$

From (1') we find $u_{t-1} = lnp_{t-1} - c - \beta(t-1)$ and $u_{t-2} = lnp_{t-2} - c - \beta(t-2)$. Insertion of these equations into (4) yields

$$u_t = \rho_1(lnp_{t-1} - c - \beta(t-1)) + \rho_2(lnp_{t-2} - c - \beta(t-2)) + \varepsilon_t \qquad (4')$$

Insertion of (4') into (1') yields

$$lnp_t = c + \beta t + \rho_1(lnp_{t-1} - c - \beta(t-1)) + \rho_2(lnp_{t-2} - c - \beta(t-2)) + \varepsilon_t$$

$$= \rho_1 lnp_{t-1} + \rho_2 lnp_{t-2} + \beta(1-\rho_1 - \rho_2)t + c(1-\rho_1 - \rho_2) + \rho_1 \beta + 2\rho_2 \beta + \varepsilon_t \qquad (1'')$$

With an adequate redefinition of coefficients this equation is identical to (1) in case of first-order serial correlation ($\rho_2 = 0$). By implication our equations and those used by Ram (2004) are equivalent if first-order autocorrelation is assumed.

Other regressors should not be included if one is only interested in getting to know whether there is a significant trend in the terms of trade. This is different of course if one is interested in explaining the terms of trade development in the sense of economic theory; then more regressors related to supply and demand are needed and they are likely to replace the time trend.[7] But this is not the interest of this paper. We only want to know (i) to which extent

[7] See Bloch and Sapsford (2000) and Mutz and Ziesemer (2008).

there is still a negative time trend; (ii) what the analysis looks like if we add time dummies as Cuddington and Urzua (1989), and Bleaney and Greenaway (1993) did; and (iii) how country-specific time trends differ, when other coefficients are homogenous or heterogeneous.

3. Data and econometric method: From fixed effects to more heterogeneity

We follow the 2009 World Bank classification for countries: low income (per capita income (GNI) of \$975 or less in 2008), lower-middle income (\$976-3855), upper-middle income (\$3856-11905), high-income-non-OECD and high-income OECD (above \$11906). As the issue of the trend in the terms of trade is typically discussed in regard to poor and hardly diversified countries other groupings of countries then in regard to income levels are more likely to hide the trends rather than to reveal them. The data are taken from the World Development Indicators (World Bank 2009). We found very similar results using the classification of 2008, which differs quite a bit from that of 2009. The similarity of the results indicates that they are robust in regard to the classification of countries.

We define the terms of trade as exports as capacity to import (ecm) divided by exports (ex), both for trade in goods and services and measured in constant local currency units. The data are available from 1960 to 2008, with some non-available observations of course. But in principle we have 49 observations per country. We resist the temptation to update in regard to 2009 data, because there is always the suspicion that crisis years in the end of the observation period drive the results.

First, we run a fixed effects estimate. For our model as expressed in equation (1) this means that we impose a constraint, that the coefficients are identical for all countries in a sample except for the intercept. The constraint imposed on the model therefore is $\beta = \beta_i$, $\gamma = \gamma_i$. With lagged dependent variables as in our model, fixed effects estimates of the coefficient of the lagged dependent variable are biased. The bias has an order of magnitude of *1/T,* and therefore the estimate is consistent in regard to the time dimension *T,* but the bias is smaller when more regressors are used (Asteriou and Hall 2011, chap. 19). As a general rule, with more than thirty observations in the time dimension the bias is low enough to use the panel fixed effects method (see Judson and Owen, 1999; Baltagi, 2008, ch.8) without instruments as we do in the first instance.

Subtraction of lnp_{t-1} on both sides of (1'') and rearrangement yields

$$dlnp_t = (\rho_1 + \rho_2 - 1)\, lnp_{t-1} - \rho_2 dlnp_{t-1} + \beta(1-\rho_1 - \rho_2)t + c(1-\rho_1 - \rho_2) + \rho_1 \beta + 2\rho_2 \beta + \varepsilon_t \qquad (1''')$$

With adequate redefinition of symbols this equation is the one underlying the augmented Dickey-Fuller test for unit roots in time-series analysis. If it is valid for that test it should be applicable for our purposes as well. The only problem is that under the null hypothesis of a unit root the standard assumptions in regard to the distribution of the coefficient of the trend variable do not hold (Davidson and McKinnon 2004, p.617). This means that we can use it for drawing strong conclusions only in the absence of unit roots. Therefore we will test for panel unit roots. A natural way out in case of unit roots is the additional use of first differences of equations (1) or (1'') such as equation (2) (see McCallum 1993, Cuddington 2010). Therefore we will estimate the equations also in first differences. However, if series have no unit roots but rather are stationary this leads to overdifferencing: Differenced stationary series have moving average residuals (Maddala and Kim 1998) and if these moving averages are not taken into account the estimates are inefficient leading to too many rejections as t-values are too low (McCallum 1993; Harvey et al. 2010). Our estimates presented below reveal that the results are indeed different then.

Second, to deal with endogeneity, we will also use system GMM, which combines in principle the level and the differenced equations above, (1) and (2), and applies instrumental variables. The econometric reasoning leading to the choice of the system GMM estimator is as follows (see Baltagi 2008, ch.8). In the presence of lagged dependent variables ignoring non-redundant fixed effects may lead to a heterogeneity bias. The use of fixed effects leads to a bias – mentioned briefly above - for the coefficient of the lagged dependent variable of the order of magnitude of *1/T*, where *T* is the number of periods for which data are available. With more than forty observations in the time dimension its bias of order of magnitude *1/T* is small anyway. Taking first differences can remove this bias and leads to the Anderson-Hsiao estimator, which is inefficient though. The first-differences estimator by Arellano-Bond removes this inefficiency. However, it has a small sample bias. The system GMM estimator by Arellano-Bover turns out to be the best estimator according to Monte-Carlo studies by Blundell and Bond (1998) for small T as well as Soto (2009) for $T = 8$ and $T=15$. Baltagi (2008, chap.8) points out that even with thirty observations and an expected value of the bias of $1/T$ = 3.3% the actual bias may still be as large as 20%. Therefore we will also apply the system GMM estimator, which estimates equation (1) and (2) simultaneously using lagged first differences of the regressors as instruments for equation (1) and lagged levels for equations (2) in the standard version. However, we will apply the orthogonal deviation version instead of the first-difference version, which uses a Helmert transformation subtracting from each residual the sum of all future residuals (see Arellano and Bover 1995). Bun and Windmeijer (2010) have pointed out that the above mentioned Monte-Carlo studies providing support for system GMM have assumed that the variance of the fixed effects and the residuals are unity. They show – for a model with a lagged dependent variable as the only regressor - that system GMM with no other regressors but the lagged dependent variable may have an upward bias of about 9% for $T = 6$ and of about 7% for $T = 15$ if the ratio of the fixed effects variance and that of the residuals is four instead of unity, but there is no bias if the variance ratio is below unity. Therefore we will also report these variances and their ratio although their analysis has not been made for the orthogonal deviation version of system GMM but rather for the standard version.

