

# What You Export Matters\*

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## Abstract

When local cost discovery generates knowledge spillovers, specialization patterns become partly indeterminate and the mix of goods that a country produces may have important implications for economic growth. We demonstrate this proposition formally and adduce some empirical support for it. We construct an index of the "income level of a country's exports," document its properties, and show that it predicts subsequent economic growth.

## 1 Introduction

Why do countries produce what they do, and does it matter? The conventional approach to these questions is driven by what we might call the "fundamentals" view of the world. In this view, a country's fundamentals—namely its endowments of physical and human capital, labor, and natural resources along with the overall quality of its institutions—determine relative costs and the patterns of specialization that go with them. Attempts to reshape the production structure beyond the boundaries set by these fundamentals are likely to fail and hamper economic performance.

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We present in this paper a complementary argument that emphasizes the idiosyncratic elements in specialization patterns. While fundamentals play an important role, they do not uniquely pin down what a country will produce and export. What is critical to our argument—and what drives its policy implications—is that not all goods are alike in terms of their consequences for economic performance. Specializing in some products will bring higher growth than specializing in others. In this setting, government policy has a potentially important positive role to play in shaping the production structure—assuming of course that it is appropriately targeted on the market failure in question.

We do not claim any novelty for the idea that specialization patterns are not entirely predictable. It has long been understood that Switzerland's prowess in watches, say, or Belgium's in chocolates cannot be explained by the normal forces of comparative advantage. To resolve such puzzles, economists have long relied on models with increasing returns to scale, network effects, technological spillovers, thick-market externalities, or some combination thereof.<sup>1</sup> The idea that specializing in some goods is more growth promoting than specializing in others is not new either. In models with learning-by-doing externalities, long run growth tends to become endogenous and depends on economic structure and the rate at which it is being transformed.<sup>2</sup> Endogenous growth models based on learning spillovers have been difficult to test empirically because we do not have good estimates on (or strong priors about) which types of goods are more likely to generate such spillovers.

In our framework production indeterminacy maps into economic performance in a straightforward and empirically verifiable way. Everything else being the same, countries that specialize in the the types of goods that rich countries export are likely to grow faster than countries that specialize in other goods. Rich countries are those that have latched on to "rich-country products," while countries that continue to produce "poor-country" goods remain poor. Countries become what they produce. The novelty in our framework is that it establishes a particular hierarchy in goods space that is both amenable to empirical measurement and has determinate growth implications.

To model this process formally we appeal to a mechanism that we have earlier called "cost discovery" (Hausmann and Rodrik 2003), and which we believe is particularly important in developing countries with undiversified production structures. An entrepreneur who attempts to produce a good for the first time in a developing economy necessarily faces considerable cost uncertainty. Even if the good comes with a standard technology ("blueprint"), domestic factor endowments and institutional realities will require tinkering and local adaptation (see Evenson and Westphal 1995, Lall 2000). What the entrepreneur effectively does is to explore the underlying cost structure of the economy. This process is one with considerable positive externalities for other entrepreneurs. If the project is successful, other entrepreneurs learn that the product in question can

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<sup>1</sup>See for example Fujita, Krugman, Venables (1999) on geographic specialization, Porter (1990) on industry clusters, and Banerjee and Munshi (2004) on networks.

<sup>2</sup>See for example Stokey (1988), Young (1991), Matsuyama (1992), Grossman and Helpman (1991), Aghion and Howitt (1998), and Barro and Sala-i-Martin (2003).

be profitably produced and emulate the incumbent. In this way, the returns to the pioneer investor's cost discovery become socialized. If the incumbent ends up with failure, on the other hand, the losses remain private. This knowledge externality implies that investment levels in cost discovery are sub-optimal unless the industry or the government find some way in which the externality can be internalized.

In such a setting, the range of goods that an economy ends up producing and exporting is determined not just by the usual fundamentals, but also by the number of entrepreneurs that can be stimulated to engage in cost discovery in the modern sectors of the economy. The larger this number, the closer that the economy can get to its productivity frontier. When there is more cost discovery, the productivity of the resulting set of activities is higher in expectational terms and the jackpot in world markets bigger.

In what follows we provide a simple formal model of this process. We also supply some evidence that we think is suggestive of the importance of the forces that our formal framework identifies. We are interested in showing that some traded goods are associated with higher productivity levels than others and that countries that latch on to higher productivity goods (through the cost discovery process just described) will perform better. Therefore, the key novelty is a quantitative index that ranks traded goods in terms of their implied productivity. We construct this measure by taking a weighted average of the per-capita GDPs of the countries exporting a product, where the weights reflect the revealed comparative advantage of each country in that product.<sup>3</sup> So for each good, we generate an associated income/productivity level (which we call *PRODY*). We then construct the income/productivity level that corresponds to a country's export basket (which we call *EXPY*), by calculating the export-weighted average of the *PRODY* for that country. *EXPY* is our measure of the productivity level associated with a country's specialization pattern.

While *EXPY* is highly correlated with per-capita GDPs, we show that there are interesting discrepancies. Some high-growth countries such as China and India have *EXPY* levels that are much higher than what would be predicted based on their income levels. China's *EXPY*, for example, exceeds those of countries in Latin America with per-capita GDP levels that are a multiple of that of China. More generally, we find that *EXPY* is a strong and robust predictor of subsequent economic growth, controlling for standard covariates. We show this result for a recent cross-section as well as for panels that go back to the early 1960s. The results hold both in instrumental variables specifications (to control for endogeneity of *EXPY*) and with country fixed effects (to control for unobserved heterogeneity). Since we are not aware of any other models in the literature that predict a positive association between *EXPY* and growth, we interpret this finding as evidence in favor of our framework.

Our approach relates to a number of different strands in the literature. Recent work in trade theory has emphasized cost uncertainty and heterogeneity

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<sup>3</sup>A very similar index was previously developed by Michaely (1984), whose work we are happy to acknowledge. We encountered Michaely's index after the working paper version of this paper was completed and distributed.

at the level of firms so as to provide a better account of global trade (Bernard et al. 2003, Melitz and Ottaviano 2005). On the empirical front, Hummels and Klenow (2005) have shown that richer countries export not just more goods, but a broader variety of goods, while Schott (2004) has reported evidence of specialization within product categories as well as across products. In contrast to this literature, we focus on the spillovers in cost information and are interested in the economic growth implications of different specialization patterns.

There is a related empirical literature on the so-called natural resource curse, which examines the relationship between specialization in primary products and economic growth (Sachs and Warner 1995). The rationale for the natural resource curse is based either on the Dutch disease or on an institutional explanation (Subramanian and Sala-i-Martin 2003). Our approach has different micro-foundations than either of these, and yields an empirical examination that is much more fine-grained. We work with two datasets consisting of more than 5,000 and 700 individual commodities each and eschew a simple primary-manufactured distinction.

Our framework also suggests a different binding constraint on entrepreneurship than is typically considered in the literature on economic development. For example, there is a large body of work on the role that credit constraints play as a barrier to investment in high-return activities (see for example McKenzie and Woodruff [2003] and Banerjee and Duflo [2004]). In our framework, improving the functioning of financial markets would not necessarily generate much new activity as it would not enable entrepreneurs to internalize the information externality their activities generate. Similarly, there is a large literature that points to institutional weaknesses, such as corruption and poor enforcement of contracts and property rights (see Fisman [2001] and Svensson [2003]), as the main culprit. Remedying these shortcomings may also not be particularly effective in spurring entrepreneurship if the main constraint is the low appropriability of returns due to information externalities. A third strand of the literature emphasizes barriers to competition and entry as a serious obstacle (see Djankov et al. [2002] and Aghion et al. [2005]). In our setting, removing these barriers would be a mixed blessing: anything that erodes the rents of incumbents will result in less entrepreneurial investment in cost discovery in equilibrium.

While we do not claim that cost-discovery externalities are more important than these alternative explanations, we believe that they do play a role in restricting entrepreneurship where it matters the most—in new activities with significantly higher productivity. Our empirical evidence suggests that failure to develop such new activities extracts a large growth penalty.

The outline of the paper is as follows. We begin in section 2 with a simple model that develops the key ideas. We then present the empirical analysis in section 3. We conclude in section 4.

## 2 A simple model

We are concerned with the determination of the production structure of an economy in which the standard forces of comparative advantage play some role, but not the exclusive role. The process of discovering the underlying cost structure of the economy, which is intrinsically uncertain, contributes a stochastic dimension to what a country will produce and therefore how rich it will be.

Our model is a general-equilibrium model with two sectors, a modern sector which can produce a variety of goods and a traditional sector which produces a single homogenous good. Labor is the only factor of production (although we will implicitly incorporate a role for human capital as well). The presentation focuses on the modern sector, as that is where the interesting action occurs.

We normalize units of goods such that all goods have an exogenously given world price  $p$ . In the modern sector, each good is identified by a certain productivity level  $\theta$ , which represents the units of output generated by an investment of given size. We align these goods on a continuum such that higher-ranked goods entail higher productivity. The range of goods that an economy's modern sector is capable of producing is given by a continuous interval between 0 and  $h$ , i.e.,  $\theta \in [0, h]$  (see Figure 1). We capture the role of comparative advantage by assuming that the upper boundary of this range,  $h$ , is an index of the skill- or human-capital level of the economy. Hence a country with higher  $h$  can produce goods of higher productivity ("sophistication").

Projects are of fixed size and entail the investment of  $b$  units of labor. When investors make their investment decisions, they do not know whether they will end up with a high-productivity good or a low-productivity good. The  $\theta$  associated with an investment project is discovered only after the investment is sunk. All that investors know ex ante is that  $\theta$  is distributed uniformly over the range  $[0, h]$ .

