Does What You Export Matter?
In Search of Empirical Guidance for Industrial Policies *

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This Version: September 27, 2010

Preliminary
For Comments Only
Not for Citation without Authors’ Permission

* This study was undertaken under the Regional Studies Program of the Office of the Chief Economist for Latin America and the Caribbean. The authors gratefully acknowledge additional funding from the Multi-Donor Trust Fund on Trade executed by the World Bank, DECTI. Augusto de la Torre, Norman Loayza, Ottaviano Canuto, Jose Guilherme Reis, Bernard Hoekman, Pravin Krishna, Andrés Rodríguez-Clare, Guido Porto, Irene Brambilla, Ana Cusolito, Francisco Rodríguez, among others, provided insightful comments on our previous work, presentations and papers that are now part of this manuscript.
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1. Introduction

Does what economies export matter for development? And, even if it does, can governments improve on the export basket that the market generates through industrial policies? This report takes up these questions by reviewing relevant literature and taking stock of what we know from conceptual, empirical, and policy viewpoints.

A large literature has answered affirmatively to the first question and suggested the characteristics that distinguish desirable exports. Some schools of thought are best known by the colorful metaphors: natural resources are a “curse”; “high tech” goods promote the “knowledge economy;” a “product space” made up of “trees” (goods) from which “monkeys” (entrepreneurs) can more easily jump to other trees fosters growth, to give just three examples. More prosaically, but no less controversially, goods which are intensive in unskilled labor are thought to promote “pro poor” or “shared growth,” whereas those which are skilled labor intensive are thought to generate positive externalities for society as a whole. Concerns about macroeconomic stability have led to a focus on the overall composition of the export basket.

This report revisits many of these arguments conceptually and, wherever possible, imports heuristic approaches into frameworks where, as more familiar arguments, they can be held up to the light, rotated, and their facets examined for brilliance or flaws. Our second task is to see what emerges empirically as a basis for policy design. That is, given certain conceptual arguments in favor of intervention, does available data allow us actually to do so with a high degree of confidence? In asking this question, we assume competent, committed policy makers and sidestep the debate about whether government failures trump market failures generically: We attempt to “give industrial policy (IP) a chance.”

Conceptual Issues

Traditional trade theory argues that welfare is maximized when countries specialize in goods that they produce relatively cheaply. Yet from Adam Smith, there have been misgivings about this as the final word in development policy and the issue is the fundamental question underlying industrial policy. Excellent surveys of the conceptual literature can be found in Pack and Saagi (2006) and Harrison and Rodriguez-Clare (2009), and we do not attempt to replicate them here. Our objectives are more modest, aiming to lay out some basic principles that can help organize and interpret new and existing empirical evidence with a view towards broad policy issues rather than specific programs. In purely economic terms, there are fundamentally two reasons why producing a good may have benefits not fully captured by the price mechanism: Marshallian externalities and rents.

Marshallian externalities offer perhaps the strongest argument for why market forces may not provide an economy the optimal basket of goods. These are local externalities that lead productivity to rise with the size of the industry and they may arise
for numerous reasons – local industry level knowledge spillovers, input-output linkages, and labor pooling, for instance- but which are not captured by the market price of a good. Harrison and Rodriguez-Clare show in a simple example where world prices are taken as given that multiple equilibria exist: The market may dictate that a country specializes in the good without externalities when, with some intervention, it would more efficiently specialize in the good with externalities.

The externality argument is one of the strongest for asserting the superiority of some goods over others, however throughout this paper we highlight two critical caveats. First, Baldwin (1969) cautioned that expanding a sector with potential externalities does not necessarily imply that they will automatically occur, if the sector is not organized appropriately. This points to a larger theme throughout this report, namely that it may be just as important or more to focus on how goods are produced than on what is being produced. Part II of the study explores the argument that, in fact, it may be altogether inappropriate to take the “good” as the unit of analysis.

Second, we need to consider not only the productivity side of the equation, but also what is happening on the price side as well. Rodriguez-Clare (2007) argues that if Mexico can exploit a Marshallian externality in a product, it is likely that the industrialized world and even China can as well and probably already have. If this is the case, then supply of that good has already expanded, and world prices have fallen to the point where the benefit of the externality has been completely offset. Rodriguez shows that in this case, the optimal pattern of specialization is determined, in fact, by considerations of deep underlying comparative advantage. That is, there may be externalities from producing computers in Mexico, but unless Mexico is intrinsically better in producing high level electronics – due to accumulated know how, human capital, etc. – than say the U.S., the externality argument is not sufficient for Mexico to prefer them to, for instance, Tequila given that the agave plant is uniquely suited to the Guadalajaran climate.

This argument is mitigated somewhat if there are inter-industry externalities, that is, the spillovers accrue to the economy as a whole. The increased productivity in all goods is not reflected in the particular profitability of any one good. In this case, any losses from moving against comparative advantage are potentially offset by the overall gains to the economy. These were the arguments forwarded by Tyson (1992) in Who’s Bashing Whom for defending the semi-conductor industry in the U.S. Still, governments around the world seeing the benefits of these goods could competitively subsidize industries and they could, again, potentially bid away the economy-wide benefits. However, if the magnitude of the externality is asymmetric between rich and poor countries, developing countries may still reap a benefit from supporting these industries. For instance, the first Intel plant in Costa Rica may teach important economy-wide lessons about the importance of tolerances (precision), the nature of international marketing networks, the best way to spin off new firms from old, and how to provide on time quality inputs to a global supply chain. Arguably, introducing a new type of chip-driven product to Silicon Valley would have little additional learning effect there. Hence, the advanced countries should be less likely to subsidize this industry, than developing
countries and hence, the global price is unlikely to fall enough to offset all the potential gains. Further, in practice, trade policies often seem geared toward protecting industries that are having trouble competing (textiles or automobiles in the U.S.) than toward fomenting industries with likely externalities.

The focus on these price considerations raises the issue of market structure and the desirability of reaping rents where the international product price lies above the cost of production. Though “rent seeking” carries negative connotations, in principle rents are part of value added and desirable. Such rents can arise where industries have increasing returns to scale, as Krugman pointed out in the work that won him the Nobel Prize. Both Boeing and Airbus, if they could dominate the market for airframes, would reap large rents. Since increasing returns to scale implies that moving first and fast due to large sunk costs of production acting as a barrier to entry is potentially more critical than “deep” parameters of comparative advantage, governments may engage in strategic subsidies to guarantee that their champion wins the market. However, rents also emerge in less exotic ways where certain goods offer producers market power. The barriers to entry posed by natural endowments of mining reserves, for example, generate clear rents to producers and, all other things equal, make natural resources excellent goods to be endowed with. Firms see these rents and there is no obvious barrier to the market allocating resources efficiently, although there may still be an argument for government intervention in the tradition of the optimal tariff literature.

The discussion of the price effects offsetting Marshallian externalities, and of rents highlights the tendency of discussions of industrial policy to focus excessively on the supply side, ignoring issues of market structure and demand. The price offset highlighted by Rodriguez is one such case where only the potential production side benefits were considered with relatively little consideration for how prices may have moved internationally to offset them. More generally, it is extremely difficult for a developing country to enter and survive in a well established and competitive market dominated by advanced country firms. Nokia’s near death experience entering the saturated television industry in the 1980s is emblematic of such challenges.

However compelling the conceptual arguments in either direction, empirically these effects have proved difficult to document and quantify, let alone permit a ranking of goods by their potential for externalities or rents. Both Harrison and Rodriguez (2009) and Pack and Saagi (2006) review much of the literature struggling to document the externalities discussed above, so we will not repeat them here. A similar dearth of

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2 However, even in this case, retaliation can reverse the original corporate profit transfer across the competing economies (or the terms of trade improvement in the case where one of the firms is an import-competing domestic monopoly).

3 However, there may still be an argument for government intervention. Even if a country holds market power in the aggregate, a high level of domestic competition could drive the export price to marginal cost and pass along all potential rents to foreign importers. Government imposition of an optimal tariff is effectively an internal coordination mechanism for restricting output of all domestic agents so that the country enjoys the rents itself. OPEC performs the same service internationally.

4 See also Basu and Fernald (1995) for an example of how difficult it is to econometrically identify spillovers.
information exists on the relevant elasticities that might offer insights into market structure and rents. Further, the closest relevant estimates vary across several orders of magnitude. Even where a consistent set of global elasticities estimates are available that might offer some suggestive ranking of goods, they do not. Kee, Nicita and Olarreaga (2008b, 2009) estimate within-country import demand elasticities for thousands of products at the HS six-digit level. They find that, on average, goods with the highest price elasticities included Cotton Yarn (-16.29), Buckwheat (-11.72), but also electronic integrated circuits (-12.89). More generally, Kee, Nicita and Olarreaga (2008a) estimates suggest that the median price elasticities of differentiated goods are numerically somewhat lower, but not statistically different from referenced-priced goods and homogeneous goods traded in organized exchanges (Rauch’s 1999 classification).

It is almost certainly our empirical blindness on both counts that has led the most prominent literatures arguing the importance of export composition – defending a natural resource “curse” and that advocating public support for “high productivity” goods – to have taken the empirical shortcut of identifying goods that are thought to embody desirable (or undesirable) qualities and then testing their impact in aggregate growth regressions.