As the use of a time trend is essential in our research we cannot use time fixed effects for all years but one as usual as it would lead to collinearity. We will therefore investigate how the introduction of selected time dummies changes our fixed effect results.

Third, we run the regression for all countries not only with fixed effects but also with country-specific time trends. The only constraint then is the one for a common coefficient of the lagged dependent variable(s), $\gamma = \gamma_i$. Then we will add time dummies again to the regressions for the low-income countries and analyse the consequences.

Fourth, we will relax the constraint on the lagged dependent variables also, and estimate a system of equations. The contemporaneous residuals of the countries may be correlated. Therefore we will use the SUR method (seemingly unrelated regression).

Table 1 OVER HERE

4. Results

Tables 1 - 3 show results using the data of ‘exports as capacity to import divided by exports’ covering all goods and non-factor services, not just commodities; they are taken in natural logarithms, and abbreviated as log(ecm/ex). We find two significant lagged dependent variables for most samples in the first instance.

4.1. Trends in log-levels of the terms of trade

Table 1 shows the value of the coefficients and the marginal significance levels (p-values) in panel (a). Only the low-income countries have a significant trend, which is negative. The long-run trend, *β/(1-sum of coefficients of the lagged dependent variables)*, is also shown. For the low-income countries it is -0.42%. This value for country terms of trade is less negative than the value for commodity terms of trade of -0.6% of Ardeni and Wright (1992) and

Sapsford and Balasubramanyam (1994) and almost equal to the value of –0.44% found by Lutz (1999b). It is also in the range of the values for commodities obtained by Bleaney and Greenaway (1993) for several periods ending in 1991 and in the range of the literature surveyed by Lutz (1999b). Other goods seemingly have a very similar trend as commodities have relative to manufactures. The negative trend is stronger in the earlier periods than in later ones in our analysis (not shown), as we can see from starting the regression successively ten years later. Starting the regression successively one year later does not make the significantly negative time trend vanish though.[8]

4.2. Unit roots and over-differencing

There are neither common nor individual unit roots in the poor country sample according to panel standard unit root tests.[9] Unit root tests can be found in panel (b) of Table 1. For all other country groups than the low-income countries, the hypothesis of common unit roots cannot be rejected, but for individual unit roots most tests have low p-values.[10] However, if a model holds in levels it should also hold in first differences from the point of view of economic modelling. From an econometric point of view though first differences of stationary variables are called over-differenced and estimation with over-differenced variables should be avoided, because they have a bias if the implied moving average residuals are not taken into account explicitly. Our estimates for first differences are shown in panel (c) of Table 1. Low-income countries again have a significantly negative long-run time trend, which is even

[8] Alternatively we can add time dummies for the slope of the trend (see below). The Durbin-Watson statistic in Table 1, panel a, column 5 indicates that the serial correlation that might be generated by structural breaks is very limited. Note that we do not get the spurious appearance of a unit root for low-income countries below when not taking into account these breaks.
[9] Similarly, Erten (2011) finds no unit roots in net-barter terms of trade in time-series analysis for several country aggregates.
[10] We have not tested for spuriousness of the unit root as one knows it from time-series literature in case of structural breaks in the trends (see Harvey et al. 2010). This issue is currently under discussion in econometric research (see Chan and Pauwels 2009) especially in regard to the adequate modeling of the potential breaks. Moreover, we are mainly interested in the poor countries, which appear not to have a unit root and therefore are not subject to this question.

larger, 1.48%. Also lower-middle-income countries and high-income OECD countries have a negative time trend but both are highly insignificant. Results are clearly different under first differences. For the low-income countries first differenced results should not be used because they are based on over-differencing, which in turn stems from absence of unit roots according to panel (b); the trend results of log-levels should be used then, which are in panel (a) of Table 1. For all other country groups there are unit roots and differencing is in order and therefore the results of panel (c) should be used.

4.3. Dealing with endogeneity using system GMM

In Table 2 we present the results for the system GMM estimator in the orthogonal deviation form in column 3. The lagged dependent variable should have a coefficient which is above the underestimating one for country fixed effects in column 1 and below the one for OLS in column 2, which overestimates it (see also Durlauf et al. 2005). Indeed we found a coefficient between these two.[11] Moreover, our system GMM estimate is indeed about 2% higher than the fixed effects estimator as it should be for a bias $1/T$ *for* $T = 45$ in the presence of no further regressors. However, we have an unbalanced panel for 45 periods and 1158 observation for 39 countries, which implies effectively $T = 30$ and the bias $1/T = 3.3\%$ without additional regressors. With a time trend included, which should yield a slightly lower bias, a correction of 2% seems reasonable. For the Sargan statistic, Davidson and MacKinnon (2004) state that it should not be too high because of the standard chi-square test. Roodman (2009b) states that it should also not be too low because then the instruments do not do their work, and taking both arguments together its p-values should therefore not be too far outside the interval of 5% and 25%. We find that with 28.5% it is indeed close to this interval. As with one instrument less we have as many instruments as we have variables and no

[11] We use only one lag here for two reasons. First, when not using the EGLS method any more the second lag was insignificant. Second, when using two lags we cannot find any result analogous to having the coefficient of the lagged dependent variable between those of OLS and the within-estimator.

overidentifying constraints we get a J-statistic of zero, the Sargan difference test for the last lag in the list of instruments is not different from the Sargan test and also reasonable for the same reasoning.[12] The squared ratio of the variances for fixed effects and the residuals is about 0.156 and therefore lower than assumed by Blundell and Bond (1998) and Soto (2009). There is no indication for an upward bias that exists for values higher than unity of this ratio according to Bund and Windmeijer (2010). The long-run trend which comes from this estimate is almost a negative one percent, -0.9% (= 0.001428/(1-0.841584)). This value is more negative than the relevant one from Table 1, panel (a).

TABLE 2 OVER HERE

4.4. Time dummies instead of trends for the relevant cases

As a modification of the simple time trend in Table 1 panel (a), column 5, we can add time dummies for the slope of the trend (see Figure 1). They reveal a positive trend until 1970, ups and down until 1982, and then a negative trend with some fluctuations though and a slightly more negative trend for the last ten or fifteen years. With the exception of the resource price boom 1976-77 price trends are negative after 1970.

FIGURE 1 OVER HERE

Nice results for time trends may break down if time dummies for intercepts are introduced as Cuddington and Urzua (1989) as well as Bleaney and Greenaway (1993) have shown. Therefore we introduce time dummies for the intercepts of the log level equation of low-income countries. If a dummy may undermine a significant trend result it could in principal also improve an insignificant one. Therefore we add time dummies to the result for low-income countries and for the lower-middle-income countries of Table 1, panel (a). The dummies are defined as going always from 1960 to the years mentioned. Similar to Powell's

[12] Second-order serial correlation is arbitrarily close to zero with p-value of 0.99. But with a coefficient lower than 0.2 it is not relevant anyway (see Roodman 2009a). A random effects estimate shows no cross-section random effects.

