Exports' quality-adjusted productivity and economic growth

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Abstract

In a recent study, Hausmann, Hwang and Rodrik (2007) find a positive and robust relationship between the productivity level associated to a country's exports, called EXPY, and subsequent economic growth. A shortcoming of the EXPY indicator used by those authors is that it does not take into account the quality differences within exported products across countries. In order to overcome this limitation, we develop a new quality-adjusted EXPY indicator. We show that, once quality differences within products are taken into account, there is not a robust relationship between EXPY and subsequent growth.

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1. Introduction

In a recent study, Hausmann, Hwang and Rodrik (2007) (henceforth HHR) show that countries that export goods associated with higher productivity levels grow more rapidly. Their results were recently confirmed by Guerson, Parks and Parra (2007) (henceforth GPP).

In order to measure the productivity of a country's exports, HHR develop an indicator, called EXPY, which is calculated in two steps. First, they compute the income level associated to each commodity. This indicator, denominated PRODY, is a weighted average of exporting countries' GDP per capita, where the weights are each exporting country's revealed comparative advantage in the commodity. Secondly, the EXPY is calculated as a weighted average of each exported commodity's PRODY, where the weights are the shares of each product in the country's total exports.

As HHR recognise, a shortcoming of PRODY, and hence of EXPY, is that it does not take into account the quality differences within products. For example, as Rodrik (2006) shows, even at the Harmonised System (HS) 6-digit disaggregation level, there are large differences in products' export unit values, a common proxy for quality, across countries. Moreover, Schott (2004) points out that those differences are related with countries GDP per capita level. He shows that, within narrowly defined manufactures, there is a clear vertical differentiation across countries, with low GDP per capita countries specialised at the lower end of the quality spectrum and large GDP per capita countries specialised at the higher end of the quality spectrum.

If the PRODY indicator does not take into account the differences in quality within products it might bias countries' EXPY. In particular, it may overvalue low GDP per capita countries' EXPY and undervalue high GDP per capita countries' EXPY. For a low GDP per capita country the overvaluation will be more severe the higher the share in its exports of commodities that are also exported by developed countries; on its hand, for a high GDP per capita country the undervaluation will be more pronounced the higher the share in its exports of commodities that are also exported by developing countries.

If the extent of the EXPY bias is correlated with countries' subsequent growth it may affect the conclusions reached by HHR. For example, we expect EXPY overvaluation to be higher among developing countries specialised in manufactured exports than among developing countries specialised in primary products, as developed countries export more of the first type of commodities. If developing countries that have specialised in manufactures' exports have grown faster than developing countries that have specialised in primary products' exports, we would find an artificially stronger correlation between country's initial EXPY and subsequent growth.

The contribution of this paper is to develop PRODY and EXPY indicators that incorporate quality differences within products. Equipped with those new indicators, we analyse whether there is still a positive and robust relationship between the initial productivity level associated to a country's exports and subsequent growth.

In order to incorporate quality differences into PRODY and EXPY indicators we create three varieties from each HS 6-digit product: a low quality variety, a medium quality variety and a high quality variety. For example, from the HS 851650 product category, "microwave ovens", we create three varieties: low quality microwave ovens, medium quality microwave ovens and high quality microwave ovens. For each commodity, we establish the three quality ranges based on the unit values of the countries that export that commodity. Once a country's exports can be assigned to a certain variety, following the procedure explained above, we are able to calculate the PRODY value for each variety; then, quality-adjusted EXPY is calculated as a weighted average of varieties' PRODY, where the weights are the share of each variety in the country's total exports. The econometric analyses show that once we control for quality differences within products, contrary to HHR and GPP results, there is no longer a robust relationship between initial EXPY and subsequent growth.

The remainder of the paper is organised as follows. Section 2 explains the construction of the quality-adjusted PRODY and EXPY indicators. Section 3 describes the varieties' PRODY and the quality-adjusted EXPY values. Section 4 studies the relationship between quality-adjusted EXPY and subsequent growth. The final section summarizes the paper's main findings.