The rest of the report is organized into two parts. The first, composed of chapters 2-4, tackles policy issues related to the quality of trade from the viewpoint of desirable goods or industries. In contrast, the second part, composed of chapters 5-7, tackles the issues through the lens of a country’s overall export or trade structure. Chapter 8 concludes with a brief review of the main policy implications. The remaining of this introduction summarizes the main messages and issues raised by each chapter.

What Makes a Good Good?

The three chapters of Part I explore the good as a unit of analysis. Each chapter examines a literature that has argued in favor of certain goods as growth promoting (inhibiting) and discusses the conceptual arguments and empirical evidence supporting that view.

Chapter 2 on Cursed Goods revisits in some detail the ubiquitous literature on the resource curse which has offered numerous arguments over the course of 200 hundred years: the absence of inter industry spillovers, toxic political economy effects, etc. In the end, there is little evidence for these particular effects and the empirical arguments recur to the aggregate level where we argue that the majority of the evidence is, in fact, in favor

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5 Goldstein and Khan’s (1985) survey estimated price demand elasticities of aggregate exports for several countries and find these centered around 1 implying substantial market power across many industries. However, Panagariya, Shah and Mishra (2001) argued that this contradicts a more mainstream assumption that most countries face very high, even infinite elasticities for their goods. They find that, at greater levels of disaggregation and improved estimation approach, estimates of a set of textile related products lie between 60 and 136 for Bangladesh. Estimates across a broader range of goods and countries are not available.
of a resource blessing. This is not to deny that in many countries natural resources have had some negative consequences, but at present the average effect appears to be positive.

Chapter 3 on High Productivity Goods and Monkeys examines recent literature produced by researchers mostly associated with the Kennedy School of Government at Harvard, which argues that exporting products currently produced by rich countries yields spillovers that lead to faster growth. This literature postulates a learning externality arising from the production of these goods. The evidence in favor of this view relies on cross-country growth regressions to show the growth enhancing effects of high-productivity (high EXPY, in the authors’ terminology) goods. We find these results to be relatively fragile, even after exploring some alternative growth-model specifications, which arguably provide a fairer (less strict) test of the underlying theoretical arguments put forth by Hausmann, Hwang and Rodrik (2007). We speculate that this may imply that the high productivity effect may be overstated, or it may be because, in fact, goods exported by high-income countries by definition are already generously supplied by competitive economies and hence, there is an offsetting low rents effect to any possible productivity externality.

We also revisit the monkey-tree argument of Hidalgo et al. (2007) and suggest that this can be cast as an externality with attendant price offset effects. An irony emerges that goods that are “close” to other goods in the product space and hence, which are easy for monkeys (entrepreneurs) to jump to, by definition, by definition enjoy few barriers to entry and the potential for rents from Marshallian externalities are likely to have been dissipated. Further, historical correlations of indexes of comparative advantage among industries (the underlying workhorse of the empirical product space espoused by these authors) are unlikely to be useful predictors of where the next high rent, high productivity goods are coming from. On the other hand, populating a high-density segment of the product space could result in export diversification, which could help reduce macroeconomic volatility, although this dimension was not explored by the original authors.

Chapter 4 on Smart Goods extends the scope for industrial policy by exploring labor market data from sixteen Latin American economies and assesses whether certain types of industries offer human capital externalities. While concerns about income distribution and pro-poor growth would lead us to conclude that subsidizing agriculture, for example, could yield growth with higher demand for unskilled labor, it is difficult to think of the market failure (besides capital-market imperfections) that would justify such a policy. That is, there are multiple other alternative policies that could re-distribute income across the population, such as taxes and transfers. In contrast, we know from the empirical literature on schooling that the aggregate (social) returns to schooling tend to be higher than the microeconometric estimates of the returns to schooling for individual workers (Krueger and Lindahl 2001). Consequently, this chapter examines patterns of the “returns to schooling” by looking at whether there is consistent evidence that certain sectors provide higher “skill premiums” than other sectors. That is, are there some goods that are “Brainy Goods” and should be encouraged due to market failures in the accumulation of education?
Following other empirical analyses in this report, this chapter asks if country effects are more or less important than those related to particular industries and hence whether the latter should be looked to provide the incentives to invest in education. In addition, the chapter assesses the role of exports and export-product differentiation as determinants of industry skill wage premiums. The preponderance of the evidence suggests that country and industry characteristics help explain national differences in the skill premium, but exports in general appear to be an important factor. This could imply that at most a combination of orthodox pro-trade policies and rather soft industrial policies in support of exporting activities could be useful in raising the skill premium within countries, thus raising private incentives to invest in education and skills that would help national development through the social spillovers of education.

**Beyond Goods**

The 3 chapters in the second part of the report raise several issues related to the previous analyses of the good or industry as the units of analysis. It argues that, for a variety of reasons, the assumption of the good as a homogenous unit of analysis, produced in uniform ways across countries is importantly wrong.

**Chapter 5 on Heterogeneity in the Production of Goods: The How versus the What** argues that, seemingly identical goods appear to be produced with different technologies of production in different countries arguably implying differing potential for externalities. Looking both at patenting activity within disaggregated goods categories, it identifies important heterogeneities. When Korea produces computers, it does so in a high tech way generating lots of knowledge. In Mexico, this is less the case.

**Chapter 6 on Export Heterogeneity along the Quality Dimension** introduces a newer literature on export quality measured by unit values and which goes to the other extreme of arguing that the important variance across countries is differences of quality, within very disaggregated product categories. In a nutshell, an issue for development policy is not whether an economy exports wine or microchips; it’s about whether the economy produces Chateau Margaux for $US 2,000 or Charles Shaw’s Two-buck Chuck. Without full knowledge of the industry structure, it is difficult to say anything about the welfare implications of specializing in one over the other. However, since average quality rises with level of development, the dynamics of quality unit value growth potentially offer insights into growth by proxying for the accumulation of underlying factors of production that yield high-quality goods and perhaps productivity.

The chapter finds support for the argument that certain goods have greater potential for quality growth due to longer “quality ladders” that offer a stronger convergence effects toward high unit values. However, there is no obvious market failure that suggests that countries are incorrectly specialized should they find themselves in goods, such as commodities, with shorter ladders. Further, the dominant factors affecting unit value growth appear to be country specific. That is, there are factors, perhaps deficient credit markets, poorly articulated national innovation systems or poor institutions that appear to inhibit growth of unit values even within the same products.
where OECD export unit values appear to grow more robustly than those of developing countries. Moreover, it appears that Latin America and the Caribbean as a whole

**Chapter 7 on Goods versus Tasks** pushing the underlying themes of the previous two chapters further, argues that the global fragmentation of the production process has meant that individual countries contribute *tasks* to an overall production process, even though their trade statistics may suggest that they are producing an entire good. The emblematic case here is China’s “export” of the iPod of which it contributes 1% of value added. This is not to say that the assembly task it contributes doesn’t offer some inter industry spillovers, only that arguing that China produces a “high tech” good over states the case. Ideally, we would have data on countries’ exports of “tasks” as opposed to what stage of the production process crosses their border, but we do not. Hence, much of our discussion in part I, like the bulk of the existing relevant trade literature, might require substantial caveats. The evidence discussed in this chapter illustrates how certain industries have notably different manifestations in terms of the factors of production used, including the level of innovation (proxied by patenting activity) that is associated with comparative advantage indicators based on trade data in the same industry across countries. Hence developing comparative advantage in a “high-tech” industry might actually be due to the commoditization of a manufactured good, rather than a truly high-tech production process that is inextricable from skilled labor or innovation.

**Chapter 8 on What Makes an Export Basket Good?** explores whether the nature of the *basket* of goods, as opposed to its individual goods, matters. Here, concentration in one good effectively provides a negative externality to other industries by inducing excessive terms of trade volatility. The government may thus have a role in ensuring a more diversified portfolio. In particular, the chapter highlights the role of product innovation for diversification, reviews studies of the importance of concentration for productivity, and discusses new evidence of the importance of export diversification for reducing macro volatility, especially among economies that are net exporters of energy and mining commodities.

Indeed, the evidence seems to suggest that small, poor, and mining-dependent economies tend to have high concentration of export revenues (at least merchandise exports), which is in turn associated with high terms of trade volatility. However, net exports of energy and mining are not associated with a higher pass-through of terms of trade volatility into growth volatility, and agricultural commodity exports appear to be an altogether different animal and tend to be weakly associated with export diversification rather than concentration. An important fact for the debate over the merits of industrial policy, highlighted by Easterly, Reshef and Schwenkenberg (2009), is that across the globe manufacturing exports themselves tend to be highly concentrated and dominated by a few “big hits.” Hence when the overall distribution of export revenues is considered as a policy objective, it becomes clear that traditional notions of industrial policy might be passé. The slogan “picking winners” becomes more than a challenge for the foresight of central planners with good intentions; it becomes a potentially harmful approach that
could increase rather than decrease export concentration because the data suggest that exports of manufactures tend to be highly concentrated in a few “big hits.”

This report concludes in chapter 8 with a brief discussion of the main findings. The focus is not a comprehensive list of specific programs, and we do not provide “toolkits” for designing appropriate industrial policies or examples of international “best practices”. Our aim is to draw links between the basic notions of positive externalities, the best available empirical evidence, and the challenges policymakers might face in advocating for different types of industrial policies.