(1991) outlier analysis we find that there are several significant time dummies and not only one. The regression results for low-income countries can be found in Appendix 1, Regression 1 and 2. For the low-income countries we find the following. The dummies go to 1962, 1970, 1974, 1975, 1977, 1981, 1987, 1992, 1995, 1996, 1997 for the fixed effects pooled least squares estimates (see Appendix 1, regression 1). They go to 1970, 1974, 1975, 1977, 1981, 1987, and 1992 for the case of a feasible or estimated Generalized Least Squares (EGLS) estimate that takes into account the heteroscedasticity (see Appendix 1, regression 2). Figure 2 shows the cumulated values of the dummies of low-income countries for each year. The solid line for the EGLS estimate is clearly on average a downward shift over time with some ups and downs, which resembles the negative time trend of column 5 of Table 1 panel (a). The stippled line for the pooled fixed effect estimate, which does not take into account heteroscedasticity, resembles the falling trend less because there are some positive jumps in the 1990s.[13]

FIGURE 2 OVER HERE

For the lower-middle-income countries we find significant dummies for the period from 1960 until the years 1972, 1974, 1975, 1977, 1992, 2007 in the first difference equation (regression output not shown). Figure 3 shows the cumulated value. Since 1993 the dummies indicate a positive intercept, which would equal the long-run growth rate if it were not for the change through the 2007 dummy. It seems clear that there is no resemblance with a negative trend here, whereas before 1992 clearly the opposite seemed to be the case. Of course this may also happen to the low-income countries in the future, for example if they have natural resources for which the prices may start increasing one day.

FIGURE 3 OVER HERE

[13] As the time dummies go always from 1960 to some later year the jumps occur when one of the time dummies ends.

Giving priority to the EGLS result we find that the dummies crowd out the trend but the overall impression is the same as for the time trend analysis: lower-middle income countries had no falling time trend in the terms of trade for the period under consideration but go up one big step through a time dummy in 1992; low-income countries have falling terms of trade either in a time trend or go downward with ups and downs, with the most serious downward jump indicated by the 1975 dummy, as suggested by Powell's (1991) outlier analysis.

4.5. Country-specific time trends

Table 3 summarizes the results if countries have a common coefficient of the lagged dependent variable and fixed effects as before but individual time trends. Column 1 shows the number of countries with a significantly negative time trend in each sample. This is largest for the poorest countries, 15; but in percentages of all countries in the respective groups, column 5, the high-income OECD has a larger share. The number of significantly positive trends in column 2 is lowest in low-income countries as a percentage of the total. Insignificant trends are most frequent in all groups except for high-income OECD countries.

Table 3 OVER HERE

When we estimate in first differences instead, only seven low-income countries have significantly negative time trends; three others are just insignificant and when starting the estimation from 1990 onwards there are eleven significantly negative ones. Differencing leads to an indication of a low number of cases here; this is likely to be generated by the inefficiency implied by over-differencing and resulting in too many rejections.[14] The common-unit-root test of Table 1, panel (b), is relevant here under our assumption of a common coefficient of the lagged dependent variable. The results of the upper part of Table 1 are the relevant ones for low-income countries and therefore level results are more plausible

[14] As the problem is low efficiency, one could accept higher significance levels, without guidance how far to go though. We have to go slightly beyond a 30% level to find 15 negative trends as for levels. This indicates the inefficiency.

in this sub-section. For lower-middle income countries first – differences are relevant and there are only two countries which show falling terms of trade.

Next, we have again added time dummies with common coefficients for the low-income countries to the regressions with country-specific time trends. The result (see Appendix 1, regression 3) is that almost all time dummies are significant. Only four low-income countries keep having a significantly negative time trend. We calculate the intercept for each year through adding up the coefficients of the valid time dummies and the constant as shown in Figure 4. There is clearly a shift down of the whole equation over time indicating falling terms of trade.

FIGURE 4 OVER HERE

4.6. All coefficients country specific

Finally, we relax also the last constraint of a common lagged dependent variable and estimate the system of equations (1), which contains forty equations because there are forty countries, using the SUR method (see Appendix 2). We use only one lagged dependent variable. All coefficients of lagged dependent variables are below 0.96 and most much lower. This adds to the information in panel (b) of Table 1, that there are no individual unit roots in low-income countries. The number of low-income countries with significantly negative trends goes from 15 in Table 3 to 19 of 39 countries (49%). There are five significantly positive ones. If we exclude countries with less than 15 observations we have 16 of 34 countries with significantly falling terms of trade. If we require at least 20 observations per country we have 15 of 29 with significantly falling terms of trade. If we require at least 30 observations 9 of 21 countries have significantly falling terms of trade. If we estimate the system without constraints using the SUR method again but now for first differences, there are only six countries with significantly negative terms of trade trends. Again over-differencing leads to a low number of cases of falling terms of trade; it should only be applied to variables which are integrated of order one.

5. Interpretation and conclusion

Our interpretation of these results is that 10 of the twenty-seven high-income OECD countries are passing on more of technical change to their customer countries than they get as suggested by Kravis (1970), whereas the majority has no significantly falling terms of trade. We rely here on the results for first differences as we find panel unit roots for the high-income OECD countries. For low income countries though there are no indications of unit roots and we should not rely on results in first differences but rather on those for levels. Assuming that the low-income countries have hardly any technical progress, the fall in the terms of trade by about 0.4% according to Table 1 might be due to a lack of growth of export demand, which reduces the growth of imported investment goods as suggested by Prebisch (1950/1962, p.2). Combining first differences and level in the system GMM estimation in order to take care of endogeneity leads to a falling trend too, with values between those from levels and over-differencing. As three low-income countries have significantly positive trends they probably have strong export demand growth relative to the technical change, if any. Applying time dummies to these results makes the time trend variable insignificant, but the calculated intercepts per period also indicate falling terms of trade for the low-income country. In no version of our model do we find falling terms of trade for lower-middle income countries. Using the SUR method and no constraints on the parameters as in equation (1) falling terms of trade are the case for almost 50% of the low-income countries. Estimation in first differences without good reason to do so, leads to inefficiency through over-differencing implying too many rejections and therefore a much lower number of low-income countries with falling terms of trade.

There are two common counterarguments in regard to the falling terms of trade results. The first refers to transport costs. Import prices contain cost, insurance and freight (CIF) but export prices are 'free on board' (fob) prices. The stronger the technical change in transport if passed on in transport prices the lower the trend in import price indices.[15] But we have no empirical indication for this for the time under consideration. If anything this biases the trend for country terms of trade upward. The second common argument is unmeasured trends in quality of goods. It could affect both, price indices of imports and exports, both of which contain raw materials, manufactures and services; here it is also important that many countries have falling shares of raw materials and multinationals are active worldwide and produce quality improvements in all goods, in particular those traded two ways in the vein of global production chains.[16] If manufactures have more quality change LDC import price increases may be overestimated, but the increasing share of manufactures in exports would do the same. It is hard to imagine how relative prices could plausibly become constant through these quality corrections. Moreover, these days many products improve quality without increasing the prices. Then it is hard to have any theory of the value of quality and the appropriate price correction, which normally is based on the idea that increasing quality has caused costs passed on into prices. But price theory is mostly not that simple. In particular, the process improving quality may have technical progress itself, which may ensure that there is no price increase when quality is improved. The forces of asymmetric technical change in processes and income elasticities of export demand would still be in existence if quality were correctly taken into account. Therefore we think that the step from the analysis of trends in commodity terms of trade as initiated by Prebisch and Singer and manufactures as initiated by Keesing (1979) and Sarkar and Singer (1991) to country terms of trade is an important one.