However, once the  $\theta$  associated with a project/good is discovered, this becomes common knowledge. Others are free to produce that same good without incurring additional "discovery" costs (but at a somewhat lower productivity than the incumbent). Emulators operate at a fraction  $\alpha$  of the incumbent's productivity, with  $0 < \alpha < 1$ . Each investor can run only one project, so having discovered the productivity of his own project, the investor has the choice of sticking with that project or emulating another investor's project.

An investor contemplating this choice will compare his productivity  $\theta_i$  to that of the most productive good that has been discovered,  $\theta^{\max}$ , since emulating any other project will yield less profit. Therefore, the decision will hinge on whether  $\theta_i$  is smaller or bigger than  $\alpha\theta^{\max}$ . If  $\theta_i \geq \alpha\theta^{\max}$ , investor  $i$  will stick with his own project; otherwise he will emulate the  $\theta^{\max}$ -project. Therefore the productivity range within which firms will operate is given by the thick part of the spectrum shown in Figure 1.

Now let's move to the investment stage and consider the expected profits from investing in the modern sector. These expected profits depend on expectations regarding both the investor's own productivity draw and the maximum of everybody else's draws. As we shall see, the latter plays a particularly im-

portant role. Obviously,  $E(\theta^{\max})$  will be an increasing function of the number of investors who start projects, and given that  $\theta$  lies in the interval  $[0, h]$ , it will also depend on  $h$ . Let  $m$  denote the number of investors who choose to make investments in the modern sector. Since  $\theta$  is distributed uniformly, we have a particularly simple expression for  $E(\theta^{\max})$ :

$$E(\theta^{\max}) = \frac{hm}{m+1}$$

For the initial draw ( $m = 1$ ),  $E(\theta^{\max})$  is simply  $h/2$ , the midpoint of the product space. As  $m$  increases,  $E(\theta^{\max})$  moves closer to  $h$ . In the limit,  $E(\theta^{\max})$  converges to  $h$  as  $m \rightarrow \infty$ .

Since productivity is distributed uniformly, the probability that investor  $i$  will stick with his own project is

$$\text{prob}(\theta_i \geq \alpha\theta^{\max}) = 1 - \frac{\alpha E(\theta^{\max})}{h} = 1 - \frac{\alpha m}{m+1}.$$

This eventuality yields the following expected profits

$$E(\pi | \theta_i \geq \alpha\theta^{\max}) = \frac{1}{2}p[h + \alpha E(\theta^{\max})] = \frac{1}{2}ph\left[1 + \frac{\alpha m}{m+1}\right]$$

since  $\frac{1}{2}[h + \alpha\theta^{\max}]$  is the expected productivity of such a project. We can similarly work out the probability and expected profits for the case of emulation:

$$\begin{aligned} \text{prob}(\theta_i < \alpha\theta^{\max}) &= \frac{\alpha E(\theta^{\max})}{h} = \frac{\alpha m}{m+1}. \\ E(\pi | \theta_i < \alpha\theta^{\max}) &= p\alpha E(\theta^{\max}) = ph\left(\frac{\alpha m}{m+1}\right) \end{aligned}$$

Putting these together, we have

$$\begin{aligned} E(\pi) &= ph \left[ \left(1 - \frac{\alpha m}{m+1}\right) \frac{1}{2} \left(1 + \frac{\alpha m}{m+1}\right) + \left(\frac{\alpha m}{m+1}\right)^2 \right] \\ &= \frac{1}{2}ph \left[ 1 + \left(\frac{\alpha m}{m+1}\right)^2 \right] \end{aligned} \tag{1}$$

Note that expected productivity in the modern sector is

$$E(\theta) = \bar{\theta} = \frac{1}{2}h \left[ 1 + \left(\frac{\alpha m}{m+1}\right)^2 \right] \tag{2}$$

Expected profits shown in (1) are simply the product of price and expected productivity. Expected productivity, and in turn profitability are determined both by "skills" ( $h$ ) and by the number of investors engaged in cost discovery ( $m$ ). The larger  $m$ , the higher the productivity in the modern sector. Hence we have increasing returns to scale in the modern sector, but this arises from cost information spillovers rather than technological externalities. If  $\alpha$  were zero, productivity and profits would not depend on  $m$ .

## 2.1 Long-run equilibrium

In long-run equilibrium, the number of entrants in the modern sector ( $m$ ) is endogenous and is determined by the requirement that excess profits are driven to zero. Let us express the flow (expected) profits in this sector as

$$r(p, h, m^*) = E(\pi)_{LR} = \frac{1}{2}ph \left[ 1 + \left( \frac{\alpha m^*}{m^* + 1} \right)^2 \right]$$

where  $m^*$  denotes the long-run level of  $m$ . Remember that each modern sector investment requires  $b$  units of labor upfront, resulting in a sunk investment of  $bw$ , where  $w$  is the economy's wage rate. Long-run equilibrium requires equality between the present discounted value of  $r(p, h, m^*)$  and the sunk cost of investment:

$$\int_0^\infty r(p, h, m^*) e^{-\rho t} dt = \frac{r(p, h, m^*)}{\rho} = bw^* \quad (ZP)$$

where  $\rho$  is the discount rate.

Wages are determined in turn by setting the economy's total labor demand equal to the fixed labor supply  $L$ . The modern sector's labor demand equals  $m^*b$ . As noted above, the traditional sector produces a single homogenous good (with a price fixed also at unity) using labor as the sole factor of production. Under the assumption that there is diminishing marginal product to labor in the traditional sector, the traditional sector's labor demand can be represented by the decreasing function  $g(w)$ ,  $g'(w) < 0$ . Labor market equilibrium is then given by

$$m^*b + g(w^*) = L \quad (LL)$$

Equations (ZP) and (LL) determine the long-run values of the endogenous variables  $m$  and  $w$ . The equilibrium is shown in Figure 2, which plots these two equations in  $(m, w)$ -space. Note that (ZP) and (LL) are both positively sloped. We have drawn (ZP) as less steep than (LL), because otherwise scale economies would be so strong that the dynamic behavior of the model would be unstable under reasonable specifications. This amounts to assuming that  $\alpha$  is not too large.<sup>4</sup>

## 2.2 Short-run equilibrium

In short-run equilibrium we require labor markets to clear but take  $m$  as fixed. This means we are always on the (LL) schedule, with the wage rate determined by equation (LL) for a given  $m$ .

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<sup>4</sup>We note that in view of the positive slopes of both schedules, the model readily admits a multiplicity of long-run equilibria. Those equilibria where ZP crosses LL from below would be dynamically unstable under the dynamic specification postulated below. So there would need to be at least three intersections for there to exist two stable long-run equilibria. We thank a referee for bringing the issue of multiplicity to our attention.

### 2.3 Dynamics

Given our assumptions so far, if  $m$  were allowed to adjust instantaneously we would jump immediately to the long-run equilibrium given by the intersection of the ( $ZP$ ) and ( $LL$ ) schedules. In fact, forward-looking behavior on the part of investors in the modern sector provides an additional mechanism for immediate convergence to the long-run equilibrium. Suppose, for example, that we start at a level of  $m$  which falls short of  $m^*$ . On the transition to the long-run equilibrium, we know that  $m$  and  $w$  will both rise. Consider how these dynamics influence the decision to enter. The rise in  $m$  implies that productivity will be higher in the future than it is today, and is a force that will induce delay in the decision to invest in the modern sector *ceteris paribus*. The rise in  $w$ , on the other hand, implies that investment will be more costly in the future than it is today, and is a factor that will precipitate investment. Given the relative slopes we have assumed, the second factor outweighs the first—i.e., wages increase faster than the rate at which productivity benefits come in—and investors would rather invest today than wait.

To provide the model with some non-trivial dynamics, we can simply assume that there is a limit to how much investment is feasible per unit of time. To be concrete, let the rate at which  $m$  increases be restricted by the exogenous parameter  $\mu$ . That is

$$\left| \dot{m}(t) \right| \leq \mu$$

Given the considerations discussed in the previous paragraph, there will be maximal adjustment in  $m$  whenever net returns at time  $t$  are non-zero. Hence,

$$\begin{aligned} \dot{m}(t) &= \mu & \text{if} & \quad \frac{r(p,h,m(t))}{\rho} > bw(t) \\ \dot{m}(t) &= -\mu & \text{if} & \quad \frac{r(p,h,m(t))}{\rho} < bw(t) \\ \dot{m}(t) &= 0 & \text{otherwise} & \end{aligned}$$

### 2.4 Comparative dynamics

We are now ready to analyze the behavior of the economy. Starting from an initial equilibrium given by  $(m_0, w_0)$ , consider an increase in the economy's labor endowment. This shifts the  $LL$  schedule down since, at a given  $m$ , labor-market equilibrium requires lower wages. Hence the impact effect of larger  $L$  is a lower  $w$ . However, the lower wage induces more firms to enter the modern sector and engage in cost discovery, which in turn pulls wages up. How high do wages eventually go? As Figure 2 shows, the new equilibrium is one where wages are higher than in the initial equilibrium. A larger labor endowment ends up boosting wages! What is key for this result is the presence of information spillovers in the modern sector. Once the modern sector expands, productivity rises, and zero profits can be restored only if wages go up.

Increases in  $p$  and  $h$  operate by shifting the  $ZP$  schedule up. They both result in higher  $m$  and  $w$  eventually. An increase in  $b$ , the fixed cost of entry into the



modern sector, shifts both schedules down, and under the stability assumptions made previously yields lower  $m$  and  $w$ . These results are less surprising, but have important policy implications. In particular, they imply that trade policies that raise  $p$  (import restrictions or export subsidies, depending on the context) would promote entrepreneurship and raise growth.