In the end, we argue that theory, intuition and empirical evidence all suggest potentially desirable public policies that go beyond the non-interventionist orthodoxy. We do find, for example, arguments for supporting efforts at diversification in NR exporters and subsidizing exports that might raise a country’s returns to schooling. More generally, we find a strong case for “horizontalish” (neutral on average across sectors) policies supporting the productivity and quality growth of existing industries and the emergence of the ever unpredictable new ones: resolving market failures in the development of trade networks, improvements in quality, and investment in R&D, etc.

However, we conclude that the literature to date offers few reliable empirical guides to the superiority of one type of good over another and hence to the selection of products or industries for special treatment. Further, what emerges consistently is an extraordinary heterogeneity of country experiences within good categories. This ranges from identical goods being produced with very different levels of productivity, quality and technological sophistication, to the fact that, in evolving global production system, countries increasingly trade in tasks--fragments of the production of a good--rendering the concept of a good increasingly anachronistic. We argue that concern with how countries produce what is currently exported merits more attention than what is produced. Understanding the roots of the observed differential performance, in turn, feeds back into the question of what is exported through conventional considerations of comparative advantage. Throughout the report, simple empirical exercises suggest that country specific characteristics, rather than goods characteristics take us a long way in explaining the incidence of potentially desirable industrial structures.

With regard to crafting optimal baskets of goods, specific programs and policies that could be part of such a policy stance remain unexplored in this report, however, partly because more analytical work is needed to understand how products within countries’ export bundles are correlated in terms of quantities, prices, and factor demands. Without such knowledge, the design of pro-diversification industrial policies must remain the subject of modest policy experimentation with rigorous monitoring and evaluation.
Part I: What Makes a Good Good?
2. Cursed Goods: Natural Resources

Like Dracula, the notion of a natural resource curse remerges periodically, haunting the development debate, striking fear into the hearts of Latin American policy makers, and causing quantities of ink to be spilled on the various ways in which being blessed with mineral, agricultural or other natural wealth, will lead to anemic growth performance. Adam Smith (1776) was perhaps first to articulate a concern that mining was a bad use of labor and capital and to be discouraged. The idea reappeared in the mid-1950s in Latin America when Raúl Prebisch (1959), observing slowing regional growth, argued that natural resource industries had fewer possibilities for technological progress and, further, were condemned to decreasing relative prices on their exports. These stylized facts helped to justify the subsequent import substitution industrialization (ISI) experiment in modifying national productive structures. Subsequently, disenchantment with the inefficiencies of protectionism and the consequences of populist macroeconomic policies led to more open trade regimes and less intrusive microeconomic policies, partly with the example of East Asia’s rapid export-led growth in mind.

Stylized Facts and the Mechanisms of the Curse

Two stylized facts have emerged to convert a new generation of analysts to believers in the curse. First, the liberalizing economies, with some notable exceptions, did not become manufacturing dynamos, or major participants in what is loosely called the new “knowledge economy.” Further, growth results were not impressive and, in the case of Africa, dramatic falls in commodity prices contributed to negative growth rates. With the increased popularity of cross-country growth regressions in the 1990s, numerous authors offered proof, that, in fact, natural resources appeared to curse countries with slower growth: Auty (1993), Davis (1995), Gylfason et al (1999), Neumayer (2004), Mehlum Moene and Torvik (2006), and arguably most influentially, with several authors drawing on their data and approach, Sachs and Warner (1995, 2001), have argued empirically that since the 1960s the resource-rich developing countries across the world have grown slower than other developing countries. In 2007, Macartan Humphrey, Jeffrey Sachs, and Nobel Prize winner Joseph Stiglitz published Escaping the Resource Curse, which adds further credence to the legend. Consequently, we find ourselves again in a time when the conventional wisdom postulates that natural resources are a drag on development, which goes against our intuition that natural riches are riches, nonetheless.

However, there has always been a countervailing current that suggests that common sense was not, in this case, misleading, and in fact, numerous authors have challenged the statistical basis for the curse. Most recently, evidence supportive of a more

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6 This chapter borrows heavily from Lederman and Maloney (2007 and 2008) and Maloney (2002, 2007).
7 “Projects of mining, instead of replacing capital employed in them, together with ordinary profits of stock, commonly absorb both capital and stock. They are the projects, therefore, to which of all others a prudent law-giver, who desired to increase the capital of his nation, would least choose to give any extraordinary encouragement …”
positive view was brought together in Lederman and Maloney (2007) in *Natural Resources, Neither Curse nor Destiny*, although, far earlier, notable observers such as Douglass North and Jacob Viner had dissented on the inherent inferiority of, for instance, agriculture relative to manufacturing. Even when Adam Smith was writing the Wealth of Nations, the American colonies were declaring their independence on their way to being one of the richest nations in the history of humanity, importantly driven, for a long period, by their endowments of natural resources (see, for example, Findlay and Lundahl, 1994). Other success stories – Australia, Canada, Finland, Sweden, remain, to date, net exporters of natural resources. Latin America’s and Africa’s disappointing experiences clearly offer a counterbalance to these success stories, but they do not negate them. Figures 2-1 and 2-2 plot Leamer’s measure of natural resource abundance (the log of net exports for net exporters and net imports for net importing countries) over workforce against (the log of) GDP per capita. The data show that high levels of income have been achieved by both low and high resource abundant countries.

**Figure 2.1. Net Exporters of Natural Resources during 1980-2005 and Real GDP per Capita in 2005**

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8 See Irwin (2000) for the US; Innis (1933) and Watkins (1963) for Canada; Wright (2001), Czelusta (2001) for Australia; Blomström and Kokko (2001) and Blomström and Meller (1987) for Scandinavia. Latin America also offers its success stories: Monterrey Mexico, Medellin Colombia, and São Paolo, Brazil all grew to become dynamic industrial centers based on mining and in the later two cases, coffee. Copper-rich Chile has been the region’s model economy since the late 1980s.
The acknowledgment of the important heterogeneity of experiences has led tentatively to a greater circumspection about the impact of resources, although not necessarily less enchantment with the term “curse.” Humphreys, Sachs and Stiglitz (2007) begin their book noting that resource abundant countries often perform worse than their resource poor comparators, and Dunning (2005) talks of “conditional resource curse” – that is, under certain conditions, there is a negative growth impact. This is, without a doubt, a more careful way to frame the issue, and it moves explaining the heterogeneity of experience to center stage. Yet, the notion of a resource “curse” suggests more than the existence of a negative tail in the distribution of impact. Dracula’s sinister reputation arises not from the occasional involuntary transfusion when in Transylvania, but rather that a bloody parasitism is the central tendency of character (Disclaimer: the authors have not reviewed carefully any of the relevant empirical literature on this topic). Arguably, while colorful, continued use of the term distracts from understanding why some countries have done well with resources, and other not and would be best dropped.

That said, numerous channels through which the curse might operate have been offered and here we discuss only a few.

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9 We don’t for example, talk about a “venture capital” curse because 19 out of 20 VC financed firms go bankrupt. If the central tendency is that NR have a positive effect, then they remain a blessing, albeit conditional, and we need to understand the complementary factors necessary to maximize it. This is not different than understanding why Taiwan did better with its electronics industry than Mexico; or that Italy did better with its fashion industry than Korea did with “Project Milan.”
First, Prebisch (1959), among others, popularized the idea that terms of trade of natural resource exporters would experience a secular decline over time relative to those of exporters of manufactures. He is thus perhaps the exception in being preoccupied with the demand side of the quality of export debate, although perhaps without identifying any compelling market failure to be addressed. However, even the stylized fact is somewhat in doubt. Cuddington, Ludema and Jayasuriya (2007) find that they cannot reject that relative commodity prices follow a random walk across the 20th century with a single break in 1929. That is, there is no intrinsic force driving the observed decline and prices could as easily rise tomorrow as fall further. While commodity by commodity, important mean reverting components are evident and are, in fact, necessary for stabilization funds to be viable, the notion that long run prices have a strong unpredictable and permanent component appears more relevant today than at any time across the last half century. Paul Krugman (2008) taking exactly the opposite position from Prebisch, argues that continued growth by China and India, combined with simply “running out of planet” will lead to continued strong excess demand such that “rich countries will face steady pressure on their economies from rising resource prices, making it harder to raise their standard of living.”

Second, beginning with Smith, observers have argued that natural resources are associated with lower human and physical capital accumulation, productivity growth, and spillovers. The latter is the argument closest to the classic externalities argument, but neither is accepted as conclusive in the literature. Even in Prebisch’s era, future Nobel Prize winner Douglass North (1955 p.252) argued that “the contention that regions must industrialize in order to continue to grow ... [is] based on some fundamental misconceptions;” and the pioneer trade economist Jacob Viner argued that “There are no inherent advantages of manufacturing over agriculture” (Viner, 1952 p. 72.) Consistent with Viner’s (1952) early assertion, Martin and Mitra (2001) find total factor productivity growth to be higher in agriculture than in manufactures in a large sample of advanced and developing countries. Taking a broader view encompassing inter industry spillovers, Wright and Czelusta (2006) and Irwin (2000) have argued that, contrary to Smith’s prejudice, mining is a dynamic and knowledge intensive industry in many countries and was critical to U.S. development. Arguably, the single most important general purpose technology of the 19th century, the steam engine, arose as a learning spillover from the mining industry. Blomstrom and Kokko (2006) have argued the same for forestry in Scandinavia where Saab, a car and aircraft producer, and Volvo emerged from truck producers serving the forestry industry and Nokia, the telecom giant, from what was originally a forestry company.