[15] Data on c.i.f./f.o.b. factors are no longer published by the IMF.
[16] Wacker (2011) finds a positive impact of multinationals on the terms of trade. This would imply that some measurable impact of multinationals is already captured by the data. But it is hard to link this to the question which quality correction should be applied to the price indices.

We have given only an intuitive interpretation of the results. More elaborate theorizing is possible but not the intention of this paper. A good model must be able to explain positive and negative trends and should take into account elements that are included by relatively successful closed economy growth models – savings, investment, labour growth and technical change. The preferred elements to be added to a closed economy growth model are exports and imported capital goods as in the model of Bardhan and S.Lewis (1970) a variant of which can be estimated (see Mutz and Ziesemer 2008; Habiyaremye and Ziesemer 2012). This type of model has the property that investment and GDP per capita growth are both positively related to the terms of trade as found in the evidence of Bleaney and Greenaway (2001) and Jawaid and Raza (2012) for India. For the countries with falling or increasing terms of trade it can be expected that the open economy model does not yield results, which are different from those of closed economy growth. The results suggest that being richer makes the problem of falling terms of trade less severe. Poor countries may have more favourable terms of trade development if they have a lower share of products with low-income elasticities of demand. This is probably more likely the more countries are diversified. Diversification policies at each level of growth may be avoiding falling terms of trade as well. Infrastructure and education are likely to be helpful to get more diversification (see Habiyaremye and Ziesemer 2006). Therefore it is tempting to speculate that some of the variables that also support growth will help stopping the terms of trade from falling. But Chakraborty (2012) shows that in the past this has not happened: manufactures of developing countries have falling terms of trade vis-à-vis those of developed countries. We hope to have shown though that the problem of falling terms of trade continues to exist for many countries also when taking into account unit roots, endogeneity, dummies, and heterogeneity.

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Appendix 1: Regression output with time dummies

Regression 1: Time dummies instead of common trend for low-income countries

Dependent Variable: (LOG(ECM?/EX?)). Method: Pooled Least Squares
Sample (adjusted): 1962 2008 Included observations: 47 after adjustments
Cross-sections included: 40 (low income countries)
Total pool (unbalanced) observations: 1238

Period SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.023	0.007	-3.279	0.001
LOG(ECM?(-1)/EX?(-1))	0.798	0.030	26.308	0.000
LOG(ECM?(-2)/EX?(-2))	0.042	0.030	1.432	0.152
DUM6062	-0.038	0.021	-1.825	0.068
DUM6070	0.061	0.026	2.321	0.021
DUM6074	0.123	0.057	2.150	0.032
DUM6075	-0.211	0.067	-3.126	0.002
DUM6077	0.101	0.050	2.018	0.044
DUM6081	-0.037	0.021	-1.752	0.080
DUM6087	0.068	0.019	3.514	0.001
DUM6092	-0.072	0.025	-2.856	0.004
DUM6095	0.075	0.026	2.867	0.004
DUM6096	-0.073	0.028	-2.605	0.009
DUM6097	0.039	0.019	2.035	0.042

Fixed Effects (Cross)			
AFG--C	-0.135	MDG--C	-0.009
BGD--C	0.014	MWI--C	0.092
BEN--C	0.002	MLI--C	-0.023
BFA--C	0.014	MRT--C	-0.001
BDI--C	-0.035	MOZ--C	0.051
KHM--C	0.018	MMR--C	0.090
CAF--C	-0.047	NER--C	-0.089
TCD--C	0.022	RWA--C	-0.073
COM--C	0.007	SEN--C	-0.009
ZAR--C	0.011	SLE--C	0.014
ERI--C	-0.017	SOM--C	-0.042
ETH--C	0.013	TJK--C	-0.091
GMB--C	0.004	TZA--C	0.043
GHA--C	-0.051	TGO--C	-0.032
GIN--C	0.013	UGA--C	0.038
GNB--C	-0.091	UZB--C	0.053
HTI--C	-0.005	VNM--C	0.014
KEN--C	-0.012	YEM--C	0.015
KGZ--C	-0.020	ZMB--C	0.076
LAO--C	0.040	ZWE--C	0.004

Effects Specification: Cross-section fixed (dummy variables)

R-squared	0.874	Mean dependent var	0.028
Adjusted R-squared	0.869	S.D. dependent var	0.417
S.E. of regression	0.151	Akaike info criterion	-0.898
Sum squared resid	27.100	Schwarz criterion	-0.679
Log likelihood	609.0	Hannan-Quinn criter.	-0.816
F-statistic	158.2	Durbin-Watson stat	2.044
Prob(F-statistic)	0		

Regression 2: Time dummies instead of common trend for low-income countries (EGLS)

Dependent Variable: (LOG(ECM?/EX?)) Method: Pooled EGLS (Cross-section weights)
Sample (adjusted): 1962 2008 Included observations: 47 after adjustments
Cross-sections included: 40 (low income countries)
Total pool (unbalanced) observations: 1238 Linear estimation after one-step weighting matrix
Cross-section weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.016	0.005	-3.610	0.0003
LOG(ECM?(-1)/EX?(-1))	0.788	0.026	30.277	0.0000
LOG(ECM?(-2)/EX?(-2))	0.046	0.026	1.804	0.0715
DUM6070	0.042	0.016	2.578	0.0101
DUM6074	0.072	0.029	2.438	0.0149
DUM6075	-0.135	0.032	-4.190	0.0000
DUM6077	0.090	0.022	3.999	0.0001
DUM6081	-0.041	0.015	-2.701	0.0070
DUM6087	0.036	0.011	3.187	0.0015
DUM6092	-0.010	0.006	-1.625	0.1044
Fixed Effects (Cross)				
AFG--C	-0.135		MDG--C	-0.009
BGD--C	0.016		MWI--C	0.097
BEN--C	0.003		MLI--C	-0.025
BFA--C	0.015		MRT--C	0.000
BDI--C	-0.034		MOZ--C	0.051
KHM--C	0.015		MMR--C	0.096
CAF--C	-0.056		NER--C	-0.090
TCD--C	0.024		RWA--C	-0.075
COM--C	0.005		SEN--C	-0.009
ZAR--C	0.011		SLE--C	0.015
ERI--C	-0.019		SOM--C	-0.041
ETH--C	0.011		TJK--C	-0.093
GMB--C	0.004		TZA--C	0.044
GHA--C	-0.053		TGO--C	-0.032
GIN--C	0.010		UGA--C	0.038
GNB--C	-0.096		UZB--C	0.047
HTI--C	-0.004		VNM--C	0.012
KEN--C	-0.012		YEM--C	0.017
KGZ--C	-0.022		ZMB--C	0.080
LAO--C	0.033		ZWE--C	0.003