## 2.5 Discussion

Our framework is obviously related to models in the endogenous-growth tradition that we cited earlier (see footnote 2), where there are externalities in the imitation and innovation process. Models of that kind also generate the result that entrepreneurial activity is too low in the laissez-faire equilibrium. What is different in our approach is that it identifies a potentially empirically verifiable relationship between the *type* of goods that an economy specializes in and its rate of economic growth. In our framework anything that pushes the economy to a higher  $\theta^{\max}$ —to specialize in good(s) with higher productivity levels—sets forth a dynamic (if temporary) process of economic growth as emulators are drawn in to produce the newly discovered high-productivity good(s). In the empirical work below, we will try to document this particular link by developing an empirical proxy for  $\theta^{\max}$  and examining its relationship with growth.

## 3 Empirics

The model shows that productivity in the modern sector is driven by  $\theta^{\max}$ , which depends on  $m$ , which in turn is driven by country size ( $L$ ), human capital ( $h$ ), and other parameters. In our empirical work, we shall proxy  $\theta^{\max}$  with a measure calculated from export statistics which we call *EXPY*. This measure aims to capture the productivity level associated with a country’s exports. Focusing on exports is a sensible strategy since  $\theta^{\max}$  refers to the most productive goods that a country produces and we can expect a country to export those goods in which it is the most productive. Consider for example a model of the world economy in which countries differ only in terms of their location in the product space depicted in Figure 1. In this model, comparative and absolute advantage would be aligned, and countries that export higher  $\theta^{\max}$  goods would be richer precisely because they export those goods. Focusing on exports makes sense also for the practical reason that we have much more detailed data on exports across countries than we do on production.

In order to calculate *EXPY* we rank commodities according to the income levels of the countries that export them. Commodities that are exported by rich countries (controlling for overall economic size) get ranked more highly than commodities that are exported by poorer countries. With these commodity-specific calculations, we then construct country-wide indices.

### 3.1 Construction of *EXPY*

First, we construct an index called *PRODY*. This index is a weighted average of the per capita GDPs of countries exporting a given product, and thus represents the income level associated with that product. Let countries be indexed by  $j$  and goods be indexed by  $l$ . Total exports of country  $j$  equals

$$X_j = \sum_l x_{jl}$$

Let the per-capita GDP of country  $j$  be denoted  $Y_j$ . Then the productivity level associated with product  $k$ ,  $PRODY_k$ , equals

$$PRODY_k = \sum_j \frac{(x_{jk}/X_j)}{\sum_j (x_{jk}/X_j)} Y_j$$

The numerator of the weight,  $x_{jk}/X_j$ , is the value-share of the commodity in the country's overall export basket. The denominator of the weight,  $\sum_j (x_{jk}/X_j)$ , aggregates the value-shares across all countries exporting the good. Hence the index represents a weighted average of per-capita GDPs, where the weights correspond to the revealed comparative advantage of each country in good  $k$ .

The rationale for using revealed comparative advantage as a weight is to ensure that country size does not distort our ranking of goods. Consider an example involving Bangladesh and US garments, specifically, the 6-digit product category 620333, "men's jackets and blazers, synthetic fiber, not knit." In 1995, the US export value for this category was \$28,800,000, exceeding Bangladesh's export value of \$19,400,000. However, this commodity constituted only 0.005 percent of total US exports, compared to 0.6 percent for Bangladesh. As defined above, the *PRODY* index allows us to weight Bangladesh's income more heavily than the U.S. income in calculating the productivity level associated with garments, even though the U.S. exports a larger volume than Bangladesh.

The productivity level associated with country  $i$ 's export basket,  $EXPY_i$ , is in turn defined by

$$EXPY_i = \sum_l \left( \frac{x_{il}}{X_i} \right) PRODY_l$$

This is a weighted average of the *PRODY* for that country, where the weights are simply the value shares of the products in the country's total exports.<sup>5</sup>

### 3.2 Data and methods

Our trade data come from two sources. The first is the United Nations Commodity Trade Statistics Database (COMTRADE) covering over 5000 products

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<sup>5</sup> As we noted in the introduction, Michaely (1984) previously developed a similar index and called it "income level of exports." Michaely used a different weighting scheme in generating what we call *PRODY*, with each country's weight corresponding to the market share in global exports of the relevant commodity. Compared to ours, therefore, Michaely's approach overweights large countries. Michaely's calculations were undertaken for 3-digit SITC categories. More recently, Lall et al. (2005) have also developed a similar measure that they call the "sophistication level of exports."

at the Harmonized System 6-digit level for the years 1992 to 2003. The value of exports is measured in current US dollars. The number of countries that report the trade data vary considerably from year to year. However, we constructed the *PRODY* measure for a consistent sample of countries that reported trade data in each of the years 1999, 2000 and 2001. It is essential to use a consistent sample since non-reporting is likely to be correlated with income, and thus, constructing *PRODY* for different countries during different years could introduce serious bias into the index. While trade data were actually available for 124 countries over 1999-2001, the real per capita GDP data from the World Development Indicators (WDI) database was only available for 113 of these countries. Thus, with the COMTRADE data, we calculate *PRODY* for a sample of 113 countries. We calculate *PRODY* using both PPP-adjusted GDP and GDP at market exchange rates. In what follows we shall present most of our results only with the PPP-adjusted measures of *PRODY*; we have found no instance in which using one instead of the other makes a substantive difference.

The average *PRODY* from 1999-2001 is then used to construct an *EXPY* measure for all countries reporting trade data during the period from 1992 to 2003. Since the number of countries reporting COMTRADE data varies from year to year, and the coverage is especially patchy for earlier years, the total number of countries for which we could calculate *EXPY* ranges from a low of 48 in 1992 to a high of 133 in 2000. Table 1 shows the country coverage for each of the years between 1992 and 2003.

Some limitations of COMTRADE data are its relatively short time-span and limited coverage of countries earlier in the period. To check the robustness of our findings against these concerns, we have also constructed our measures with the World Trade Flows dataset which has recently been updated to extend coverage back to 1962 (Feenstra et al. 2005). Trade flows are based on 4-digit standard international trade classifications (SITC rev. 2) comprising over 700 commodities. Our *PRODY* and *EXPY* indices are calculated by combining the World Trade Flows data on export volumes with PPP-adjusted GDP from the Penn World Tables, yielding a sample of 97 countries for the period 1962-2000.

We prefer to work with the indices based on more disaggregated data, and the basic patterns in the data are very much consistent between the two datasets. Hence we limit our discussion of descriptive statistics below to the COMTRADE data. We return to the 4-digit data when we turn to growth regressions.

### 3.3 Descriptive statistics

Some descriptive statistics on *PRODY* are shown in Table 2. The first row shows *PRODY* calculated using GDP at market exchange rates and the second row shows *PRODY* with PPP-adjusted GDP levels. As the table reveals, the income level associated with individual traded commodities varies greatly, from numbers in hundreds (of 2000 US dollars) to tens of thousands. This reflects the fact that specialization patterns are highly dependent on per-capital incomes.

The five commodities with the smallest and largest *PRODY* values are shown in Table 3. As we would expect, items with low *PRODY* tend to

be primary commodities. Consider for example product 10120, “live asses mules and hinnies.” The main reason this product has the lowest income level is that it constitutes a relatively important part of the exports of Niger, a country with one of the lowest per capita GDPs in our sample. Similarly, sisal, cloves, and vanilla beans have low *PRODY* values because they tend to be significant exports for poor sub-Saharan African countries. On the other hand, product 7211060, flat rolled iron or non-alloy steel, has the highest *PRODY* value because it holds a substantial share of Luxembourg’s exports, and this country has the highest per capita GDP in our sample.

Table 4 and Figure 3 summarize some basic descriptive statistics for *EXPY*. We note that the mean *EXPY* for the sample of countries included exhibits a downward trend over time. Mean *EXPY* has fallen from \$12,994 in 1992 to \$10,664 in 2003. Since the income levels associated with individual products are held constant over time (as explained above), this is due partly to the changing composition of the sample of countries (with more low-*EXPY* countries being included over time) and partly to the reduction in *EXPY* levels in many of the countries. Indeed, Table 5 shows that a majority of countries (among those that have *EXPY* values throughout our sample period) have experienced a reduction in *EXPY* over time. This downward trend may be specific to the recent period and dependent on levels of aggregation, since we do not see a similar trend since the 1960s when we use 4-digit trade data.

How does *EXPY* vary across countries? Figure 4 shows a scatterplot of *EXPY* against per-capita GDP. Unsurprisingly, there is a very strong correlation between these two variables. The correlation coefficient between the two is in the range 0.80-0.83 depending on the year. Rich (poor) countries export products that tend to be exported by other rich (poor) countries. Although in our framework this relationship has a different interpretation, it can also be explained with the Heckscher-Ohlin framework if rich country goods are more intensive in human capital or physical capital. The relationship between *EXPY* and per capita GDP exists partly by construction, since a commodity’s *PRODY* is determined by the per capita GDPs of the countries that are important exporters of that commodity. However, the relationship is not just a mechanical one. Calculating country specific *PRODY*s by excluding own exports from the calculation of these measures does not change the results much. Note also that the variation in *EXPY* across countries is much lower than the variation in per-capita GDPs. This is a direct consequence of the fact that *PRODY* (and therefore *EXPY*) is a weighted average of national income levels.