The question of why such miracles did not appear in Latin America and the Caribbean arguably points toward Balwin’s argument that such spillovers are not automatic but depend on how goods are produced. Several authors stress the complementarity of essential factors, particularly human capital (see Gylfason and Bravo Ortega and de Gregorio, 2007). Relatedly, Maloney (2002, 2007) argues that Latin America missed opportunities for rapid resource-based growth due to deficient

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technological adoption driven by two factors. First, deficient national “learning” or “innovative” capacity, arising from low investment in human capital and scientific infrastructure, led to weak capacity to innovate or even take advantage of technological advances abroad. Second, the period of inward-looking industrialization discouraged innovation and created a sector whose growth depended on artificial monopoly rents rather than the quasi-rents arising from technological adoption, and at the same time undermined natural-resource-intensive sectors that had the potential for dynamic growth. Hence, natural resources were produced in a “low tech” way. The alternate path chosen by the US, Finland, and Sweden was and is to an important degree still open. Røed Larsen (2004) argues that Norway’s surge from Scandinavian laggard in the 1960s to regional leader in per capita income was based largely on the opposite strategy to that chosen by Latin America and concludes that “Norwegian Oil is a high technology sector which we may assume has much the same positive spillover effects as manufacturing is supposed to have” (p 17).

These arguments are central to the discussion surrounding the “Dutch Disease” aspect of the curse emphasized by, among others, Gylfason et al (1999), Sachs and Warner (2001) where perhaps through an appreciated exchange rate or classic Rybczinski effects, resource booms depress manufacturing activity. However, if the natural resource sector is not inferior in terms of externalities, then this sectoral shift would be of similar import to the canonical displacement of agriculture by manufacturing.

Third, either for reasons of history or Dutch disease, countries may develop high levels of export concentration which may lead to higher export price volatility and hence increased macro volatility. The externality posed by such concentration is discussed extensively in chapter 7 and appears as perhaps the most important of all. However, it is necessary to mention that this is a more general concern. Dependence on any one export, be it copper in Chile or potentially micro-chips in Costa Rica, can leave a country vulnerable to sharp declines in terms of trade with attendant channels of influence through volatility.

Fourth, another important literature suggests that natural riches produce institutional weaknesses (See, among other, Auty 2001, 2005, Ross 1999, Gelb 1988 Easterly and Levine 2002). Tornell (1999) described the phenomenon where various social groups attempt to capture the economic rents derived from the exploitation of natural resources as the “voracity effect.” Subsequent refinements have focused on how “point source” natural resources – those extracted from a narrow geographic or economic base, such as oil or minerals – and plantation crops have more detrimental effects than those that are diffuse such as livestock or agricultural produce from small family farms.

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11 These arguments are fundamentally modifications of the Rybczynski theorem of the Heckscher-Ohlin-Vanek framework in which it can be shown, using a 2x2 Edgeworth Box, that an increased endowment of one good necessarily implies an absolute fall in the production of the good not intensive in that factor.

12 Sachs and Warner (1995b) argue that Dutch disease leads to concentration in resource exports which they assume to have fewer possibilities for productivity growth. Lederman and Xu (2010) provide extensive evidence that is directly on point, showing that net exports of energy and mining are associated with concentration of export revenues, which in turn are linked to terms of trade volatility. This material is discussed further in Chapter 7.
(Murshed 2004, Isham et al 2006). But again, this concern is not specific to natural resources, but to any source of rents. Autey, for instance, points to a similar impact of foreign aid. “Natural” monopolies, such as telecom have given rise to precisely the same effects in Mexico, and the rent-seeking literature generated by Krueger often focused on the adverse political economy effects arising from trade restrictions. Rajan and Zingales (2004) in Saving Capitalism from the Capitalists examine rentier mentalities among the corporate, including manufacturing and finance, elite, and the need for active financial markets to ensure the pressure of new entry.

That said, there is clearly an important agenda to understand the interaction between political institutions and the emergence of resource sectors. Mehlum, Moene and Torvik (2006) have argued the importance of strong institutions to minimize rent seeking activity, and Rodríguez and Gomolin (2008) stress the pre-existing centralized state and professionalized military as essential to Venezuela’s stellar growth performance during 1920-1970 after the oil exploitation began in 1920. Dunning (2005) offers a model of how differences in the world structure of resources, the degree of societal opposition to elites, and the prior development of the non-resource private sector help predict the incentives to diversification and political stability. Numerous other contributions could be cited here. Without wanting to dwell on the government failures argument, it is nonetheless worth pointing out that if public governance is significantly worsened by the existence of natural-resource rents, then industrial policies which require a insulated and dispassionate government would seem an unlikely approach to exorcizing the curse.

Finally, the Hidalgo et al. (2007) Monkey-Tree metaphor and accompanying neural network estimations suggest that natural resources appear in the low-density part of the product “forest” than other goods and hence might offer fewer possibilities for jumping to other industries. This perspective will be discussed further in the next chapter, but, it is worth highlighting here that, proximity in this sense can be cast as a Marshallian externality and potentially offers a role for intervention. However, again keeping an eye on the demand side, while some natural resource sectors might be lonely trees in the product space forest, this also implies that rents are protected from excessive entry. To our knowledge, there has been no systematic evaluation of trade off between these two considerations.

The Elusive Resource Curse

Without question, many of the channels discussed above may have important implications for growth, although documenting them individually has been difficult. However, an important benchmark is whether taking all these impacts together, resource abundance has, as a central tendency, curse-like qualities. The literature has used a variety of proxies for resource abundance but has not been able to demonstrate this.

By far, the best known formal empirical tests for the resource curse are found in the work of Sachs and Warner (1995a, 1997a, 1997b, 1999, 2001a, b) who employ natural resource exports as a share of GDP as their proxy. Using cross sectional data employed previously by Barro (1991); Mankiw, Romer and Weil (1992); and DeLong and Summers (1991) across the period 1970-1990, they persistently find a negative
correlation with growth, much to the alarm of many resource abundant developing countries. Yet, this proxy leads to some counterintuitive results as a measure of resource abundance. Singapore, for example, due to its substantial re-exports of refined raw materials, appears very resource abundant and given its high growth rates, even seems to impart a positive relationship between resource abundance and growth. Because this gross measure is clearly not capturing the country’s true factor endowments, Sachs and Warner replaced the values of Singapore and Trinidad and Tobago with net resource exports as a share of GDP (see data appendix in Sachs and Warner 1997a). While understandable, such considerations extend beyond these two countries and ideally, a uniform transformation of the data would be preferred. The issue turns out to be central to the findings of a curse. When Lederman and Maloney (2007) replicate the Sachs Warner results using either a net measure of resource exports, or using the gross export measure without the adjustments for the two countries, they find that the negative impact of natural-resource abundance on growth disappears.

In fact, even accepting the modified data, the interpretation of the Sachs Warner results is not entirely clear. Sala-i-Martin, Doppelhofer, and Miller (2004) in their Bayesian search for robust regressors across millions of growth regressions find a persistent negative sign when the proxy enters, but it is not robust enough to be considered a core explanatory variable for growth as other variables appear to absorb its influence. In a similar vein, Lederman and Maloney (2007) show that, controlling for fixed effects in a panel context; the negative impact of resources also goes away suggesting that it may not be their particular proxy, but its correlation with unobserved country characteristics that are driving the result. Manzano and Rigobón (2007) concur, and argue that the cross sectional result arises from the accumulation of foreign debt during periods when commodity prices were high, especially during the 1970s, that lead to a stifling debt overhang when prices fell. These results, and the analogy to other bubbles, are important, not only because they further dispel the alleged curse of natural resources, but especially because the policy implication is that the right levers to deal with the lackluster performance of resource-rich developing countries in recent decades lie in the realm of macroeconomic policy instead of trade or industrial policies.

Bravo-Ortega and de Gregorio (2007) using the same proxy (as well as resource exports over total exports), also find a negative cross sectional impact but trace its origin to a Dutch disease effect working through human capital. Adding an interactive human capital term suggests that as the stock of human capital rises, the marginal effect of the exports of natural resources on income growth rises and becomes positive. This is broadly consistent with Gylfason et al.’s argument that a national effort in education is

13 The other papers by Sachs and Warner (1995b, 1997b, 1999, 2001a, 2001b) contain the basic results of 1997a, at times using a slightly longer time span (1965-1990 instead of 1970-1989), and often including additional time-invariant explanatory variables such as dummies identifying tropical and landlocked countries, plus some additional social variables.

14 Numerous countries in Asia and Latin America have a large presence of export processing zones that would, using the gross measure, overstate their true abundance in manufacturing related factors. The variable also shows substantial volatility over time reflecting terms of trade movements and hence the average for the period is probably a better measure than the initial period value hat was used by Sachs and Warner in several of their papers.
especially necessary in resource rich countries, although without their hypothesis that resource rich sectors intrinsically require, and hence induce, less education. However, Bravo-Ortega and de Gregorio find that the point at which exports of natural resources begin to contribute positively to growth occurs at around 3 years of education, a level achieved by all but the poorest countries.

Sachs and Vial (2002) and Sachs and Warner (1995) confirm a negative and robust relationship using a second, related proxy – the share of natural resources exports in total exports, and this proved somewhat more robust. However, it, again, does not make Sala-i-Martin et al.’s (2004) core list of robust regressors. Further, when Lederman and Maloney (2007) include a generic measure of concentration, the Herfindahl Index, using export data disaggregated at 4-digit SITC, the resource curse disappears (See also Bulte and Brunnschweiler (2008, 2009). The curse is one of concentration, not resources. This finding is consistent with Auyt’s (2000) concern about a resource drag on growth arising from the limited possibilities of diversification within commodities. However, Lederman and Xu (2007) argue that diversification into non-resource sectors from a strong resource base is feasible.