Effects Specification: Cross-section fixed (dummy variables)

	Statistics		
R-squared	0.878	Mean dependent var	0.045
Adjusted R-squared	0.873	S.D. dependent var	0.421
S.E. of regression	0.150	Sum squared resid	26.85
F-statistic	178.8	Durbin-Watson stat	1.981
Prob(F-statistic)	0		

	Unweighted Statistics		
R-squared	0.872	Mean dependent var	0.028
Sum squared resid	27.56	Durbin-Watson stat	2.036

Regression 3: Time dummies with country specific trends and fixed effects for low-income countries

Dependent Variable: (LOG(ECM?/EX?)) Method: Pooled Least Squares
Sample (adjusted): 1961 2008 Included observations: 48 after adjustments
Cross-sections included: 40 (low income countries). Total pool (unbalanced) observations: 1278
Cross-section weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Prob.		Coefficient	Prob.	Fixed Effects (Cross)	
C	-0.192	0.061	AFG--@TREND	-0.532	0.000	AFG--C	23.89
LOG(ECM?(-1)/EX?(-1))	0.724	0.000	BGD--@TREND	-0.004	0.072	BGD--C	0.205
DUM6007	0.037	0.000	BEN--@TREND	0.007	0.001	BEN--C	-0.128
DUM6005	-0.021	0.000	BFA--@TREND	0.006	0.010	BFA--C	-0.062
DUM6003	0.019	0.001	BDI--@TREND	0.005	0.047	BDI--C	-0.129
DUM6002	0.014	0.008	KHM--@TREND	0.004	0.053	KHM--C	-0.020
DUM6001	-0.037	0.000	CAF--@TREND	0.004	0.085	CAF--C	-0.105
DUM6000	0.028	0.000	TCD--@TREND	0.004	0.045	TCD--C	-0.021
DUM6099	0.021	0.000	COM--@TREND	0.006	0.005	COM--C	-0.112
DUM6098	-0.014	0.016	ZAR--@TREND	0.012	0.000	ZAR--C	-0.251
DUM6097	0.043	0.000	ERI--@TREND	0.001	0.630	ERI--C	0.039
DUM6096	-0.070	0.000	ETH--@TREND	0.000	0.846	ETH--C	0.142
DUM6095	0.134	0.000	GMB--@TREND	0.002	0.314	GMB--C	0.017
DUM6094	-0.104	0.000	GHA--@TREND	0.005	0.027	GHA--C	-0.164
DUM6093	0.028	0.000	GIN--@TREND	-0.003	0.221	GIN--C	0.243
DUM6092	-0.080	0.000	GNB--@TREND	0.001	0.741	GNB--C	-0.103
DUM6091	0.066	0.000	HTI--@TREND	0.011	0.000	HTI--C	-0.212
DUM6090	0.022	0.003	KEN--@TREND	0.007	0.001	KEN--C	-0.154
DUM6089	-0.027	0.000	KGZ--@TREND	0.009	0.000	KGZ--C	-0.281
DUM6088	0.104	0.000	LAO--@TREND	0.012	0.000	LAO--C	-0.368
DUM6087	-0.070	0.000	MDG--@TREND	0.006	0.008	MDG--C	-0.116
DUM6086	0.069	0.000	MWI--@TREND	0.004	0.082	MWI--C	0.104
DUM6083	0.021	0.006	MLI--@TREND	0.005	0.028	MLI--C	-0.103
DUM6082	-0.030	0.000	MRT--@TREND	0.007	0.001	MRT--C	-0.141
DUM6081	-0.033	0.000	MOZ--@TREND	0.000	0.984	MOZ--C	0.202
DUM6080	0.051	0.000	MMR--@TREND	-0.003	0.188	MMR--C	0.272
DUM6079	0.026	0.003	NER--@TREND	0.008	0.000	NER--C	-0.296
DUM6078	-0.047	0.000	RWA--@TREND	0.012	0.000	RWA--C	-0.370
DUM6077	0.146	0.000	SEN--@TREND	0.007	0.001	SEN--C	-0.155
DUM6076	-0.053	0.000	SLE--@TREND	0.015	0.000	SLE--C	-0.298
DUM6075	-0.162	0.000	SOM--@TREND	0.013	0.000	SOM--C	-0.285
DUM6074	0.162	0.000	TJK--@TREND	-0.022	0.000	TJK--C	0.897
DUM6072	-0.022	0.008	TZA--@TREND	0.005	0.016	TZA--C	-0.020
DUM6071	-0.022	0.016	TGO--@TREND	0.003	0.146	TGO--C	-0.086
DUM6070	0.117	0.000	UGA--@TREND	-0.004	0.044	UGA--C	0.351
DUM6067	0.014	0.108	UZB--@TREND	0.014	0.000	UZB--C	-0.380
DUM6066	0.015	0.084	VNM--@TREND	0.005	0.011	VNM--C	-0.074
DUM6063	0.032	0.001	YEM--@TREND	0.002	0.337	YEM--C	0.061
DUM6062	-0.054	0.000	ZMB--@TREND	0.003	0.150	ZMB--C	0.096
DUM6061	0.036	0.000	ZWE--@TREND	0.008	0.000	ZWE--C	-0.159

Effects Specification: Cross-section fixed (dummy variables)

R-squared	0.887	Mean dependent var	0.034	S.D. dependent var	0.421
Adjusted R-squared	0.875	Akaike info criterion	-0.884	Prob(F-statistic)	0
S.E. of regression	0.149	Schwarz criterion	-0.404	F-statistic	76.86
Sum squared resid	25.7	Hannan-Quinn criter.	-0.704	Durbin-Watson stat	2.008
Log likelihood	684.0				

Appendix 2 Simultaneous equation estimation with full heterogeneity
Regression results for equation (1) with country-specific coefficients for trends, constants and lagged dependent variables