2. The construction of quality-adjusted PRODY and EXPY indicators

In order to construct the quality-adjusted PRODY and EXPY indicators, we start from countries' exports at HS 6-digit product classification. For each product we calculate each country's exports unit value and sort them from the lowest to the highest. In order to minimise the impact of measurement errors, we remove unit values which are below or equal to the 1st percentile, as well as unit values that are equal or above the 99th percentile. From the remaining unit values we select the 33rd percentile unit value and 67th percentile unit value. Exports' whose unit value falls between the minimum unit value and the 33rd percentile are considered as low-quality varieties; those exports whose unit value falls between the 33rd percentile and 67th percentile are considered as medium-quality varieties; finally, those exports whose unit value falls between the 67th percentile and the maximum unit value are considered as high-quality varieties.

Once we have established, for each product, the unit value ranges for each quality level, we are able to calculate the income level associated to each variety. Following HHR's procedure, algebraically, a variety's PRODY is computed as follows:

$$PRODY_{kq} = \sum_j \frac{\left(x_{j,kq} / X_j \right)}{\sum_j \left(x_{j,kq} / X_j \right)} Y_j$$

where $x_{j,kq}$ denotes country *j* exports of commodity *k*'s *q* variety, where *q* can be low, medium or high . X_j denotes *j* country's total exports and Y_j is *j* country's GDP per capita. The numerator of the weight, $x_{j,kq} / X_j$, is the share of commodity *k*'s *q* variety in country *j* total exports; the denominator of the weight, $\sum_j \frac{x_{j,kq}}{X_j}$, aggregates the shares of commodity *k*'s *q* variety in total exports across countries. Hence, the weight reflects *j* country's revealed comparative advantage in commodity *k*'s *q* variety. $PRODY_{kq}$ is, therefore, the average of exporting countries GDP per capita, weighted by each country's revealed comparative advantage in commodity *k*'s *q* variety.

Following HHR, we also define the productivity (income) level associated to a country's exports:

$$EXPY_j = \sum_k \sum_{q=low,medium,high} \left(\frac{x_{j,kq}}{X_j} \right) PRODY_{kq}$$

which is a weighted average of each variety's *PRODY*, where the weights are the shares of each variety in total exports.

3. Varieties' PRODY and countries quality-adjusted EXPY

In order to calculate varieties' PRODY we use a sample of countries that reported export and GDP per capita data in 2002, 2003 and 2004[1]. Exports' data are total country's exports at the HS 6-digit disaggregation; these data are obtained from the UN Comtrade database; GDP per capita in PPP constant dollars are obtained from the World Bank's World Development Indicators database. The sample is composed by 115 countries[2]. In order to reduce measurement errors we drop from the analysis those observations where the value of exports is below 10000$. The sample accounts for 89 per cent of total world merchandise exports in the 2002-2004 period. The Data Appendix describes how we treat data in order to calculate the quality-adjusted PRODY and EXPY indicators.

Table 1 presents the descriptive statistics for varieties' PRODY values and compares them with products' PRODY values. As can be seen in the table, the division of products in quality levels increases the spread of PRODY values, which is reflected in the higher standard deviation for varieties' PRODY. In line with Schott's (2004) findings, we presume that low income countries specialise in low quality varieties and high income countries in high quality varieties; hence, we expect smaller minimum values and larger maximum values in varieties' PRODY than in products' PRODY. Paradoxically, this does not happen for the minimum value. However, this strange result occurs because, as explained in the Data Appendix, we cannot compute varieties' PRODY for all products. If we only consider those products whose

[1] As in HHR, we use three years in order to attenuate the biases generated by observations driven by year specific circumstances.

[2] We decide to drop Luxembourg from the sample due to its artificially high GDP per capita.

varieties' PRODY can be calculated, as expected, we find that varieties' minimum value is lower than products' minimum value.

Table 2 presents the five varieties with the lowest and the highest PRODY values; the table also presents the five products with the highest and the lowest PRODY values. As shown in the table, the largest PRODY value is shared by three manufactures: the medium quality variety of Complete movements of watches, the medium quality variety of Industrial Diamonds and the low quality variety of Unsorted Diamonds[3]; the lowest value is for the medium quality variety of Raw furskins pieces. If we do not control for differences in quality within products, the highest PRODY value is for Colloidal precious metals and the lowest value for Raw musk-rat furskins.