Leamer (1984) argues that standard Heckscher-Ohlin trade theory dictates that the appropriate measure is net exports of resources per worker. This measure has been the basis for extensive research on the determinants of trade patterns (e.g., Trefler 1995, Antweiler and Trefler 2002, Estevadeordal and Taylor, 2002). This was Lederman and Maloney’s (2007) preferred measure because it obviated the Singapore issue mentioned above, by netting out resource exports from the beginning. Lederman and Maloney (2008) also show, using a simple 2 sector model, that it also has the advantage of being strictly positively correlated, with resource endowments which is not true of the trade constructed measures discussed above. The Leamer measure, in cross section and in panel contexts across the Sachs-Warner period, yielded either insignificant or positive results. Using Maddison’s (1994) well-known growth data from 1820-1989, Maloney (2002, 2007) finds suggestive evidence of a positive growth impact of resources from 1820-1950, but then a negative impact thereafter, driven by Latin America’s underperformance.

In fact, the results become more favorable when researchers use proxies even closer to direct measures of endowments. Stijns (2005) finds no correlation of fuel and mineral reserves on growth during 1970-1989. This is consistent with earlier work by Davis (1995) that mineral dependent economies, defined by high share of minerals in

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15 Assuming identical preferences, a country will show positive net exports of resource intensive goods if its share of productivity-adjusted world endowments exceeds its share of world consumption. Usually, the net exports are then measured with respect to the quantity of other factors of production, such as the labor force.

16 It is worth mentioning that the cited references show that the HO model of factor endowments performs relatively well for natural resources net exports, but it performs less well for manufactures. The current debate in the trade literature revolves around the question of how the HO model might be amended (by considering, for example, technological differences across countries, or economies of scale) to help predict better the observed patterns of net exports across countries. But there is not debate about the use of net exports as a proxy for revealed comparative advantage in this literature.
exports and GDP, did well relative to other countries across the 1970s and 1980s. Across their several million regressions, Sala-i-Martin et al (2004) find the mining share in GDP to be consistently positive and in the core of explanatory variables. Nunn (2008) finds a positive partial correlation between the per capita production of gold, oil, and diamonds and GDP per capita, in an analysis of long-term fundamental determinants of development, with a special focus on the role of the slave trade and its concomitant economic consequences for African economies. Alexeev and Conrad (2009)

In sum, there is no reliable evidence for a resource curse to date. The only remaining potentially negative effects emerge in models that use natural resource gross exports as a share of total merchandise exports, but even these results appear to support a “conditional” curse. Indeed, the share of natural resource gross exports in total exports is probably best interpreted as a proxy of export concentration, as in Lederman and Maloney (2007), and this topic is addressed further below in chapter 7. This is not to say that there are not good and bad experiences with natural resources. Estimating growth regressions in a quantile-regressions context, Lederman and Maloney do find international heterogeneity in the effect of net export of natural resources per worker on the growth rate of GDP per capita during 1980-2005; richer countries tended to have a more strongly positive coefficient. However, overall, there is no curse.

It is tempting to view the Bayesian approach to testing for robust regressors as the final word, as in Sachs and Warner (2001b) where the authors (mistakenly) argue that the curse is robust based on the 2000 working paper version of Sala-i-Martin et al. (2004). As mentioned, Sala-i-Martin et al found a positive effect of the fraction of mining in GDP on growth. However, this approach is not well suited for dealing with biased coefficients or robustness of coefficients over time. That is, the results might change with changes in the time period covered by the data or by including only exogenous explanatory variables. Furthermore, the Bayesian approach does not yield robust results even in the presence of measurement errors in the GDP data, and hence yield different results when using slightly different versions of the Penn World Tables purchasing-power adjusted data – see Ciccone and Jarocinski (2010).

Lederman and Maloney (2008) use quantile regressions to test for international heterogeneity in the natural-resource variable coefficients. They find that in the long run net exports of natural resources are positively correlated, with no statistically significant international heterogeneity, with the level of GDP per capita. This implies that countries would be poorer if they did not have natural resources. Still, there is no evidence of a curse, even if it is true that the long-term gains from natural resources had already been absorbed prior to 1980. There is heterogeneity in the growth regressions.

Rodrik and Hausmann\(^\text{19}\) offer a particular information spillover model that arguably corresponds most closely to the inter-industry externality case discussed above. Producing a high productivity good signals to all potential entrepreneurs what level of productivity is possible and leads to a higher level of productivity overall. Since the level of productivity of goods is not known \textit{a priori}, once an entrepreneur has an experiment that pays off and ‘discovers’ a profitable product, others can easily imitate their success, providing an externality. Empirically, their bottom line is that producing products that rich countries produce is more conducive to high growth rates.

Operationally, they develop two measures in “What You Export Matters” (Hausmann, Hwang, and Rodrik, 2007) to assess the level of sophistication of a country’s exports.\(^\text{20}\) PRODY is the trade-weighted income of countries producing a particular good. That is, if poor countries produce bananas, PRODY will be low; if rich countries produce cold fusion reactors, the reactor PRODY will be high. Value-weighting the PRODYs of the entire export basket of a particular country gives an EXPY, the overall sophistication of a country’s exports. Rodrik, Hwang and Hausmann (2007) find EXPY to be correlated with growth.

The approach offers a new type of externality and an innovative way of capturing the corresponding measure of good quality. There are, however, arguably several critiques to this approach. First, conceptually, while the focus on motivating PRODY and EXPY is largely heuristic and not meant to be empirically validated per se, conceptually, it is still subject to the Rodriquez critique and abstracts from issues of rents that are potentially important. A good that is very established with very mature markets is likely to have few rents left and be very competitive. A prime example of this occurred in the 1980s when the Finnish government pushed Nokia into producing televisions. To use our present terminology, TVs have a high PRODY, but the market was thoroughly saturated and Nokia nearly went bankrupt as a result. Were it not for a small division producing a product (cell phones) that would not even show up in our present PRODY calculations because it did not exist yet, Finland’s largest company would be bust.

Relatedly, if countries really did have reasonable latitude in choosing to be in rich country goods, this also implies that other countries do too and, again, those industries will become extremely competitive. Pack, for example, argues that the Asian model of the past is exhausted simply because if, before, advanced technology could be combined with cheap labor, the entry of China and potentially other competitors has driven the rents arising from this combination to nothing. Similarly, if “deep” comparative advantage is not so critical for a multinational company to set up a shop in one country versus another, it also means that a MNC has little to keep it there in the face of small perturbations.

Second, empirically transport costs, protection and other factors affect the composition of the rich country exports. Entrepôts like Singapore are re-exporting goods which are independent of their actual production structure. Hence, the 1991 finding that “Asses, mules and hinnies, live” had the highest PRODY value.

Finally, as we will discuss in chapter 6, the fragmentation of the global production process renders assignment of a product to an export increasingly irrelevant. As we will see, the fact that China exports the iPod may not imply that it is acquiring substantial learning from it.

These considerations may simply be adding “noise” to the PRODY estimates, or there may constitute a systematic bias as well.

**What Are High PRODY goods?**

What are these high productivity goods? Figure 3.1 presents the PRODY values for relatively aggregated categories. Two findings are important. First, as is perhaps expected, at the high end we find electrical machinery, services, transport equipment, allied chemicals, plastic and rubber and at the lower level, head and footwear, leather products, vegetables textiles and minerals. In this ranking, the latter suggests that natural resources are less desirable. However, secondly, the highest value is found for service exports, while animals and metals (processed raw ores) are also among the highest PRODY goods. Hence, an intuitive mapping of PRODY to product types is not so clear. Third, there is a high degree of variance in countries producing any particular good, a fact that remains at lower levels of aggregation. This suggests either that a wide variety of countries can, in fact produce “high productivity goods” and vice versa, or that there is a wide variety of ways of producing a good. Electric machines have high PRODY’s, but, again the nature of the task being produced in the country may be more relevant.
Figure 3.2 shows Latin America’s EXPYs by country in international comparison. While Bermuda, Guadeloupe, Mexico and Brazil, Venezuela, Argentina and the Bahamas are comparable to, for instance, fast growing China, overall LAC is substantially below, and several large countries – Colombia, Peru, and even Chile are substantially below these relatively poorer countries. At first glance, then, the idea that this may explain part of Latin America’s low growth seems plausible.
As is the case for the resource curse, PRODY as a guide to the desirable export baskets literature rises or falls on its empirical validation. To date, the literature using PRODY and EXPY is effectively restricted to their inventors, who find a strong relationship between EXPY and growth.

Revisiting these regressions, however, casts some doubt on EXPY’s stimulative power and suggests alternative explanations for its appearance. Column 1 in Table 1 replicates Rodrik, Hwang and Hausmann’s results, showing that EXPY leads to higher growth. The convergence term (log gdp) is negative and of predicted sign; EXPY is positive and strongly significant for both the IV and GMM regressions. However, including investment’s share in GDP, a standard regressor in growth regressions, knocks out EXPY in the GMM regressions (not shown) and adding the Herfindahl Index, as a measure of export concentration, eliminates the effect of EXPY in both estimations (columns 3 and 4). The finding that export concentration is not good for growth is important and it is likely that natural resource exporting countries with low EXPY’s are also concentrated. But the finding suggests that it is the concentration, and not the good per se, that matters. Chapter 7 takes up the issue of diversification more directly.