Table 6 shows the countries with smallest and largest *EXPY* values for 2001 (the year with the largest possible sample size). Note that French Polynesia (PYF) ranks in the top 5 among those with the largest *EXPY*. This surprising outcome arises in part because cultured pearl exports contribute heavily to a French Polynesia’s export basket and this product has a relatively large *PRODY* value of \$22,888. A few other cases where countries appear to have very large *EXPY* values relative to per capita GDP are Mozambique (MOZ), Swaziland (SWZ), Armenia (ARM), India (IND), and China (CHN). In a couple of these instances, the culprit is once again a specific commodity with a high

*PRODY* value: unwrought, alloyed aluminum for Mozambique and "mixed odoriferous substances in the food and drink industries" for Swaziland. But in the remaining cases (China, India, and Armenia), this is the result of a portfolio of a high *PRODY* exports, and not one or two specific items. At first sight, diamonds seem to play a large role in India and Armenia, but both countries retain their high *EXPY*s even with diamonds removed from the calculation. And China has a very diversified set of exports, with no single product category standing out in terms of high export shares. It is worth remembering at this juncture that China and India have both been experiencing very rapid economic growth (as has Armenia more recently).

Figure 5 shows the time trend for *EXPY* for China, India, and a sample of other Asian and Latin American countries. Among the Latin American countries included (Argentina, Brazil, Chile, and Mexico), only Mexico has a level of *EXPY* that is comparable to those in East Asia. This probably reflects the fact that the exports of the other three are heavily based on primary products and natural resources, which tend to have lower *EXPY*s. Chile has the lowest *EXPY* by far, and its *EXPY* has been steadily drifting downwards. At the other end, South Korea and Hong Kong have the highest *EXPY*s. Note how China has significantly closed the gap with these countries over time. China's *EXPY* has converged with that of Hong Kong, even though Hong Kong's per capita GDP remains five times larger (in PPP-adjusted terms). And China's *EXPY* now exceeds those of Brazil, Argentina, and Chile by a wide margin, even though China's per-capita GDP is roughly half as large as those of the Latin American countries (see Rodrik [2006] and the related work of Schott [2006] for more detail on China). India's *EXPY* is not as spectacular as China's, but that is in large part because our measure is based on commodity exports and does not capture the explosion in India's software exports. Nonetheless, by 2003 India had a higher *EXPY* than not only Chile, but also Argentina, a country that is roughly four times richer.<sup>6</sup>

Do all natural-resource exporting countries have low *EXPY*s? Figure 6 shows a similar chart for five primary-product exporting countries: Canada, Norway, New Zealand, Australia, and Chile. The variation in *EXPY* among these countries turns out to be quite large. Once again, Chile is at the bottom of the scale. But even among the remaining four advanced countries, the range is quite wide. Canada's *EXPY* is between 20-25 percent larger than Norway's or Australia's. Therefore, our measure seems to capture important differences among primary product exporting countries as well.

### 3.4 Determinants of *EXPY*

What might be some of the fundamental determinants of the variation across countries in levels of *EXPY*? We have shown above that *EXPY* is highly cor-

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<sup>6</sup>We note that the *EXPY* index does not correct for differences in quality within a product category. even though we are working with highly disaggregated product categories, there is still wide variation in the unit values of goods produced by different countries. See Rodrik (2006) for the case of China.

related with per-capita GDP. The model laid out in the early part of the paper suggests that specialization patterns will be determined both by fundamentals and by idiosyncratic elements. Among fundamentals, the model pointed to human capital and the size of the labor force as two key determinants. The first extends the range of "discoverable" goods, and the second promotes cost discovery through (initially) lower wages. We find support for both of these implications in the cross-national data. Human capital and country size (proxied by population) are both associated positively with *EXPY*, even when we control for per capita GDP separately (Table 7). It may be difficult to give the relationship with human capital a direct causal interpretation, since the causal effect may go from *EXPY* to human capital rather than vice versa. But it is easier to think of the relationship with country size in causal terms: it is hard to believe that there would be reverse causality from *EXPY* to population size. Interestingly, institutional quality (proxied by the Rule of Law index of the World Bank, a commonly used measure of institutional quality) does not seem to be strongly associated with *EXPY* once we control for per capita GDP (Table 7, column 3). This makes it less likely that *EXPY* is a proxy for broad institutional characteristics of a country.

Even if we ascribe a causal role to per-capita income and human capital, there is a lot that remains unexplained in the determination of *EXPY*. Figure 7 shows a scatter plot of deviations from the cross-country norms established in column 4 of Table 7 against per capita GDP. There are big outliers in either direction, especially among low-income countries. Mozambique (+88 percent), Swaziland (+55 percent), and Senegal (+29 percent) have *EXPY* levels that are much higher than would be predicted on the basis of the right-hand side variables in Table 7, while Guinea (-66 percent), Niger (-55 percent), and Burundi (-57 percent) have much lower *EXPY*s. If indeed such differences matter to subsequent economic performance (and we claim that they do), it is important to understand where they arise from. Moreover, to the extent that *EXPY* levels exert an independent influence on per capita income levels and human capital stocks, the "unexplained" component of the cross-national variation in *EXPY* is naturally much larger. Hausmann and Rodrik (2003) provide some anecdotal evidence which suggests that successful new industries often arise for idiosyncratic reasons. Fundamentals are only part of the story.

### 3.5 *EXPY* and growth

We finally turn to the relationship between *EXPY* and economic growth. We analyze this relationship in both cross-national and panel settings and using a wide variety of estimation techniques.

Table 8 shows a set of cross-national regressions in which growth is regressed on initial values of *EXPY* and other regressors. The maximum time span that we can use for these regressions based on COMTRADE data is a time horizon of 11 years (1992-2003). However, this leaves us with a sample of only some 40 odd countries. By focusing on a somewhat shorter time horizon—between 1994 and 2003—we can nearly double the sample of countries included in the regres-

sion. The table shows results with both samples. All regressions include initial per-capita GDP as a covariate. We also include human capital as a regressor, since it plays a role in our theoretical specification. We add the (physical) capital-labor ratio and a rule of law index as well to account for neoclassical explanations for economic growth. Finally, we show both OLS and IV results. We appeal to the theory developed previously and the empirical results above in using country size (population and land area) as instruments in the IV specification. Country size is plausibly exogenous with respect to *EXPY* levels and economic growth. But excludability from the second-stage regression can be viewed as more problematic. Many endogenous growth theories contain scale effects—operating through channels other than what we have emphasized here—and would in principle call for country size to be introduced as an independent regressor in growth regressions. We take comfort and refuge in the fact that it has been very difficult to find such scale effects in growth empirics. Rose (2006) has recently undertaken a comprehensive empirical analysis looking for such scale effects and reports decisively negative results.<sup>7</sup> In light of such findings, our use of country size as an instrument seems plausible. We also note that we will use fixed-effects and an alternative instrumentation strategy when we turn to panel estimation.

*EXPY* enters with a large and positive coefficient that is statistically significant in all of these specifications. The estimated coefficient varies from 0.032 to 0.082, with IV estimates being larger than OLS estimates.<sup>8</sup> Taking the midpoint of this range, the results imply that a 10 percent increase in *EXPY* boosts growth by half a percentage points, which is quite large. Figure 8 shows a representative scatter plot. Human capital, physical capital, and institutional quality do not enter in a robustly significant way, and their presence does not affect much the significance of *EXPY*. These results suggest that *EXPY* exerts an independent force on economic growth and that it is not a proxy for the factor or institutional endowments of a country.

A shortcoming of these regressions is that the time horizon is short, and that they suffer, as with all cross-national specifications, from possible omitted variables bias. While 6-digit disaggregation based on COMTRADE does not allow us to examine pre-1992 data, 4-digit calculations based on World Trade Flows allows us to construct a panel going back to 1962. Table 9 shows results from panel regressions. Data are grouped into 5- and 10-year intervals and four different estimators are used: pooled OLS, IV, OLS with fixed effects (for countries and years), and GMM. (See notes at the bottom of the table for more

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<sup>7</sup>Rose summarizes his results thus: "There is little evidence that countries with more people perform measurably better. Indeed, a good broad-brush characterization is that a country's population has no significant impact on its well-being" (2006, 15). The only exception that Rose notes is the well-known regularity that smaller countries have higher shares of trade in GDP.

<sup>8</sup>F-tests in IV specifications always indicate that instruments are jointly significant in the first stage. Overidentification tests using the J-statistic cannot reject excludability in columns (4)-(6). However, in columns (10)-(12) covering a shorter period, the null hypothesis of zero correlation of instruments with second-stage residuals is rejected in two of the three specifications.

details.) The estimated coefficient on *EXPY* is significant in all cases, with a magnitude that is comparable to that in the cross-section results reported above.<sup>9</sup> The fixed effects results are particularly telling, since these explicitly control for time-invariant country characteristics and identify the impact of *EXPY* off the variation within countries. They are significant in both the 5- and 10-year panels. These fixed effects estimates suggest that a 10 percent increase in *EXPY* raises growth by 0.14 to 0.19 percentage points. This is a smaller effect than what we found in the cross-national specifications, but it is still noteworthy.