As mentioned before, we expect high GDP per capita countries to export high quality varieties and low GDP per capita countries to export low quality varieties. Hence, for each product we expect the low quality varieties' PRODY (PRODY low) to be smaller than the medium quality varieties' PRODY (PRODY medium), and even smaller than the high quality varieties' PRODY (PRODY high). In Table 2 we can see that this is not always the case. For example, it is the medium variety of Raw furskin pieces which commands the lowest PRODY value; on the other hand, we find medium and low quality varieties within the top five PRODY ranking. In order to check the pervasiveness of these odd results we analyse, for the whole sample, whether low quality varieties have a smaller PRODY than medium quality varieties, and whether those latter varieties have a smaller PRODY than high quality varieties. As can be seen in Table 3, this happens in 50% of products. The percentages are higher when we compare quality levels one by one: in 79% of products PRODY low is smaller than PRODY medium, and in 83% of products PRODY low is smaller than PRODY high. On the other hand, in 69% of products PRODY medium is smaller than PRODY high. Although only half of the products have a smooth relationship between the quality level and the PRODY value, this percentage is similar to that found by Schott (2004), when he analysed the percentage of manufactures exhibiting a positive and significant correlation between unit value and exporter GDP per capita.

[3] The three varieties have the same PRODY because, in our sample, Ireland is the only country that exports them. Hence, the 35194$ value corresponds to Ireland's average GDP per capita in constant PPP US dollars in the 2002-2004 period.

Table 4 presents the median varieties' PRODY ratios. As can be seen in the table, medium quality varieties incorporate 73% more income than low quality varieties; on the other hand, high quality varieties command 122% more income than low quality varieties. Finally, high quality varieties only incorporate 28% more income than medium quality varieties.

Table 5 presents the countries with the highest and the lowest EXPY values in 2004. Benin has the lowest quality-adjusted EXPY value in 2004, followed by Burkina Faso, Cambodia, Madagascar and Malawi; Benin, Burkina Faso and Malawi also appear in the lowest positions of the non quality-adjusted EXPY ranking. At the top of the ranking we find Ireland, followed Switzerland, Iceland, Germany and Finland; those countries, except for Finland, also appear in the non quality-adjusted EXPY top countries' ranking.

At this point, we can analyse the differences between countries quality-adjusted and non-quality adjusted EXPY figures. As average, we expect quality-adjusted EXPY to be smaller than non quality-adjusted EXPY in low GDP per capita countries; on the contrary, we expect quality-adjusted EXPY to be larger than non-quality adjusted EXPY for large GDP per capita countries. In order to test this presumption, in Figure 1 we present the relationship between GDP per capita and the difference between quality-adjusted EXPY and non quality-adjusted EXPY in 2004[4]. As can be seen in the figure, there is a positive relation between GDP per capita and the difference between quality-adjusted and non-quality adjusted EXPY; the correlation coefficient between both variables is 0.64. This analysis shows that if we do not control for differences within products, as average, we will overvalue low GDP per capita countries' EXPY and undervalue high GDP per capita countries' EXPY. In the next section we analyse whether this miscalculation may alter the robustness of the relationship between initial EXPY and subsequent growth found by HHR and GPP.

[4] We drop Jamaica from the sample because it constitutes a very clear outlier. This country presents a very large difference between quality-adjusted EXPY and non quality-adjusted EXPY: 12304 PPP $. On its hand, that large difference is explained by a very high quality-adjusted EXPY value in 2004 (18304 PPP $). The large quality-adjusted EXPY stems from the large share of medium-quality's aluminium oxide in Jamaica's exports, a variety which commands a high PRODY. If Jamaica, a middle-income country, participates in the sample to calculate aluminium oxide's varieties' PRODY value, why the medium-quality variety commands a high PRODY value? As explained in the Data Appendix, when we calculate varieties' PRODY we use average values for the 2002-2004 period. When we calculate the average unit value of Jamaican aluminium oxide exports' for this period it falls in the low-quality range. Hence, the aluminium oxide low-quality variety commands a low PRODY value; however, in 2004, Jamaican aluminium oxide unit value upgrades to the middle-quality range and, hence, Jamaican EXPY rockets.