It is possible that this result arises from misspecification of the estimation. HHR, for example, argue, sensibly, that a country should adopt the good showing the highest productivity within its comparative advantage. That is, it is very likely inefficient for Bolivia to produce at the top of the rich country goods. To bring the specification a bit
closer to Hausmann et al.’s model, the second panel includes a variable that captures average EXPY for countries of the same level of income (decile). The interpretation of log (exp) is now “the level of EXPY relative to those generally found at the country’s level of income.” EXPY is now more significant and positive than before in both specifications. The negative category EXPY in the first column could be seen as analogous to an additional convergence term: the higher the EXPY, the less catch up is possible and the lower level of growth. However, again, the inclusion of investment and the Herfindahl eliminates any significance on any EXPY variable.

Table 3.1: Influence of EXPY on Growth: Revisiting the Evidence from HHR

<table>
<thead>
<tr>
<th></th>
<th>Base: HHRs Regressions</th>
<th>Including the Export Herfindahl and the Investment Share</th>
<th>With Income Average EXPY</th>
<th>Including the Export Herfindahl and the Investment Share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IV</td>
<td>GMM</td>
<td>IV</td>
<td>GMM</td>
</tr>
<tr>
<td>Log (initial gdp)</td>
<td>-0.038</td>
<td>-0.02</td>
<td>0.149</td>
<td>-0.007</td>
</tr>
<tr>
<td></td>
<td>(4.40)**</td>
<td>(2.48)*</td>
<td>(0.64)</td>
<td>(0.78)</td>
</tr>
<tr>
<td>Log (exp)</td>
<td>0.093</td>
<td>0.053</td>
<td>-0.583</td>
<td>-0.029</td>
</tr>
<tr>
<td></td>
<td>(4.58)**</td>
<td>(2.45)*</td>
<td>(0.71)</td>
<td>(1.15)</td>
</tr>
<tr>
<td>Category Log (exp)</td>
<td>-0.0577***</td>
<td>(0.01)</td>
<td>-0.058</td>
<td>0.061</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.10)</td>
<td>(1.84)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Log (primary schooling)</td>
<td>0.005</td>
<td>0.006</td>
<td>0.021</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>(1.77)</td>
<td>(0.89)</td>
<td>(0.76)</td>
<td>(1.84)</td>
</tr>
<tr>
<td>Log (Investment Share)</td>
<td>0.045</td>
<td>0.023</td>
<td>0.045</td>
<td>0.023</td>
</tr>
<tr>
<td></td>
<td>(1.05)</td>
<td>(1.91)</td>
<td>(1.05)</td>
<td>(1.91)</td>
</tr>
<tr>
<td>Root Herfindal Index</td>
<td>-0.666</td>
<td>-0.058</td>
<td>-0.666</td>
<td>-0.058</td>
</tr>
<tr>
<td></td>
<td>(0.81)</td>
<td>(2.05)*</td>
<td>(0.81)</td>
<td>(2.05)*</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.426</td>
<td>-0.25</td>
<td>3.756</td>
<td>0.272</td>
</tr>
<tr>
<td></td>
<td>(4.28)**</td>
<td>(1.96)</td>
<td>(0.73)</td>
<td>(1.64)</td>
</tr>
<tr>
<td>Number of wbgroup</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
</tbody>
</table>

Regressions include decade dummies
Robust t statistics in parenthesis, * significant at 5%; ** significant at 1%

In the end, it is hard to know whether EXPY’s unimportance for growth is a result of the difficulty of demonstrating the existence of the kinds of externalities that are the conceptual core of the argument that what you produce matters, the offsetting effects of saturated markets, or other measurement issues that will be taken up in the next section. What does seem the case is that some circumspection is in order in taking PRODY as a measure of pro-growth quality for policy purposes?

Of Monkeys and Trees

Rodrik and Hausmann (et al., 2007) have also been pursuing another type of externality as a justification for good quality customarily termed the “Monkey and Tree” analogy. Here, a country’s product space is likened to a forest with monkey’s climbing trees as a metaphor for productivity growth. To capture the evolution of economies, certain goods allow an easier transition to other goods, and hence, a continuing dynamic
growth process. Monkeys climb up trees but at a certain point would need jump to other trees (new goods) which then they can climb again.

The imagery is attractive, although the ambiguous relationship to standard economic models makes it somewhat difficult to dissect as an argument. It is not conceptually obvious why jumping from tree to tree is preferred to being in one very tall tree although, in practice, most countries have graduated through industries and hence it is fair to ask what facilitates jumping into new areas. Again, while the link between diversification and productivity is not tight (see Rodriguez and Harrison 2009), as we just saw and chapter 7 will discuss further, from a volatility point of view, diversification may matter to growth. However, even here, it is not clear that the answer to having one hugely productive, rent-generating tree, (perhaps looking suspiciously like an oil derrick) is to diversify production, or to financially smooth and hedge across time.

Whatever the benefits to having other trees in proximity, Rodriguez-Clare (2006) has come the closest to approximating a mainstream argument by highlighting the analogy from a tree in close proximity to others where jumps are easy, to standard Marshalling externalities with the same caveats discussed earlier. In particular, if a good provides easy jumping in one country, then that must be the case in all countries and international prices must reflect this. Unless a poor country gets asymmetric benefits from such agglomeration, which is plausible as it fills out its industrial structure, proximity effects may be offset. Further, we might argue that trees in the dense forest are not only easy to jump from, but they may also be easy to jump to since there are so many potential trees of origin. That is, the barriers to entering industries in dense parts of the forest must by definition be lower and hence, competition must be higher and rents few.

Other issues arise when we reflect on the relationship between the externalities surrounding proximity and those being captured by PRODY. That is, is there any guarantee that rich country goods are also those in the thick part of the forest? We might actually expect that frontier goods produced by rich countries, those with the highest quasi rents from innovation, would, by definition, be at the edge of the forest with the next obvious place for monkeys to jump yet to be invented.

This raises an issue which is present in the previous arguments, but especially germane here. It is the case that, in Scotland in the 19th century, mining led to the invention of the steam engine, a transformative technology. It is also the case that Saab and Volvo began as trucking companies for the Swedish forestry industry. Scottish and Swedish monkeys jumped to major new sources of economic dynamism. But, do we believe that these trees remain close to each other in a world of now very highly fragmented production. That is, both forestry and mining used to have transportation industries very close to them in the forest and hence they had the quality of “transport industry proximity.” Does that mean that Chile is likely to develop its own Volvo? It has been argued that thousands of industry clusters have been analyzed for more recent periods using neural networking, but the question remains: does past performance guarantee future performance? It is just highly unlikely that the next Nokia will emerge from a forest company again. In fact, it would seem better for Chile to explore whether
the genetic modifications it is undertaking to make its Salmon more disease resistant might lead, let us speculate, to a cure for cancer, a relationship that will make the country billions should it occur. Such a jump, of course, could not be inferred from past relational patterns.

Finally, the “not what but how” critique is valid here, too. Part of the reason that Chile’s forestry will never produce a Volvo is because of the “low-tech” nature of production there. As Blomstrom and Kokko (2006) argue, what made Nokia possible was that it came from an innovative company, not that it came from company producing a certain good. That is, the Scandinavian forestry sectors trained very adept monkeys who could identify and especially create new trees. Table 3.2 shows just one set of institutions involved in the pulp and paper cluster in Sweden. The agglomeration of high level research in states and institutions for the development of human capital is far beyond what would be found in Chile today. Arguably, we should be training monkeys that can jump further and smarter, even to trees that do not yet exist, rather than trying to move the trees closer together.

<table>
<thead>
<tr>
<th>Table 3.2: Participants in the Knowledge and Skill Cluster in the Paper and Pulp Industry (1990)</th>
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</thead>
<tbody>
<tr>
<td><strong>Skills (Education)</strong></td>
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<tr>
<td></td>
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<tr>
<td></td>
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<tr>
<td><strong>Knowledge (Research)</strong></td>
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Again, the proof of the conceptual pudding is in the empirical eating and here the effort has been dedicated more to establishing historical correlations among goods, rather than showing that proximity is, in fact, at all correlated with growth.
Human capital is thought to provide externalities not captured in the private rate of return. Hence, often implicit in the discussion of the desirability of high tech industries is that notion that certain goods will provide a greater incentive to the accumulation of high level human capital and hence should be favored.21

This chapter accepts this argument as a point of departure, but then asks which goods appear to offer a higher incentive to the accumulation of higher level human capital. Relying on research by Brambilla, Carneiro, Lederman, and Porto (2010), we ask whether estimated returns to education suggest that certain sectors demonstrate higher “skill premia,” the relative return of high to low skilled workers, and hence a greater incentive to stimulate the accumulation of higher level human capital.

Analogous to other empirical analyses discussed in this report, the econometric analyses focus on industry effects on skill-wage premia across as many Latin American and Caribbean economies as possible. And in the same spirit of understanding the heterogeneity of experiences within goods, we decompose the effects due to goods, and effects that seem country specific. If country effects dominate over industry effects on skill premia, then we can conclude that it is country rather than industry characteristics that affect skill premia, and thus the private incentives to invest in education by workers and private firms could be addressed with national policies that are sector neutral or horizontal. In addition, this chapter assesses the role of exports and export-product differentiation as determinants of the industry skill wage premium, and thus could support export-related industrial policies.