There is no reason a priori to expect that *EXPY* works the same way for all countries, and the panel regressions allow us to check for heterogeneity in its estimated impact on growth across different country subgroups. Table 10 shows various panel specifications estimated separately for four different country groups distinguished by income levels: high-income OECD countries, upper middle-income countries (MIDUP), lower middle-income countries (MIDLW), and low income countries. We find that *EXPY* enters most strongly in countries at intermediate income levels. The fixed-effects point estimate for the MIDLW sub-sample suggests that a 10 percent increase in *EXPY* boosts growth by 0.35-0.37 percentage points, double the estimate for the sample as a whole and close to the cross-section estimate. Interestingly, *EXPY* never enters significantly in the OECD sub-sample. This is perhaps because rich countries have fairly stable *EXPY* values: the standard deviation of *EXPY* is half as large in the OECD sub-sample as it is in the rest of the sample. In fixed-effects regressions, the results in the lowest-income sub-sample are very poor as well, possibly reflecting considerable measurement error (in trade statistics over time) for this sub-sample. So with respect to the within-variation, *EXPY* does a much better job distinguishing performance among middle-income countries than among countries at either end of the income spectrum.

We have subjected these results to a large number of additional robustness tests, which we do not report for reasons of space. In particular, both the cross-national and panel results are robust to the inclusion of additional covariates such as distance from the equator, legal origin dummies and measures of financial development (e.g., private credit as a share of GDP). Even with these controls, *EXPY* remains statistically significant and of similar magnitude in each of the twelve equations in Table 8, except in the last three. In the panel, the additional controls do not materially change the significance or magnitude of *EXPY* in any of the 5-year results. All of the 10-year results are also preserved, except in the case of GMM, where the coefficient is no longer significant although its magnitude remains the same.

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<sup>9</sup>The variables used as instruments fail the overidentification test in columns (2) and (6), most likely because they are very persistent and are akin to country fixed effects in a panel. Reassuringly, columns (4) and (8) show that the GMM setup where lagged levels and differences are used as instruments passes both the overidentification test and exhibits no second-order correlation.



### 3.6 Discussion

Our results show that countries that export goods associated with higher productivity levels grow more rapidly, even after we control for initial income per head, human capital levels, and time-invariant country characteristics. What is the economic mechanism that drives this growth? In the simple model we sketched out, growth is the result of transferring resources from lower-productivity activities to the higher-productivity goods identified by the entrepreneurial cost-discovery process. An important characteristic of these goods is that there is elastic demand for them in world markets, so that a country can export them in large quantities without significant adverse terms-of-trade effects. As an indication of this mechanism, we find, for example, that countries with initially high levels of *EXPY* subsequently experience higher growth in exports (see Figure 9).<sup>10</sup>

Fostering an environment that promotes entrepreneurship and investment in new activities would appear therefore to be critical to economic convergence. From an allocative-efficiency standpoint, the key is that such activities generate information spillovers for emulators (on which see Hausmann and Rodrik [2003] for more discussion and evidence). A full discussion of the policy implications of this is beyond the scope of the present paper (see Rodrik [2004]). But, generically, the requisite policy is to subsidize initial entrants in new activities (but not followers).

More broadly, our results suggest that the type of goods in which a country specializes has important implications for subsequent economic performance. Everything else being the same, an economy is better off producing goods that richer countries export.<sup>11</sup> Standard models of comparative advantage indicate that pushing specialization up the product scale in this fashion would be bad for an economy's health: it would simply distort production and create efficiency losses. The framework we developed in the paper, and the evidence that we offered, suggest an alternative interpretation. A country's fundamentals generally allow it to produce more sophisticated goods than it currently produces. Countries can get stuck with lower-income goods because entrepreneurship in cost discovery entails important externalities. Countries that are able to overcome these externalities—through policies that entice entrepreneurs into new

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<sup>10</sup> A complementary mechanism is that countries that start producing sophisticated products can grow more rapidly as they experience convergence to the quality frontier in those goods. Work by Hwang (forthcoming) has found strong evidence of *unconditional* convergence in product quality (measured by unit values) at the level of individual products.

<sup>11</sup> A question arises as to whether it is possible for all countries to do this in the general equilibrium of the world economy. In a world with homogeneous goods, it would be impossible for all countries to move "upscale" as some goods would not be produced at all and the gains from trade would disappear. But in a world with differentiated goods, it is possible to envisage poor countries producing more of the "types" of goods that rich countries produce and trading these "varieties" against those that rich countries produce. Still, for poor countries there may be compensating terms-of-trade benefits from producing goods that are dissimilar to "rich-country" goods. Our analysis does not track these potential gains/losses since we are focusing on growth in output (not income, which is what the terms of trade affect). We thank an anonymous referee for bringing these issues to our attention.

activities—can reap the benefits in terms of higher economic growth.

## 4 Concluding remarks

What we have shown in this paper is that there are economically meaningful differences in the specialization patterns of otherwise similar countries. We have captured these differences by developing an index that measures the "quality" of countries' export baskets. We provided evidence that shows that countries that latch on to a set of goods that are placed higher on this quality spectrum tend to perform better. The clear implication is that the gains from globalization depend on the ability of countries to appropriately position themselves along this spectrum.

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**Table 1: Sample size of *EXPY***

<i>Year</i>	<i>No. reporting countries</i>
1992	48
1993	65
1994	87
1995	99
1996	111
1997	119
1998	119
1999	126
2000	133
2001	133
2002	127
2003	122

**Table 2: Descriptive statistics for *PRODY* (2000 US\$)**

<i>Variable</i>	<i>No. obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
mean <i>PRODY</i> , 1999-2001, at market exchange rates	5023	11,316	6,419	153	38,573
mean <i>PRODY</i> , 1999-2001, PPP-adjusted	5023	14,172	6,110	748	46,860

**Table 3: Largest and smallest *PRODY* values (2000 US\$)**

	<i>product</i>	<i>product name</i>	<i>mean PRODY, 1999-2001</i>
smallest	140490	Vegetable products nes	748
	530410	Sisal and Agave, raw	809
	10120	Asses, mules and hinnies, live	823
	90700	Cloves (whole fruit, cloves and stems)	870
	90500	Vanilla beans	979
largest	721060	Flat rolled iron or non-alloy steel, coated with aluminium, width>600mm	46,860
	730110	Sheet piling of iron or steel	46,703
	721633	Sections, H, iron or non-alloy steel, nfw hot-roll/drawn/extruded > 80m	44,688
	590290	Tyre cord fabric of viscose rayon	42,846
	741011	Foil of refined copper, not backed, t < 0.15mm	42,659

**Table 4: Descriptive statistics for *EXPY* (2000 US\$)**

<i>Year</i>	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
1992	48	12,994	4,021	5,344	20,757
1993	65	12,407	4,179	3,330	20,361
1994	87	11,965	4,222	2,876	20,385
1995	99	11,138	4,513	2,356	19,823
1996	111	10,950	4,320	2,742	20,413
1997	119	10,861	4,340	2,178	19,981
1998	119	11,113	4,621	2,274	20,356
1999	126	11,203	4,778	2,261	26,218
2000	133	10,714	4,375	1,996	25,248
2001	133	10,618	4,281	2,398	24,552
2002	127	10,927	4,326	2,849	24,579
2003	122	10,664	3,889	2,684	23,189

**Table 5: Number of countries that show an increase/decrease in *EXPY*, 1992-2003**

	<i>EXPY, ppp</i>	<i>EXPY, market XRs</i>
Increase	8	13
Decrease	37	32

**Table 6: Countries with smallest and largest *EXPY*s**

	<i>Reporter</i>	<i>EXPY</i>
<i>Smallest</i>	Niger	2,398
	Ethiopia	2,715
	Burundi	2,726
	Benin	3,027
	Guinea	3,058
<i>Largest</i>	Luxembourg	24,552
	Ireland	19,232
	Switzerland	19,170
	Iceland	18,705
	French Polynesia	18,550

**Table 7: Correlates of *EXPY***

	(1)	(2)	(3)	(4)
	Dependent variable: log <i>EXPY</i> in 2001			
log GDP per capita	0.354 (14.75)**	0.298 (9.37)**	0.288 (6.96)**	0.282 (7.47)**
log human capital		0.281 (2.08)*	0.268 (1.79)	0.157 (1.16)
rule of law index			0.019 (0.41)	0.065 (1.58)
log population				0.089 (5.01)**
log land area				-0.032 (2.30)*
constant	6.090 (27.39)**	6.405 (26.45)**	6.497 (18.03)**	5.523 (14.66)**
Observations	131	102	101	100
R-squared	0.72	0.75	0.74	0.79

Robust t-statistics in parentheses

\* significant at 5% level; \*\* significant at 1% level

**Table 8: Cross-national growth regressions**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dependent variable: growth rate of GDP per capita over 1992-2003						Dependent variable: growth rate of GDP per capita over 1994-2003					
	OLS	OLS	OLS	IV	IV	IV	OLS	OLS	OLS	IV	IV	IV
log initial GDP/cap	-0.015 (2.37)*	-0.019 (2.89)**	-0.035 (3.30)**	-0.017 (2.56)*	-0.025 (3.99)**	-0.040 (3.54)**	-0.008 (1.90)	-0.013 (2.78)**	-0.012 (1.92)	-0.012 (1.44)	-0.018 (2.61)**	-0.014 (2.03)*
<b>log initial EXPY</b>	<b>0.060</b> <b>(3.96)**</b>	<b>0.056</b> <b>(3.83)**</b>	<b>0.046</b> <b>(2.88)**</b>	<b>0.072</b> <b>(3.55)**</b>	<b>0.082</b> <b>(4.13)**</b>	<b>0.082</b> <b>(3.85)**</b>	<b>0.035</b> <b>(3.05)**</b>	<b>0.034</b> <b>(2.74)**</b>	<b>0.032</b> <b>(2.55)**</b>	<b>0.046</b> <b>(1.99)*</b>	<b>0.053</b> <b>(2.55)*</b>	<b>0.049</b> <b>(2.88)**</b>
log human capital		0.028 (2.02)	0.014 (1.22)		0.024 (1.92)	0.016 (1.58)		0.021 (2.20)*	0.008 (0.67)		0.015 (1.45)	0.006 (0.57)
log capital-labor ratio			0.010 (1.84)			0.009 (1.75)			-0.004 (0.72)			-0.006 (1.05)
rule of law index			0.011 (2.65)*			0.005 (0.95)			0.009 (2.23)**			0.007 (1.69)
constant	-0.419 (4.32)**	-0.357 (3.68)**	-0.212 (1.84)	-0.501 (3.62)**	-0.550 (3.78)**	-0.507 (2.92)**	-0.242 (3.15)**	-0.201 (2.36)*	-0.144 (1.49)	-0.305 (2.12)*	-0.323 (2.42)*	-0.268 (2.07)*
F-statistic on instruments (first stage)				4.80	4.37	4.06				10.36	4.89	6.22
Hansen J-statistic (p-value)				0.89	0.73	0.74				0.02	0.04	0.13
Observations	46	43	43	44	42	42	85	69	68	76	68	67
R-squared	0.35	0.40	0.48				0.20	0.26	0.32			

Robust t-statistics in parentheses

Instruments for IV regressions: log population, log land area.