Before proceeding with the econometric analysis, to finish this section we analyse the correlation between countries GDP per capita and the share of low-quality, middle-quality and high-quality exports in total exports. As expected, we find a negative correlation between GDP per capita and the share of low-quality exports (-0.31) and a positive correlation between GDP per capita and the share of high-quality exports (0.39). We also find a mild negative correlation between GDP per capita and middle-quality exports (-0.08).

4. Quality-adjusted EXPY and growth

Once we have developed an EXPY indicator that incorporates differences in quality within products, we analyse whether there is still a positive and statistically significant relationship between initial EXPY and subsequent growth. As in HHR and GPP all regressions include initial GDP per capita as covariate.

We first regress GDP per capita growth during the 1994-2004 period on initial non quality-adjusted EXPY and initial GDP per capita (Table 6 - Reg (1)). As in HHR and GPP, we find that the coefficient for initial non-quality adjusted EXPY is positive and statistically significant. In Reg (2) we introduce quality-adjusted EXPY and find that the coefficient is, as well, positive and statistically significant. We observe that the fit of the model is reduced almost by half and the size of the quality-adjusted EXPY coefficient is lower than the non quality-adjusted EXPY coefficient. Notwithstanding those remarks, according to this first analysis, there is still a positive and significant relationship between initial EXPY and subsequent growth when we take into account differences in quality within products.

However, when we introduce additional regressors there is no longer a statistically significant link between quality-adjusted EXPY and subsequent growth. As in HHR and GPP, we include the log of human capital and the rule of law as additional independent variables. As in those studies, we still find a positive and significant coefficient for non-quality adjusted EXPY. However, the quality-adjusted EXPY coefficient, although positive, is no longer statistically significant. This result points out that, once we control for other variables, such as human capital, that are correlated with both initial quality-adjusted EXPY and growth, there is no longer a statistically significant effect of initial EXPY on subsequent growth.

In order to control for EXPY's endogeneity, HHR propose to use the log of population and the log of land area as instruments. In Table 7 we present the results of the two-stage least square regressions. Contrary to HRR results, but in line with GPP results, the initial EXPY coefficients, both non quality-adjusted and quality-adjusted, are not statistically significant. We can also see that the log of population and the log of land area are weak instruments for quality-adjusted EXPY, as the identification tests are only rejected at 10%.

In order to control for time-invariant country characteristics, following HHR and GPP, we build a data-panel and estimate a fixed effects model. In addition to that, and in order to control for both time-invariant country characteristics and EXPY's endogeneity, we also estimate a GMM model. Comtrade's HS classification data does not allow to build a suitable panel due to its short time-span (it starts in 1992) and the low number of countries reporting data at the beginning of the period. In order to enlarge the panel's time horizon and number of countries we turn to Comtrade's SITC Revision 2 classification data[5]. We build a panel from 1980 to 2005, where data are grouped into 5 years intervals.

As can be seen in Table 8, when we estimate a fixed effects model we obtain a positive and robust relationship between initial non quality-adjusted EXPY and growth. However, when we introduce quality differences within products, the effect of initial EXPY on growth vanishes. When we estimate the GMM model the results are similar to those obtained with the fixed effects model: the non quality-adjusted initial EXPY indicator's coefficient is positive and statistically significant and the quality-adjusted EXPY coefficient, although positive, is statistically not significant.

Finally, we analyse whether the effect of initial EXPY on subsequent growth depends on countries' income level. Following GPP, in Table 9 we present econometric results for a sample that only includes non-high-income countries. The results are similar to those obtained with the whole sample.

[5] The shortcoming of the SITC Revision 2 classification, as compared to the HS classification, is that the disaggregation of products is much lower: 779.

7. Conclusions

In a recent study, Hausmann, Hwang and Rodrik (2007) develop a quantitative index of the productivity level associated to a country's exports. They show that there is a positive and robust relationship between this index, denominated EXPY, and subsequent economic growth.