We should emphasize, however, that the estimates of skill premia can be biased in the sense that they may not capture only the effects of educational attainment per se on real wages across workers. It is well known that such estimates suffer from at least two types of biases, namely ability bias (or unobserved human capital) due to talented individuals getting both more education and higher wages and attenuation bias due to errors in worker self-reported information on wages and schooling.22 The literature is clear in that these biases are important, but it is ambiguous about which one dominates. In any case, in the spirit of giving industrial policy a chance, we will discuss some econometric issues in the estimation of the skill premium across industries and countries without taking a firm stance on these biases. This approach essentially provides a greater scope for industrial policies, as the estimated skill premia will be assumed not be due to ability bias.

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21 See, for example, Krueger and Lindahl (2001) on the theoretical arguments and empirical evidence concerning externalities from education. However, it is plausible that in some countries the private returns to education can be close to the social returns. For skeptical views with applications to the cases of Italy and the United States, see Cingano, Ciccone and Cipollone (2004) and Ciccone and Peri (2006), respectively.

22 See Griliches (1977), Card (1999), and Krueger and Lindahl (2001) on the econometric issues that plague estimates of the returns to schooling or the skill premium. In their review of the literature as of 2000, Krueger and Lindahl conclude that there is surprisingly little evidence of ability bias in the literature.
Further, institutions may play important roles in determining premia. Unions, for instance, may lead to compression of the wage structure, or more generally differential rewards to different skills types of workers. To the degree that some industries are more favorable to unionization than others, this may bias our results. Further, efficiency wage considerations may lead to premia dependent on the nature of the technology of production of certain types of goods. Indeed, commonalities of premia across industries have been interpreted as evidence of precisely this kind of effect (see Romaguera 1991 for example).

Box 4.1 discusses the basic elements of wage models that are routinely used to estimate wage premia, which is needed to understand where the variable of interest for the rest of the chapter comes from. In turn, the chapter discusses the relationship between wages and educational outcomes (specifically, the ratio of skilled over unskilled workers) which are the most obvious country-level characteristic that could affect relative wages as it captures the relative supply of skilled workers. The countries covered by Brambilla, Lederman and Porto include: Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, and Uruguay. These authors estimated average skill premiums for the national economy as well as for the numerous industries within countries. After summarizing the authors’ estimates of sectoral skill premia for 61 tradable and non-tradable sectors in each economy, including 23 manufacturing sectors, the chapter reviews empirical analyses of industry and country effects on industry-specific wage premia, and provides a preliminary assessment of export-related determinants of the skill premium in manufacturing industries.
Box 4.1 Estimating skill wage premia

The workhorse of the literature on the returns to schooling or the skill premium is the so-called Mincerian wage equation. It entails econometrically estimating the relationship between real wages and the indicators of educational attainment, while also controlling for other worker characteristics that can affect wages. The model estimated by Brambilla et al. takes the following general form,

\[
\ln w_{ijt} = f(Ed_{ijt}) + x'_{ijt}\beta + \delta_j + \delta_t + \epsilon_{ijt}
\]

where the subscript \(i\) denotes individuals, \(j\) the industry that the individual is affiliated to, and \(t\) denotes years. The hourly wage is given by \(w\). It is computed as the reported weekly wage divided by the number of hours worked per week (in several surveys these answers refer to the total wages received and number of hours worked during the week prior to the survey).

The variable used to construct the skill premium is education, denoted by \(Ed\). In one approach, skilled workers are those with at least a high school diploma. Thus, the function \(f(Ed_{ijt})\) becomes a binary variable \((Sk)\) that is equal to one if the individual has at least a high school diploma. The wage model is thus:

\[
\ln w_{ijt} = \gamma Sk_{ijt} + x'_{ijt}\beta + \delta_j + \delta_t + \epsilon_{ijt}
\]

The coefficient \(\gamma\) measures the skill premium; the percentage difference in wages of skilled workers relative to unskilled workers.

Another specification is:

\[
\ln w_{ijt} = \alpha YEd_{ijt} + x'_{ijt}\beta + \delta_j + \delta_t + \epsilon_{ijt}
\]

where \(YEd\) are years of education. The coefficient \(\alpha\) measures the percentage-points increase in wages due to an additional year of education. This model controls for individual characteristics in the vector \(x\) and for industry and year effects in the indicator variables \(\delta\). The controls included in \(x\) are gender, age and age squared, marital status, whether the individual works full-time or part-time, a dummy for individuals in rural areas, and regional dummies. It should

**Wage Premiums and Educational Endowments in Latin America**

Table 4.1 displays basic descriptive statistics of the education and skill variables. The first two columns show sharp differences in average years of education and in ratios of skilled to unskilled workers across countries (skilled workers are defined as
individuals who hold a high school diploma). Average years of education are comparatively high in Argentina (10.63), Uruguay (9.82), Chile (8.89), Panama (8.81), Colombia (8.53), and Ecuador, the Dominican Republic and Mexico (around 7.9). These countries also show the highest share of skilled workers, ranging from 27 percent in Mexico to 52 percent in Argentina (in Colombia, instead, the share is relatively lower). Years of education are lowest in Nicaragua, Guatemala and Honduras (5.31, 5.70, and 5.99) but the share of skill workers in lowest in Nicaragua and Brazil (9 and 13 percent). In the cases of Argentina and Uruguay, the comparatively high statistics are partly explained by survey design since in these two countries the household surveys represent only urban households. In the remaining fourteen countries the surveys are representative of the rural population as well as urban.

Column 5 in Table 4.1 presents the share of highly-skilled workers conditional on being skilled; the share of workers with more than a high school diploma (individuals with tertiary education, some college experience, college degree, and graduate degrees) on the total of workers with at least a high school diploma. This statistic indicates the composition of skilled labor in each country. The differences across countries are again very sharp, thus implying that the composition of the skilled labor force varies across countries. Countries with high shares of highly-skilled workers in the skilled group (41 to 56 percent) are Colombia, Peru, Mexico and Nicaragua. Notice, for instance, that since Nicaragua is the country with the lowest skill share, this means that those relative few workers with degrees tend to reach a high educational attainment. Countries with low shares of highly-skilled workers are El Salvador, Paraguay, Argentina and Chile (19 to 23 percent). The participation of highly-skilled workers in the total labor force can be obtained multiplying column 5 by column 2.

Figure 4.1 shows the results from the first model. The results imply, for example, that in Ecuador the wage of an employed individual with a high school diploma is, on average and after controlling for observable worker characteristics, 53 percent higher than the wage of an employed unskilled worker. Coefficients range from 38 to 98 percent. Returns to skill are highest in Brazil and Colombia—over 90 percent. Countries with returns to skill over 60 percent are Nicaragua, Guatemala, Costa Rica, Honduras, Mexico and Chile. In Paraguay and Ecuador the skill premium is above 50 percent. In the remaining countries—Dominican Republic, Panama, Argentina, El Salvador, Peru and Uruguay—the skill premium ranges from 49 to 38 percent.
Table 4.1 Education and Skill Endowments in 5 Million Latin American Workers

<table>
<thead>
<tr>
<th>Country</th>
<th>Average years of education</th>
<th>Share of skilled workers&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Share of highly-skilled workers&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>All (2)</td>
<td>Male (3)</td>
</tr>
<tr>
<td>Argentina</td>
<td>10.63</td>
<td>0.52</td>
<td>0.49</td>
</tr>
<tr>
<td>Brazil</td>
<td>6.94</td>
<td>0.13</td>
<td>0.11</td>
</tr>
<tr>
<td>Chile</td>
<td>8.89</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>Colombia</td>
<td>8.53</td>
<td>0.20</td>
<td>0.21</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>7.55</td>
<td>0.18</td>
<td>0.18</td>
</tr>
<tr>
<td>Dominican Rep.</td>
<td>7.96</td>
<td>0.30</td>
<td>0.28</td>
</tr>
<tr>
<td>Ecuador</td>
<td>7.95</td>
<td>0.31</td>
<td>0.31</td>
</tr>
<tr>
<td>El Salvador</td>
<td>6.20</td>
<td>0.23</td>
<td>0.24</td>
</tr>
<tr>
<td>Guatemala</td>
<td>5.70</td>
<td>0.19</td>
<td>0.22</td>
</tr>
<tr>
<td>Honduras</td>
<td>5.99</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>Mexico</td>
<td>7.94</td>
<td>0.27</td>
<td>0.28</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>5.31</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>Panama</td>
<td>8.81</td>
<td>0.36</td>
<td>0.32</td>
</tr>
<tr>
<td>Paraguay</td>
<td>7.25</td>
<td>0.24</td>
<td>0.23</td>
</tr>
<tr>
<td>Peru</td>
<td>7.85</td>
<td>0.22</td>
<td>0.24</td>
</tr>
<tr>
<td>Uruguay</td>
<td>9.82</td>
<td>0.35</td>
<td>0.32</td>
</tr>
</tbody>
</table>

<sup>a</sup>: Share of workers with a high school diploma or more (skilled) in the total number of workers. (Semi-skilled + Highly-skilled)/(Unskilled + Semi-skilled + Highly-skilled).<br/>
<sup>b</sup>: Share of workers with more than a high school diploma (highly-skilled) in all workers with at least a high school diploma (skilled). (Highly-skilled)/(Semi-skilled + Highly-skilled).