\* significant at 5% level; \*\* significant at 1% level



**Table 9: Panel growth regressions, 1962-2000**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	5-year panels		GMM	OLS	10-year panels		GMM
		IV	FE			IV	FE	
log initial GDP/cap	-0.0117 (4.39)**	-0.0299 (4.78)**	-0.0272 (4.24)**	-0.0143 (2.65)**	-0.0128 (4.42)**	-0.0384 (4.37)**	-0.0318 (5.69)**	-0.0177 (2.37)*
<b>log initial EXPY</b>	<b>0.0287</b> <b>(5.38)**</b>	<b>0.0739</b> <b>(5.06)**</b>	<b>0.0185</b> <b>(2.26)*</b>	<b>0.0446</b> <b>(4.10)**</b>	<b>0.0286</b> <b>(5.22)**</b>	<b>0.0919</b> <b>(4.54)**</b>	<b>0.0141</b> <b>(1.97)*</b>	<b>0.0444</b> <b>(2.29)*</b>
log human capital	0.0068 (3.27)**	0.0041 (1.76)	0.0049 (1.08)	0.0035 (0.92)	0.0077 (3.75)**	0.0045 (1.75)	0.0038 (0.81)	0.0085 (1.23)
constant	-0.1146 (4.08)**	-0.3372 (4.68)**	0.0937 (1.35)	-0.2301 (3.91)**	-0.1076 (3.68)**	-0.4197 (4.25)**	0.164 (2.53)*	-0.2023 (1.75)
Hansen J-statistic (p-value)		0.000		0.51		0.001		0.09
Second-order serial correlation (p-value)				0.61				0.32
observations	604	604	604	604	299	299	299	299
R-squared	0.16		0.13		0.24		0.28	

Robust t-statistics in parentheses

All equations include period dummies. IV regressions use log population and log area as instruments. Fixed effects (FE) include dummies for countries. GMM is the Blundell-Bond System-GMM estimator using lagged growth rates and levels as instruments. The GMM estimation also uses log population and log area as additional instruments.

\* significant at 5% level; \*\* significant at 1% level

**Table 10: Panel growth regressions by income sub-groups**

**A: 5-year panels, 1962-2000**

	(1)	(4)	(3)	(2)	(5)	(8)	(7)	(6)	(9)	(12)	(11)	(10)
	OECD	MIDUP	MIDLW	LOW	OECD	MIDUP	MIDLW	LOW	OECD	MIDUP	MIDLW	LOW
	OLS				IV				FE			
log initial GDP/cap	-0.024 (2.87)**	-0.023 (2.75)**	-0.025 (3.89)**	-0.021 (3.00)**	-0.020 (1.34)	-0.040 (3.32)**	-0.039 (3.76)**	-0.031 (3.43)**	-0.035 (1.79)	-0.024 (1.78)	-0.040 (2.30)*	-0.022 (1.95)
<b>log initial EXPY</b>	<b>0.002</b> <b>(0.16)</b>	<b>0.020</b> <b>(1.11)</b>	<b>0.028</b> <b>(3.06)**</b>	<b>0.027</b> <b>(2.85)**</b>	<b>-0.007</b> <b>(0.25)</b>	<b>0.119</b> <b>(2.34)*</b>	<b>0.088</b> <b>(3.03)**</b>	<b>0.057</b> <b>(3.11)**</b>	<b>-0.003</b> <b>(0.15)</b>	<b>0.003</b> <b>(0.15)</b>	<b>0.035</b> <b>(2.03)*</b>	<b>0.016</b> <b>(1.08)</b>
log human capital	-0.002 (0.34)	0.015 (1.36)	-0.005 (0.91)	0.005 (1.82)	-0.002 (0.40)	-0.018 (0.83)	-0.002 (0.31)	0.003 (0.88)	-0.010 (0.44)	0.038 (1.61)	0.011 (0.85)	0.011 (1.61)
cons	0.247 (2.92)**	0.049 (0.39)	0.003 (0.05)	-0.052 (0.73)	0.295 (2.14)*	-0.597 (1.80)	-0.364 (2.06)*	-0.220 (1.98)*	0.398 (1.82)	0.150 (1.01)	0.079 (0.73)	0.040 (0.30)
observations	152	112	178	162	152	112	178	162	152	112	178	162
R-squared	0.48	0.22	0.21	0.15	0.48		0.01	0.09	0.57	0.51	0.34	0.28

**B: 10-year panels, 1962-2000**

	(1)	(4)	(3)	(2)	(5)	(8)	(7)	(6)	(9)	(12)	(11)	(10)
	OECD	MIDUP	MIDLW	LOW	OECD	MIDUP	MIDLW	LOW	OECD	MIDUP	MIDLW	LOW
	OLS				IV				FE			
log initial GDP/cap	-0.029 (2.49)*	-0.031 (3.19)**	-0.030 (4.58)**	-0.023 (3.69)**	-0.026 (1.37)	-0.054 (3.52)**	-0.050 (3.34)**	-0.037 (3.85)**	-0.057 (3.45)**	-0.029 (2.27)*	-0.057 (3.73)**	-0.023 (2.28)*
<b>log initial EXPY</b>	<b>0.008</b> <b>(0.50)</b>	<b>0.021</b> <b>(1.16)</b>	<b>0.029</b> <b>(2.84)**</b>	<b>0.024</b> <b>(2.84)**</b>	<b>0.001</b> <b>(0.03)</b>	<b>0.157</b> <b>(2.22)*</b>	<b>0.104</b> <b>(2.54)*</b>	<b>0.070</b> <b>(3.21)**</b>	<b>0.010</b> <b>(0.35)</b>	<b>0.005</b> <b>(0.28)</b>	<b>0.037</b> <b>(2.36)*</b>	<b>0.013</b> <b>(1.06)</b>
log human capital	-0.001 (0.20)	0.017 (1.42)	-0.001 (0.14)	0.005 (1.85)	-0.002 (0.24)	-0.030 (0.89)	0.005 (0.64)	0.001 (0.43)	0.002 (0.13)	0.044 (1.94)	0.016 (1.08)	0.006 (1.02)
cons	0.241 (2.87)**	0.105 (0.78)	0.031 (0.49)	-0.010 (0.13)	0.274 (2.23)*	-0.789 (1.67)	-0.412 (1.72)	-0.274 (2.03)*	0.454 (2.02)*	0.163 (1.12)	0.192 (1.60)	0.082 (0.67)
observations	76	56	88	79	76	56	88	79	76	56	88	79
R-squared	0.59	0.32	0.31	0.19	0.59				0.74	0.69	0.56	0.52