As those authors recognise, a shortcoming of the EXPY index is that it does not take into account the quality differences within products. In order to overcome this shortcoming, we develop an EXPY indicator that incorporates quality differences within products. We show that, if quality differences within products are not taken into account, as average, there is an overvaluation in low GDP per capita countries' EXPY and an undervaluation in high GDP per capita countries EXPY. In order to analyse whether those biases affect the robustness of the relationship between initial productivity level associated to a country's exports and subsequent growth, we undertake different econometric analyses using the new quality-adjusted EXPY indicator. We show that, once we control for quality differences within products, there is no longer a robust relationship between initial EXPY and subsequent growth.

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Data Appendix

As explained at the beginning of Section 3 we use a sample of countries that reported export and GDP per capita data in 2002, 2003 and 2004 to calculate varieties' PRODY. In order to obtain average values for the 2002-2004 period, we have to transform current exports' values into constant exports' values. To perform this operation, ideally, we would like to have exports' price indexes for each country and each HS product included in the sample. Since we do not have those data, we decide to use the US Harmonised System import price index in order to proxy the evolution of export prices in the world; these data were obtained from the Bureau of Labour Statistics. For each country and HS product, we add up the 2002, 2003 and 2004 (constant) exports and quantity data. With this procedure we only allow each country to have one variety per each product. Not all exports' observations provide a quantity measure that allows the calculation of the unit value; for example, in our sample such observations account for 7.5 per cent of total sample's exports. The Comtrade database offers export observations that, in most cases, report a net weight figure, which allows a $ per kilogram unit value calculation. In other cases, a supplementary quantity figure is reported as well. In order to compare a commodity's unit value across years and countries, all unit values should be calculated with the same quantity unit. For each commodity we analyse which is the quantity unit (kilograms, items, litres,...) that maximises the number of observations. In the majority of cases the weight in kilograms is the quantity unit chosen. This procedure obliges us to remove from the sample some observations that allow the calculation of a unit value but do not use the quantity measure that has been chosen for the product. The removal of those observations raises the percentage of exports for which a valid unit value cannot be computed to 18.4 per cent of total sample's exports. Finally, in order to minimise measurement errors, we remove observations where the unit value is below or equal to the 1st percentile and equal or above the 99th percentile. The removal of those observations further raises the number of excluded exports to 19.8 per cent of total exports[6].

In order to calculate countries' EXPY indicator we assign each HS 6 digit export observation to the low, medium or high variety, depending on which quality range the unit value falls. It is important to note that we only calculate the EXPY of those countries that were included in the sample to compute the PRODY values. In order to overcome the effect of the evolution of

[6] This figure also includes those exports that are dropped from the sample because there were not enough unit value observations per product to calculate varieties' PRODY.

prices and exchange rates on the calculation of unit values, as explained before, we use the US import price index to transform current values into 2000 constant values. Secondly, each country's exports are valued at the 2002-2004 average exchange rates. Observations that lack a valid unit value enter the EXPY calculation multiplying their value by the non quality-adjusted PRODY[7].

As explained in the text, in order to estimate a fixed effect and a GMM model we need to enlarge our sample's time horizon. In order to do that we turn to Comtrade's SITC Revision classification, which offers data from 1962 onwards. However, as explained previously, to calculate the quality-adjusted EXPY we need to control for the evolution of prices; the US imports SITC Revision 2 price index starts, for the majority of commodities, in 1980; hence, we have to limit our sample to the 1980-2005 period.

[7] There are differences across countries in the amount of exports that lack a valid unit value. We perform different sensitivity analysis dropping from the sample countries with the highest percentages of exports with a non-valid unit value. The main results of the econometric analyses are not altered due to this change in the sample.

Table 1. PRODY descriptive statistics (2000 US $ PPP)

	Nº of obs.	Mean	Std. Deviation	Min	Max
Varieties' PRODY	14670	14767	7452	616	35194
Products PRODY	4989	14119	6284	594	33243
Products PRODY (2)	4890	14283	6179	823	33243

(2): Only those products whose varieties' PRODY values can be calculated.

Source: author's calculations based on Comtrade and World Bank data.