Country	*lag.dep.var.*	*p-value*	*trend*	*p-value*	*constant*	*p-value*	*Obs.*	*adj.R2*	*DW (a)*
AFG	-0.168	0.000	-0.255	0.000	12.050	0.000	3	1.00	1.54
BGD	0.953	0.000	0.000	0.928	-0.013	0.888	48	0.94	1.56
BEN	0.399	0.000	-0.002	0.016	0.073	0.007	45	0.36	1.93
BFA	0.754	0.000	-0.001	0.317	0.068	0.119	41	0.63	1.88
BDI	0.525	0.000	-0.006	0.080	0.066	0.375	36	0.35	1.98
KHM	-0.012	0.949	-0.002	0.081	0.081	0.045	14	0.00	1.82
CAF	0.010	0.965	-0.028	0.023	1.016	0.048	8	0.49	1.93
TCD	0.386	0.000	-0.008	0.000	0.307	0.000	48	0.82	2.04
COM	0.183	0.108	-0.004	0.113	0.124	0.170	28	0.02	1.80
ZAR	0.493	0.000	0.008	0.000	-0.208	0.000	48	0.70	1.67
ERI	0.703	0.000	-0.001	0.883	-0.011	0.972	15	0.51	1.47
ETH	0.630	0.000	-0.009	0.001	0.319	0.001	27	0.72	1.98
GMB	0.550	0.000	-0.008	0.000	0.261	0.000	42	0.78	1.56
GHA	0.510	0.000	-0.006	0.001	0.004	0.916	48	0.64	1.87
GIN	0.578	0.000	-0.009	0.012	0.374	0.015	22	0.91	1.35
GNB	0.675	0.000	-0.005	0.095	-0.032	0.677	37	0.65	1.98
HTI	0.375	0.003	0.004	0.093	-0.086	0.054	33	0.09	1.76
KEN	0.956	0.000	0.001	0.353	-0.023	0.351	48	0.79	1.92
KGZ	0.737	0.000	0.003	0.574	-0.164	0.437	15	0.55	2.00
LAO	0.537	0.048	0.010	0.026	-0.436	0.033	9	0.05	1.79
MDG	0.827	0.000	-0.001	0.290	0.016	0.568	48	0.80	1.78
MWI	0.745	0.000	-0.004	0.018	0.237	0.002	48	0.81	1.77
MLI	0.555	0.000	-0.003	0.002	0.042	0.127	40	0.64	1.54
MRT	0.640	0.000	-0.001	0.427	0.037	0.366	45	0.52	1.74
MOZ	0.675	0.000	-0.008	0.003	0.389	0.002	28	0.75	1.85
MMR	0.731	0.000	-0.011	0.000	0.421	0.000	44	0.95	1.84
NER	0.874	0.000	-0.001	0.471	-0.041	0.457	39	0.73	2.12
RWA	0.413	0.000	0.007	0.006	-0.424	0.000	39	0.35	1.96
SEN	0.685	0.000	-0.001	0.483	0.004	0.866	48	0.62	1.73
SLE	0.418	0.001	0.010	0.050	-0.249	0.044	28	0.33	1.39
SOM	0.656	0.000	0.005	0.071	-0.143	0.021	29	0.63	1.49
TJK	0.717	0.000	-0.033	0.000	1.190	0.000	18	0.72	1.97
TZA	0.385	0.011	0.003	0.495	-0.027	0.875	16	0.11	2.05
TGO	0.168	0.105	-0.015	0.000	0.268	0.000	45	0.59	1.98
UGA	0.637	0.000	-0.014	0.001	0.599	0.001	26	0.77	1.17
UZB	0.441	0.002	0.016	0.003	-0.623	0.005	14	0.68	1.12
VNM	0.389	0.011	0.003	0.150	-0.135	0.136	18	0.20	1.51
YEM	-0.055	0.770	0.000	0.151	0.000	0.101	13	-0.06	2.10
ZMB	0.724	0.000	-0.005	0.040	0.258	0.002	48	0.74	1.69
ZWE	0.697	0.000	0.001	0.602	-0.027	0.489	29	0.54	1.10

(a) Estimation Method: Seemingly Unrelated Regression with one equation per country. Sample: 1961-2008. Periods: 48. Total system (unbalanced) observations 1278. Linear estimation after one-step weighting matrix.

(b) Durbin-Watson statistic; in case of endogeneity it is only indicative. It is not used for an exact test here; that would require a Breusch-Godfrey test.

Table 1					
Common trend in panels of exports-as-capacity-to-import/exports					
with fixed effects and lagged dependent variables (a)					
Panel (a)					
Estimation in levels (a)					
Income group	High income OECD	High income Non-OECD	Upper middle income	Lower middle income	Low income
Constant	0.0020	0.0001	0.0063	0.0030	0.0125
(p-value)	(0.27)	(0.99)	(0.03)	(0.01)	(0.11)
coeff.lag.dep.(-1)	1.05	1.03	0.91	0.89	0.80
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
coeff.lag.dep.(-2)	-0.151	-0.140	-0.064	-0.034	0.049
(p-value)	(0.00)	(0.03)	(0.06)	(0.26)	(0.06)
Coeff. Trend	-0.00009	0.00026	-0.00004	-0.00003	-0.00064
(p-value)	(0.21)	(0.30)	(0.70)	(0.54)	(0.02)
long-run coeff (b)	-0.0009	0.0023	-0.0003	-0.0002	-0.0042
Adj.R^2	0.916	0.95	0.834	0.831	0.874
DW (c)	1.94	1.89	1.90	1.98	1.99
Number of countries	27	19	39	44	40
Total observations	1152	338	1110	1420	1238
Prob. fixed effects redundant (F-stat.)	0.77	0.00	0.14	0.04	0.00
Period	1962-2008	1962-2008	1962-2008	1962-2008	1962-2008
(a) Dependent variable: LOG(ECM/EX). Method:Fixed effects. Pooled EGLS;PCSE: Period SUR					
(b) Coefficient of trend divided by (1- sum of coefficients of lagged dependent variables).					
This value is the stable growth rate to which the system converges.					
(c) Durbin-Watson statistic. Although it is not the adequate statistic for rigorous tests under endogeneity, its size indicates that there can be no serious serial correlation bias. See Epple and McCallum 2006.					
(d) F-statistic					
Panel (b) Unit roots					
Income group	High income OECD	High income Non-OECD	Upper middle income	Lower middle income	Low income
Test\p-values					
Null: Unit root (assumes common unit root process)					
Levin, Lin & Chu t*	0.58	0.0014	0.62	0.66	0.03
Breitung t-stat	0.03	0.98	0.998	0.98	0.00
Null: Unit root (assumes individual unit root process)					
Im, Pesaran and Shin W-stat	0.060	0.264	0.0001	0.137	0
ADF - Fisher Chi-square	0.008	0.093	0	0.002	0
PP - Fisher Chi-square	0.122	0.005	0.0001	0.001	0.0001
Observations	1141-1179	294-334	1035-1128	1337-1423	1184-1275
Countries	27	18	38	41	39

Table 1 (continued)					
Panel (c)					
Estimation in first differences					
Income group	High income OECD	High income Non-OECD	Upper middle income	Lower middle income (c)	Low income (d)
Constant	-0.000065	0.0108	0.0056	-0.0007	-0.0175
(p-value)	(0.75)	0	(0.00)	(0.86)	(0.00)
coeff.lag.dep.(-1)	0.144	0.114979	-0.02	-0.13	-0.18
(p-value)	0.00	0.1	(0.56)	(0.00)	(0.00)
coeff.lag.dep.(-2)	-0.198	-0.225	-0.110	-0.138	-0.157
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
long-run coeff (b)	-0.0001	0.0097	0.0050	-0.00062	-0.0148
Adj.R^2	0.058	0.10	-0.003	0.012	0.032
DW (a)	2.02	2.04	1.93	1.95	2.03
Number of countries	27	19	39	43	39
Period	1963-2008	1963-2008	1963-2008	1966-2008	1970-2008
Total observations	1125	318	1071	1240	987
Prob. fixed effects redundant (b)	0.47	0.37	0.93	0.56	0.76
Dependent Variable: D(LOG(ECM/EX))	Method: Pooled EGLS (Cross-section weights) for first three regressions; panel least squares first the last two. PCSE: Period SUR.				