Robust t-statistics in parentheses

\* significant at 5% level; \*\* significant at 1% level

Figure 1: The production space

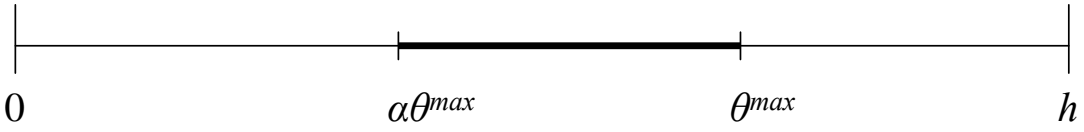


Figure 2: Equilibrium and comparative dynamics

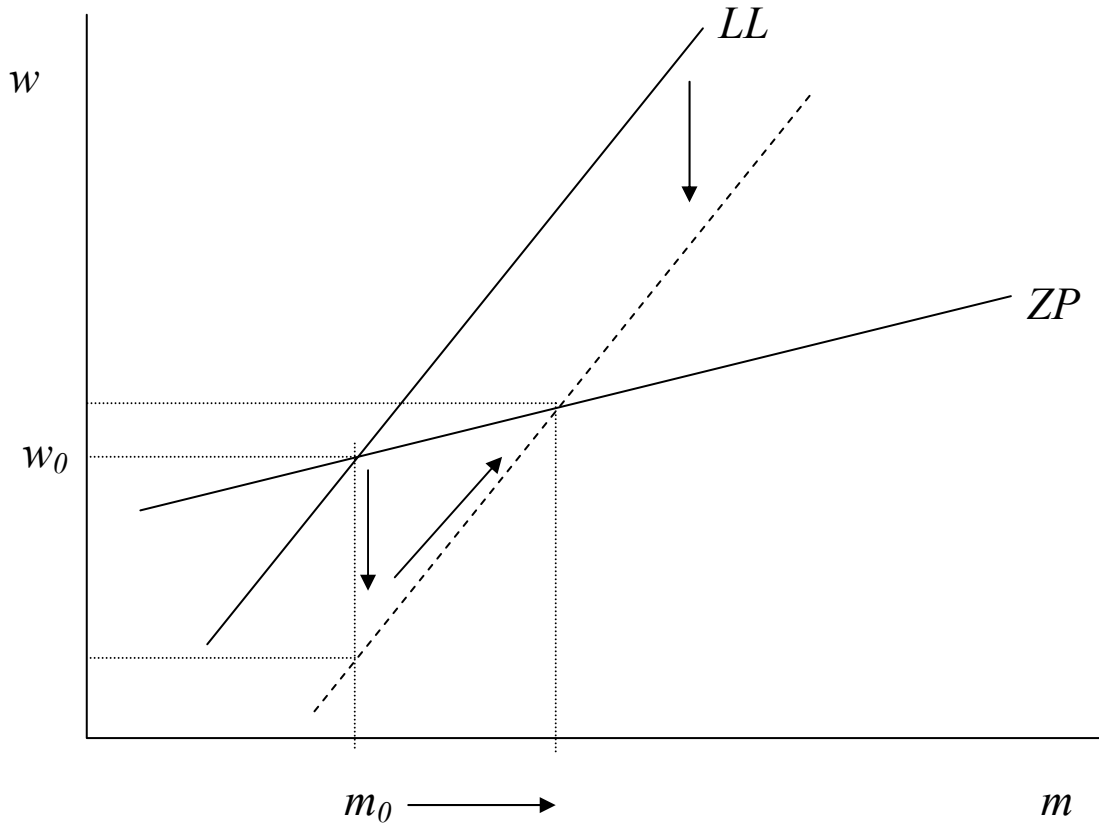


Figure 3: How *EXPY* varies over time

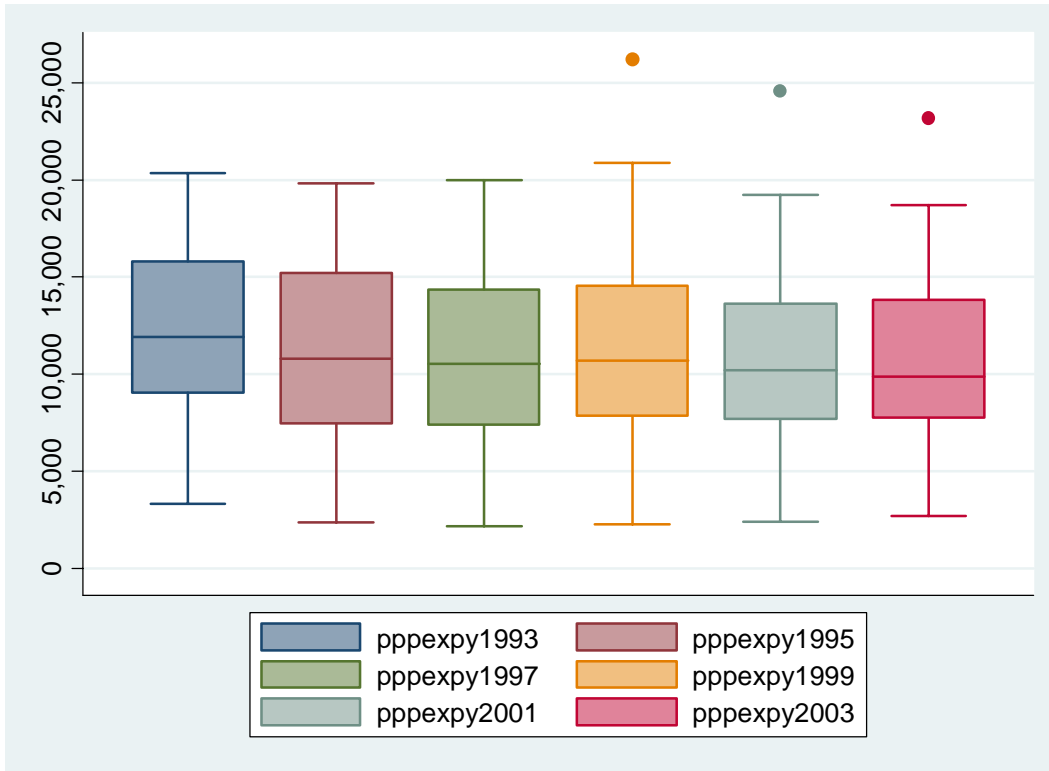


Figure 4: Relationship between per-capita GDP and *EXPY*, 2003

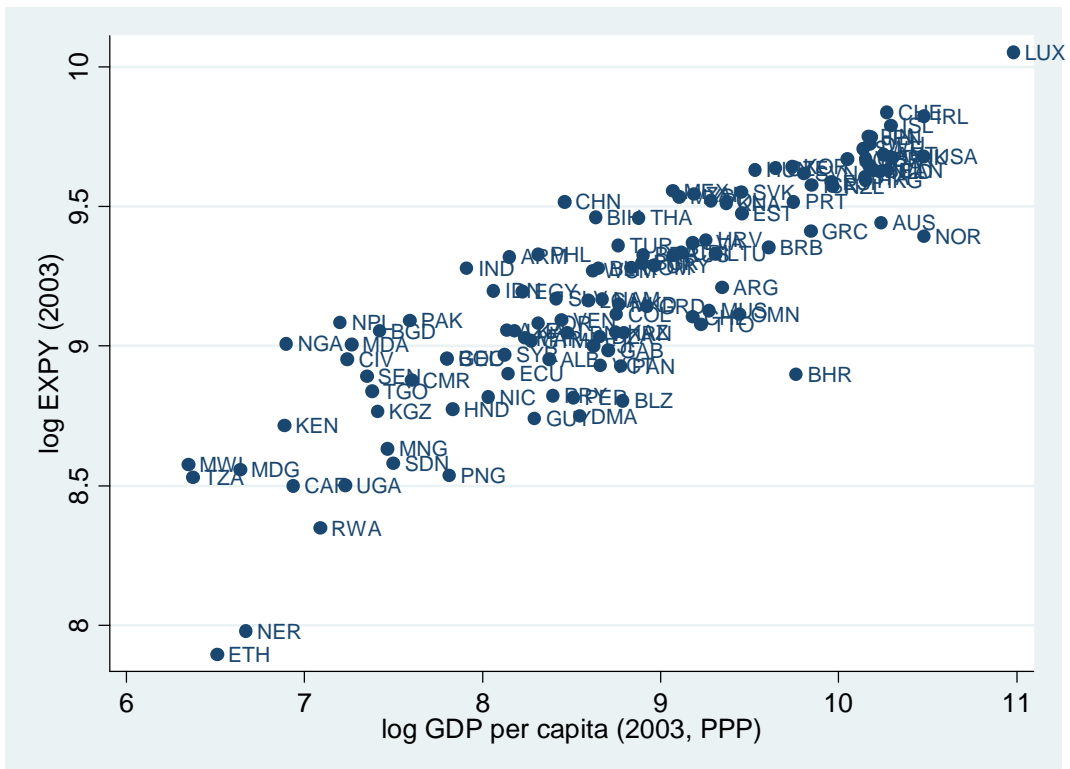


Figure 5: *EXPY* over time for selected countries

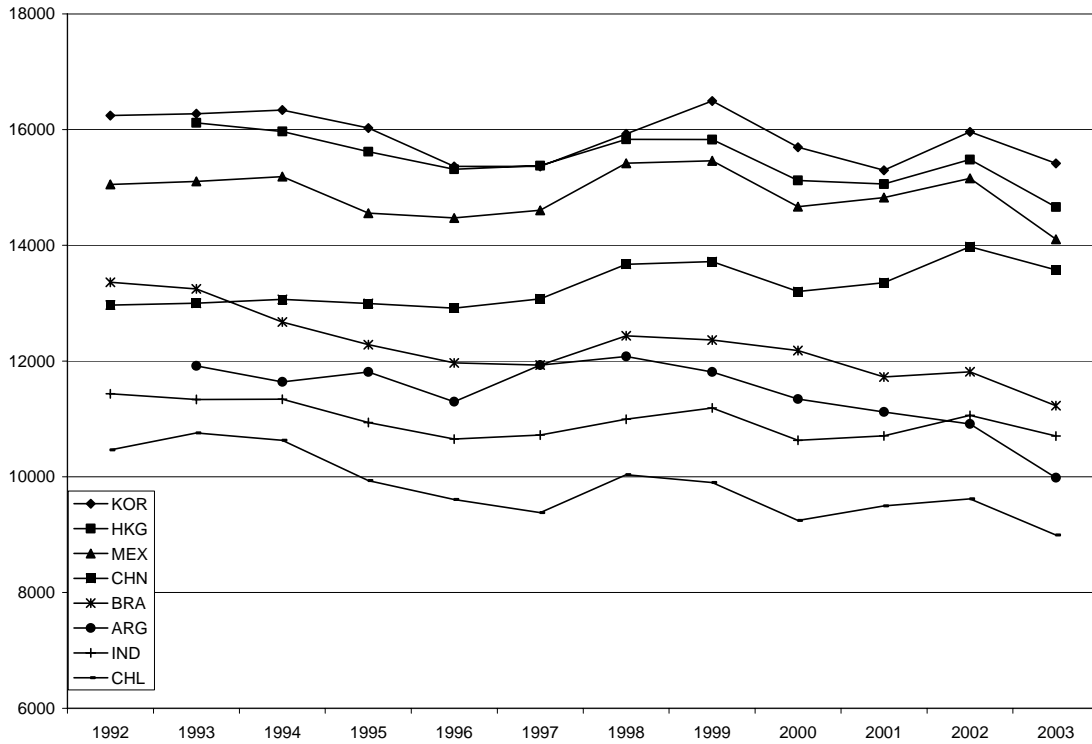


Figure 6: *EXPY* over time for natural-resource exporting countries