Table 2. Largest and smallest PRODY values (2000 US$ PPP)

	Varieties' PRODY			Products' PRODY		
	HS code	Product name and *variety*	PRODY	HS Code	Product	PRODY
Smallest	430190	Raw furskins pieces (e.g. heads, tails, paws); *Medium quality*	616	430150	Raw musk-rat furskins, whole	594
	551634	Woven fabric <85% artificial staple+wool/hair, *Low quality*	784	090500	Vanilla beans	823
	090500	Vanilla beans; *High quality*	791	530410	Sisal and agave, raw	955
	560730	Twine, cordage, ropes and cables, of abaca etc; *Low quality*	826	081290	Fruits and nuts, provisionally preserved nes	1091
	260900	Tin ores and concentrates; *High quality*	844	090700	Cloves (whole fruit, cloves and stems)	1092
Largest	911011	Complete movements of watches; *Medium quality*	35194	284310	Colloidal precious metals	33243
	710229	Diamonds industrial, worked; *Medium quality*	35194	252930	Leucite, nepheline and nepheline syenite	32828
	710210	Diamonds, unsorted; *Low quality*	35194	292111	Methylamine, di- or trimethylamine, salts	32495
	902150	Pacemakers for stimulating heart muscles; *Medium quality*	35187	293490	Heterocyclic compounds, nes	31770
	520635	Cotton yarn<85% multiple uncombed; *High quality*	35071	030373	Coalfish, frozen, whole	31379

Source: author's calculations based on Comtrade and World Bank data.

Table 3. Comparison of PRODY by varieties

Percentage of manufactures for which	
PRODY low < PRODY medium < PRODY high	50%
PRODY low <PRODY medium	79%
PRODY low <PRODY high	83%
PRODY medium <PRODY high	66%

Source: author's calculation based on Comtrade data.

Table 4. Median varieties' PRODY ratios

PRODY medium/PRODY low	1.73
PRODY high/PRODY low	2.22
PRODY high/PRODY medium	1.28

Source: author's calculations based on Comtrade and World Bank data.

Table 5. Largest and smallest EXPY values, 2004 (2000 US$ PPP)

	Country	Quality adjusted EXPY	Country	Non-quality adjusted EXPY
Smallest	Benin	2789	Gambia	2951
	Burkina Faso	2975	Benin	3196
	Cambodia	3279	Burkina Faso	3432
	Madagascar	3426	Burundi	3516
	Malawi	3633	Malawi	3539
Largest	Ireland	24404	Ireland	21259
	Switzerland	23098	Switzerland	20483
	Iceland	20828	Iceland	19094
	Germany	20347	Japan	18279
	Finland	20096	Finland	18080

Source: author's calculations based on Comtrade and World Bank data.

Table 6. Cross-national growth regressions, 1994-2004

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Log initial GDP per capita	- 0.014	-0.010	-0.015	-0.012	-0.016	-0.012
	(-2.71)***	(-1.88)*	(-2.36)**	(-1.71)*	(-2.23)**	(-1.69)*
Log non quality-adjusted EXPY	0.041		0.024		0.024	
	(3.32)***		(1.90)***		(1.90)**	
Log quality-adjusted EXPY		0.029		0.012		0.012
		(2.52)**		(0.95)		(0.90)
Log human capital			0.014	0.016	0.014	0.016
			(3.14)***	(3.50)***	(3.08)***	(3.47)***
Rule of Law					0.002	0.001
					(0.58)	(0.24)
Constant	-0.231	-0.153	-0.110	-0.035	-0.099	-0.027
	(-3.22)***	(-2.41)**	(-1.52)	(-0.52)	(-1.36)	(-0.36)
Number of observations	81	81	71	71	71	71
R-squared	0.22	0.12	0.33	0.29	0.33	0.29

Human capital is proxied by the percentage of population over 25 years that attended secondary schooling in 1990, which was obtained from Barro and Lee (2000). The Rule of Law index is obtained from the World Bank Governance Indicators database and corresponds to 1996.
Robust t-statistics in parentheses. *** statistically significant at 1%; ** statistically significant at 5%; * statistically significant at 10%.