(a) Durbin-Watson statistic. Although it is not the adequate statistic for rigorous tests under endogeneity, its size indicates that there can be no serious serial correlation bias. See Epple and McCallum 2006.

(b) F-statistic. Dropping fixed effects changes neither the sign nor the size of the coefficients or p-values strongly.

(c) There are three more lags included, because lag five is still significant, and serial correlation should be minimized.

(d) There are four more lags included, because lag six is still significant, and serial correlation should be minimized.

Table 2	**A system GMM estimate dealing with endogeneity**		
(a)	*Fixed effects (b)*	*OLS (c)*	*System GMM (d)*
constant	0.044	0.0085	-
	(0.0012)	(0.37)	-
LOG(ECM(-1)/EX(-1))	0.825	0.915	0.842
	(0.0000)	(0.00)	(0.00)
trend	-0.0017	-0.0005	-0.0014
	(0.0003)	(0.09)	(0.01)
long-run trend	-0.010	-0.006	-0.009
Countries	40	40	39
Periods	1961-2008	1961-2008	1964-2008
Observations	1278	1278	1158
s.e. of regression	0.157	0.159	0.156
s.e. of fixed effects	0.066	-	0.062
variance ratio (e)	0.178	-	0.156

Source: Author's estimates

(a) For all three regressions, p-values in parentheses and PCSE Period SUR.

(b) Panel least squares with fixed effects, equivalent to the least-squares dummy variable estimator or within estimator. Adj. R sq.: 0.861. Durbin-Watson stat.: 2.07

(c) Ordinary least squares. Adj. R-sq.: 0.858. Durbin-Watson: 2.15

(d) Fixed effects with orthogonal deviations of Arellano and Bover (1995). Instrument rank: 3. J-statistic: 1.14. Sargan p-value: 0.285. Instrument specification: LOG(ECM(-2)/EX(-2)) LOG(ECM(-3)/EX(-3)), trend. The Sargan-difference test for the last lag is the same as the Sargan test, because an instrument rank of 2 equal to the number of estimated coefficients yields a J-statistic of zero.

(e) Variance ratio is the squared fraction of s.e. of fixed effects and s.e. of regression.

Table 3 **Number of countries with individual trends in exports-as-capacity-to-import/exports (a)**

Levels

Group	*Signif. Neg.*	*Signif.pos.*	*Insign.*	*Total*	*% sign.neg*	*coeff. lag.dep.(b)*
High income OECD	11	8	8	27	0.41	0.84
High Income Non-OECD	1	2	16	19	0.05	-0.06
Upper Middle income	4	8	27	39	0.10	0.81
Lower Middle Income	11	7	26	44	0.25	0.76
Lower income	15	3	22	40	0.38	0.73

(a) Least squares with country-specific fixed effects and common coefficient of the lagged dependent variable.

(b) Period SUR PCSE; p-val. is 0.0000 in all cases. For high income countries four lags are significant; for all other samples only one lag.

First differences

Group	*Signif. Neg.*	*Signif.pos.*	*Insign.*	*Total*	*% sign.neg*	*coeff. lag.dep.(b)*
High income OECD	10	9	8	27	0.37	-0.05
High Income Non-OECD	0	4	15	19	0.00	-0.27
Upper Middle income	0	1	38	39	0.00	-0.12
Lower Middle Income	2	3	37	43	0.05	-0.42
Lower income	7	3	29	39	0.18	-0.77

(a) Least squares with country-specific fixed effects and common coefficient of the lagged dependent variable.

(b) See Table 1, panel (c) for details of estimation.

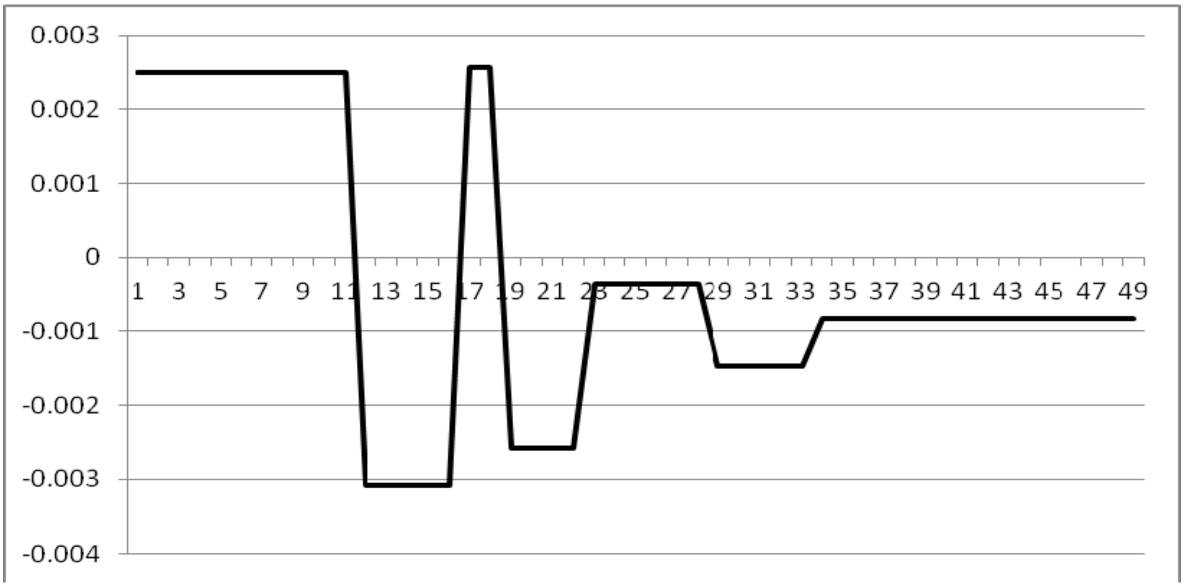

Fig. 1: Time-dependent coefficients of trends for low-income countries (EGLS fixed effects cross), 1960-2008.