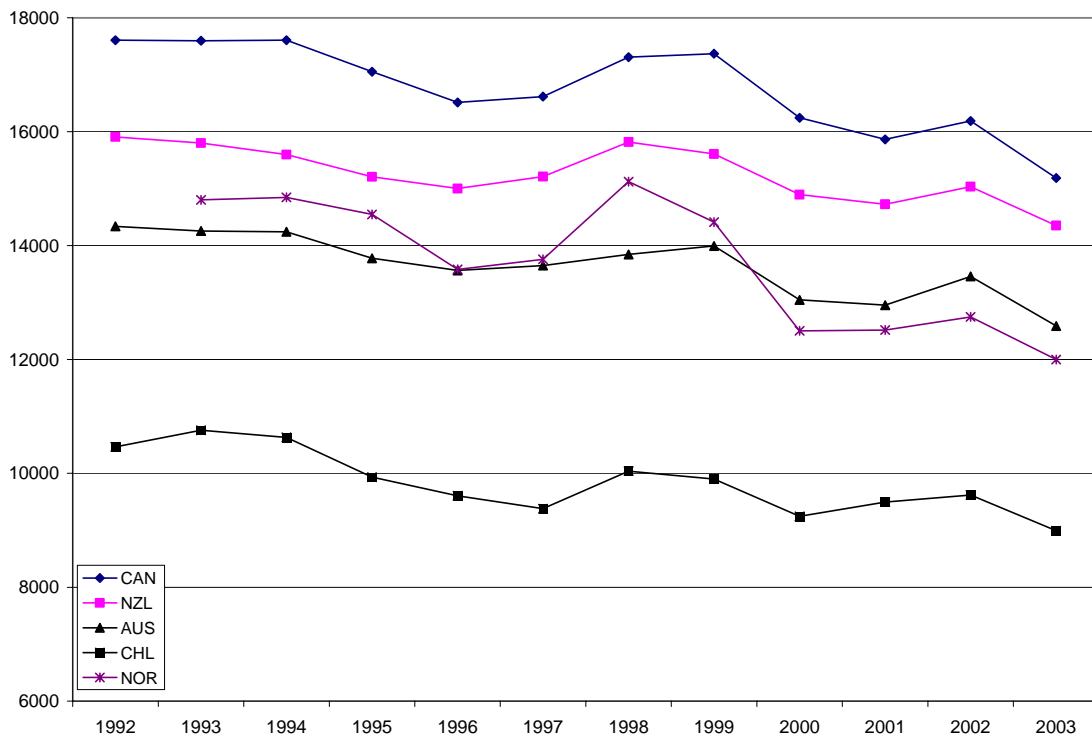
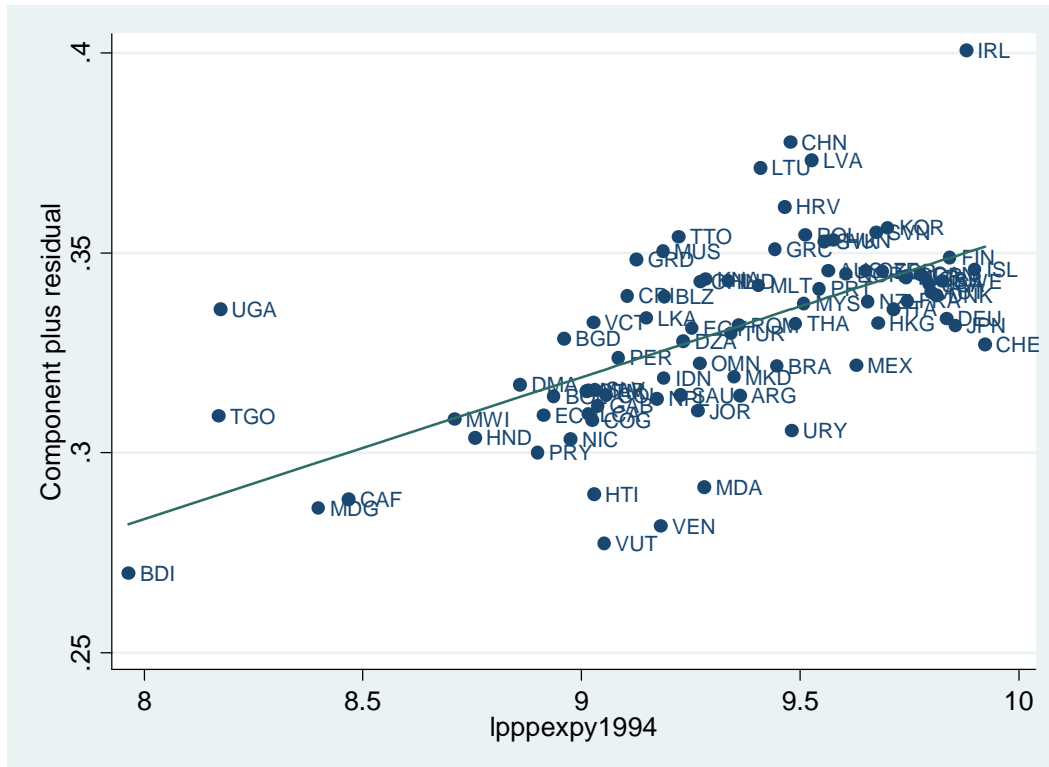


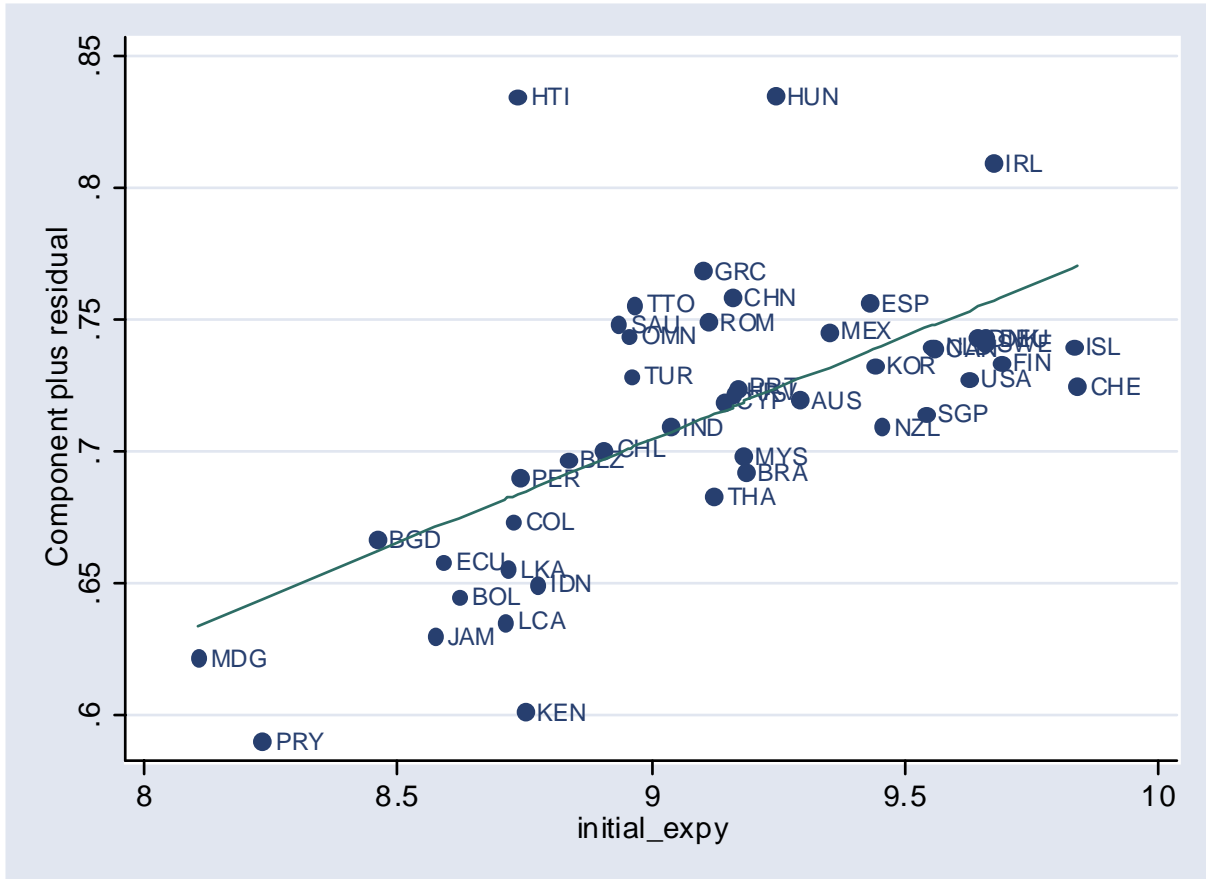
Figure 7: Deviations from cross-national norm for *EXPY*  
 (Percent differences from the regression specification in Table 7, column 4)



Figure 8: Partial relationship between *EXPY* and subsequent growth (Table 8, col. 5)



**Figure 9: Relationship between *EXPY* and subsequent export growth**



Note: This chart shows growth in exports over 1992-2003 as a function of the 1992 level of *EXPY* (controlling for initial income).