Table 7. Cross-national growth regressions, 1994-2004. Instruments for EXPY

	(1)	(2)	(3)	(4)	(5)	(6)
	IV	IV	IV	IV	IV	IV
Log initial GDP per capita	-0.009	-0.018	-0.010	-0.012	-0.012	-0.012
	(-0.87)	(-1.32)	(-0.96)	(-0.97)	(-1.09)	(-1.15)
Log non quality-adjusted EXPY	0.028		0.009		0.010	
	(1.11)		(0.27)		(0.28)	
Log quality-adjusted EXPY		0.048		0.013		0.012
		(1.48)		(0.38)		(0.33)
Log human capital			0.017	0.016	0.016	0.016
			(2.44)**	(2.40)**	(2.41)**	(2.46)**
Rule of Law					0.002	0.001
					(0.57)	(0.17)
Constant	-0.157	-0.262	-0.019	-0.040	-0.008	-0.027
	(-1.09)	(-1.44)	(-0.10)	(-0.20)	(-0.04)	(-0.12)
Number of observations	81	81	71	71	71	71
R-squared	0.23	0.07	0.31	0.29	0.31	0.29
First stage F-statistics on excluded instrument p-value	0.003	0.073	0.029	0.063	0.031	0.059
Hansen J statistics p-value	0.021	0.071	0.260	0.291	0.249	0.270

Human capital is proxied by the percentage of population over 25 years that attended secondary schooling in 1990, which was obtained from Barro and Lee (2000). The Rule of Law index is obtained from the World Bank Governance Indicators database and corresponds to 1996.
Robust t-statistics in parentheses. *** statistically significant at 1%; ** statistically significant at 5%; * statistically significant at 10%.

Table 8. 5-year panel growth regressions

	(1)	(2)	(3)	(4)
	FE	FE	GMM	GMM
Log initial GDP per capita	-0.073	-0.070	-0.027	-0.017
	(-6.38)***	(-5.86)***	(-4.18)***	(-2.29)**
Log non quality-adjusted EXPY	0.015		0.048	
	(1.81)*		(3.20)***	
Log quality-adjusted EXPY		-0.006		0.009
		(-0.87)		(0.42)
Log human capital	0.009	0.012	0.028	0.034
	(1.40)	(1.80)*	(3.27)***	(3.74)***
Constant	0.491	0.651	-0.266	-0.013
	(4.01)***	(6.14)***	(-2.68)***	(-0.21)
Number of observations	319	319	319	319
R-squared	0.32	0.31		
Hansen J-statistic (p-value)			0.279	0.411
Arellano-Bond Test fot AR(2) in first differences (p-value)			0.606	0.442

All equations include period dummies. Human capital is proxied by the percentage of population over 25 years that attended secondary schooling, which was obtained from Barro and Lee (2000). GMM is Blundell-Bond System GMM estimator using lagged growth rates and levels as instruments as well as log population and log land area. Robust t-statistics in parentheses. *** statistically significant at 1%; ** statistically significant at 5%; * statistically significant at 10%.

Table 9. 5-year panel growth regressions. Non-high-income economies

	(1)	(2)	(3)	(4)
	FE	FE	GMM	GMM
Log initial GDP per capita	-0.072	-0.070	-0.024	-0.018
	(-4.61)***	(-4.39)***	(-2.67)***	(-2.01)**
Log non quality-adjusted EXPY	0.011		0.047	
	(1.16)		(2.91)***	
Log quality-adjusted EXPY		-0.003		0.018
		(-0.34)		(1.23)
Log human capital	0.003	0.005	0.032	0.042
	(0.39)	(0.48)	(2.91)***	(4.80)***
Constant	0.518	0.624	-0.296	-0.115
	(3.39)***	(4.56)***	(-1.94)*	(-1.15)
Number of observations	202	202	202	202
R-squared	0.36	0.36		
Hansen J-statistic (p-value)			0.880	0.979
Arellano-Bond Test fot AR(2) in first differences (p-value)			0.379	0.633

All equations include period dummies. Human capital is proxied by the percentage of population over 25 years that attended secondary schooling, which was obtained from Barro and Lee (2000). GMM is Blundell-Bond System GMM estimator using lagged growth rates and levels as instruments as well as log population and log land area. Robust t-statistics in parentheses. *** statistically significant at 1%; ** statistically significant at 5%; * statistically significant at 10%.

Figure 1. Relationship between GDP per capita and the difference between quality-adjusted and non quality-adjusted EXPY, 2004 (constant 2000 international $)