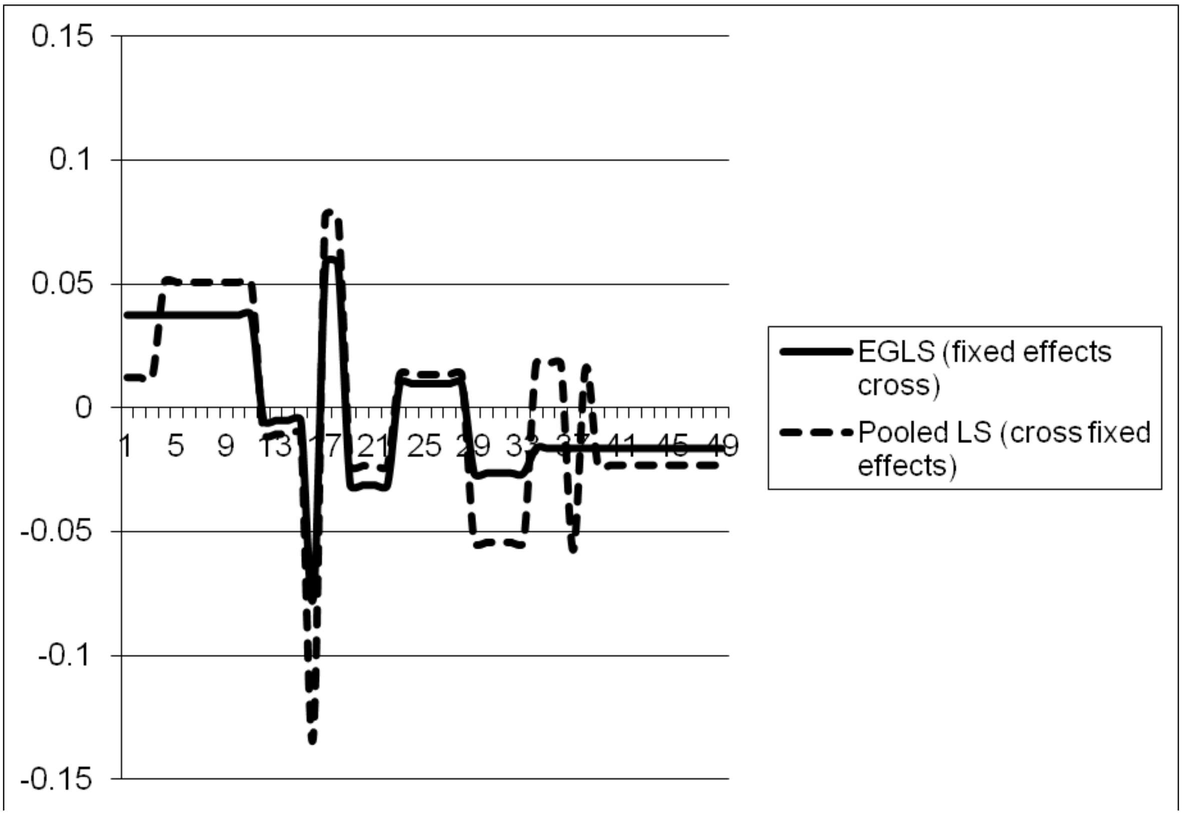

Fig. 2. Intercept dummies replacing a significant downward trend in terms of trade of low-income countries, 1960-2008.

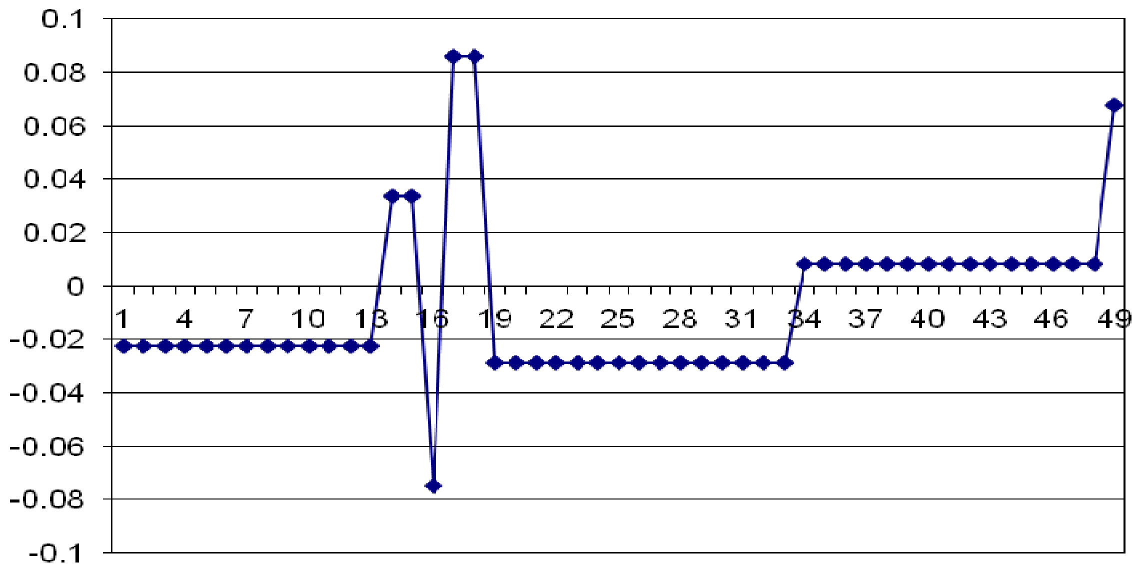

Fig. 3. Cumulated values of constant and intercept dummies for first-difference estimates for lower-middle income countries, 1960-2008.

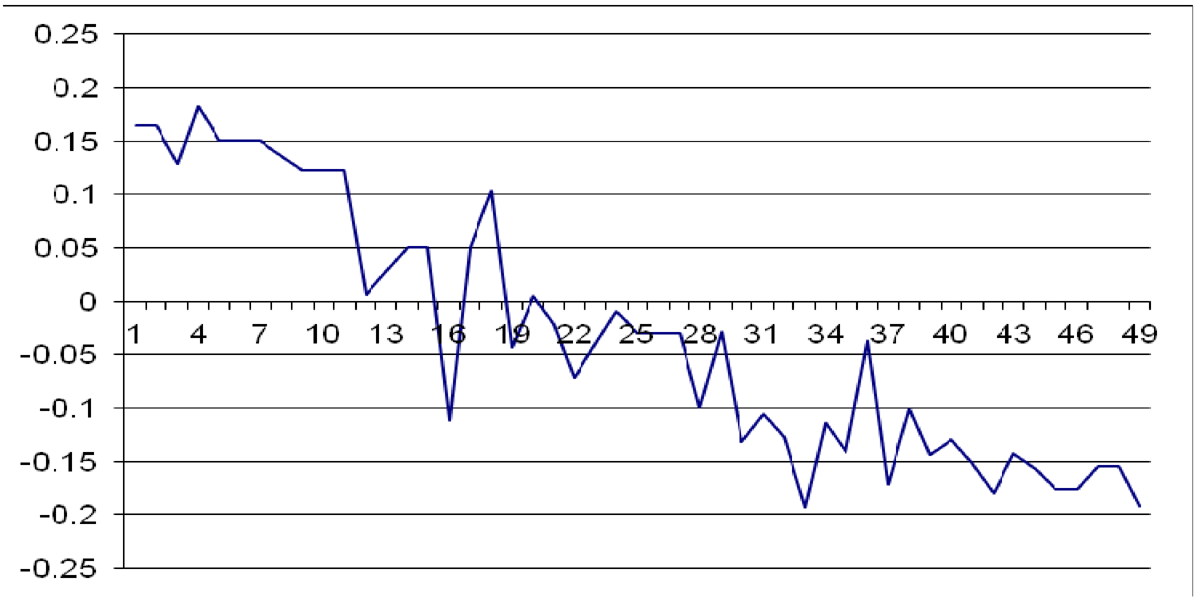

Fig. 4. Period-specific intercepts from time dummies in the presence of country-specific time trends show falling terms of trade, 1960-2008.

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