Figure 4.1 Skill Premia by Countries

Figure 4.2 shows the skilled to unskilled ratio in each country, where countries are sorted in the same order as in the Figure 1. There is a negative correlation between the skill ratio and the skill premium.

Figure 4.2 Relative Skill Endowments by Countries

Wage Premiums across Industries

In economies with perfect mobility, wages equalize across sectors and thus there should be skill premium affecting all skilled workers in the labor market. With departures from that model, including imperfect factor mobility of skilled labor (but also of unskilled labor), wage equalization does not follow, and skill premia at the industry level can result in equilibrium. In the spirit of giving IP a chance, in this chapter we are thus assuming that the wages of skilled workers across industries can differ because of industry-specific characteristics that make it efficient for employers in some industries to offer higher wages to skilled labor in order to retain them. That is, efficiency wages might be required to maintain skilled labor. Furthermore, give our focus on exports, Brambilla, Lederman and Porto (2010) review the relevant literature and propose a theory that explains why exporting firms will tend to higher relatively more skilled labor and pay higher wages than firms that sell to domestic consumers. In a nutshell, the assumption is that selling goods to foreign consumers with higher relative incomes than domestic consumers requires quality upgrading, marketing and other types of knowledge (for example, knowledge of foreign languages) provided by skilled workers.23

To explore this possibility in the LAC data, Brambilla, Carneiro, Lederman, and Porto (2010) included interactions between skill categories and industries (defined at the 2-digit level). The results by industry are then ranked within countries (from highest to lowest wage premium).

Table 4.2 reports the High-Premium sectors, those with average ranking in the 25th percentile. The best ranked industry across countries is sector 74, “Other business activities,” followed by sector 99, “Extra-territorial organizations and bodies,” and sector 85, “Health and social work.” Other consistently High-Premium industries are related to chemicals and mining (sectors 26 “Manufacture of other non-metallic mineral products,” 24, “Manufacture of chemicals and chemical products,” and 23, “Manufacture of coke, refined petroleum products and nuclear fuel,” and 14, “Other mining and quarrying,”), other non-tradable services sectors (like “Real estate activities,” “Wholesale trade,” and “Public Administration,”) and education (sector 73, “Research and development,” or sector 80, “Education.”).

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23 To be sure, there are likely to be many other plausible explanations for inter-industry wage differentials, besides the export-driven efficiency wages argument. For example, unionization and policy distortions might make some sectors pay higher wages to workers with a given skill level. However, if exports are associated with higher wage premia, it is unlikely to be driven by unionization as it is well known that export oriented industries are less unionized than import competing and public-sector industries.
Table 4.2 High-Premium Sectors in Latin America

<table>
<thead>
<tr>
<th>Industry</th>
<th>Average Skill Premium</th>
<th>Average rank&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Average rank&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>74 Other business activities</td>
<td>0.94</td>
<td>7.06</td>
<td>7.07</td>
</tr>
<tr>
<td>99 Extra-territorial organizations and bodies</td>
<td>1.12</td>
<td>8.75</td>
<td>4.00</td>
</tr>
<tr>
<td>85 Health and social work</td>
<td>0.82</td>
<td>11.13</td>
<td>11.29</td>
</tr>
<tr>
<td>26 Manufacture of other non-metallic mineral products</td>
<td>0.87</td>
<td>12.13</td>
<td>10.57</td>
</tr>
<tr>
<td>24 Manufacture of chemicals and chemical products</td>
<td>0.78</td>
<td>12.87</td>
<td>12.77</td>
</tr>
<tr>
<td>70 Real estate activities</td>
<td>0.87</td>
<td>13.27</td>
<td>11.62</td>
</tr>
<tr>
<td>73 Research and development</td>
<td>0.99</td>
<td>13.78</td>
<td>11.00</td>
</tr>
<tr>
<td>23 Manufacture of coke, refined petroleum products and nuclear fuel</td>
<td>0.84</td>
<td>13.86</td>
<td>10.00</td>
</tr>
<tr>
<td>1 Agriculture, hunting and related service activities</td>
<td>0.88</td>
<td>13.88</td>
<td>13.21</td>
</tr>
<tr>
<td>80 Education</td>
<td>0.76</td>
<td>15.19</td>
<td>14.14</td>
</tr>
<tr>
<td>51 Wholesale trade and commission trade, except of motor vehicles and motorcycles</td>
<td>0.73</td>
<td>16.23</td>
<td>15.27</td>
</tr>
<tr>
<td>91 Activities of membership organizations n.e.c.</td>
<td>0.74</td>
<td>16.81</td>
<td>16.36</td>
</tr>
<tr>
<td>14 Other mining and quarrying</td>
<td>0.82</td>
<td>18.62</td>
<td>18.09</td>
</tr>
<tr>
<td>75 Public administration and defense; compulsory social security</td>
<td>0.65</td>
<td>19.00</td>
<td>19.00</td>
</tr>
</tbody>
</table>

(a): Simple average  
(b): Average dropping the highest and the lowest value


Sectors with consistently low premiums are reported in Table 4.3. These sectors include retail trade (“Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel”), heavy manufacturing (like “Manufacture of basic metals,” “Manufacture of fabricated metal products, except machinery and equipment,” “Manufacture of furniture; manufacturing n.e.c.,” “Manufacture of tobacco products,” and “Manufacture of medical, precision and optical instruments, watches and clocks”), and basic services (“Renting of machinery and equipment without operator and of personal and household goods,” “Hotels and restaurants”, “Other service activities,” “Land transport; transport via pipelines,” and “Private households with employed persons”).
Table 4.3 Low-Premium Sectors in Latin America

<table>
<thead>
<tr>
<th>Industry</th>
<th>Average Skill Premium</th>
<th>Average rank&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Average rank&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel</td>
<td>0.49</td>
<td>30.93</td>
<td>31.75</td>
</tr>
<tr>
<td>72 Computer and related activities</td>
<td>0.48</td>
<td>31.08</td>
<td>32.20</td>
</tr>
<tr>
<td>11 Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying</td>
<td>0.59</td>
<td>31.67</td>
<td>33.00</td>
</tr>
<tr>
<td>27 Manufacture of basic metals</td>
<td>0.46</td>
<td>31.83</td>
<td>32.80</td>
</tr>
<tr>
<td>71 Renting of machinery and equipment without operator and of personal and household goods</td>
<td>0.45</td>
<td>32.69</td>
<td>33.91</td>
</tr>
<tr>
<td>28 Manufacture of fabricated metal products, except machinery and equipment</td>
<td>0.43</td>
<td>33.06</td>
<td>33.57</td>
</tr>
<tr>
<td>36 Manufacture of furniture: manufacturing n.e.c.</td>
<td>0.43</td>
<td>33.25</td>
<td>33.93</td>
</tr>
<tr>
<td>16 Manufacture of tobacco products</td>
<td>0.46</td>
<td>33.38</td>
<td>34.07</td>
</tr>
<tr>
<td>55 Manufacture of medical, precision and optical instruments, watches and clocks</td>
<td>0.45</td>
<td>33.75</td>
<td>34.07</td>
</tr>
<tr>
<td>33 Hotels and restaurants</td>
<td>0.60</td>
<td>33.75</td>
<td>36.50</td>
</tr>
<tr>
<td>18 Manufacture of wearing apparel; dressing and dyeing of fur</td>
<td>0.45</td>
<td>33.94</td>
<td>34.35</td>
</tr>
<tr>
<td>93 Other service activities</td>
<td>0.42</td>
<td>34.56</td>
<td>34.07</td>
</tr>
<tr>
<td>60 Land transport; transport via pipelines</td>
<td>0.35</td>
<td>39.75</td>
<td>40.57</td>
</tr>
<tr>
<td>95 Private households with employed persons</td>
<td>0.13</td>
<td>44.88</td>
<td>45.57</td>
</tr>
</tbody>
</table>

(a): Simple average
(b): Average dropping the highest and the lowest value

Thus far the evidence suggests the following:

i) There are differences in the industry skill premium, both across countries (for a given industry) and across industries (within a country);

ii) It is difficult to identify sectors with consistently high (or low) skill premium across countries. The highest ranking sectors have an average ranking of around 7 to 10, thus suggesting that even the these sectors rank relatively low in some countries. However, it is abundantly clear that natural-resource industries do not systematically pay lower skill premia. If anything, some appear among the top industries in terms of skill premia.

iii) Similarly, the lowest ranking sectors have ranking of around 35-45. It follows that even these sectors rank relatively well in some cases.

iv) In the three categories of sectors, high-rank, mid-rank (not shown here), and low-rank, tradable or manufacturing sectors are intertwined with services and non-tradable sectors. There is no indication in the data that exportable (or import competing sectors) do better in terms of the skill premium at the sector level. We now turn to the discussion about the role of exports in determining wage premia.
Country and Industry Effects on Skill Premiums

To assess the relative importance of country and industry dummies on wages, Brambilla, Lederman and Porto (2009a) estimate a series of regressions that attempt to explain industry-skill premia with i) only country dummies; ii) industry dummies; and iii) country and industry dummies. The results appear in Table 4.4, which reports the adjusted R-squared the F-test of joint significance of each set of dummies, and for the model estimated with data from all sectors, for the manufacturing sectors, and for the non-tradable (and services sectors).

Table 4.4 The Explanatory Power of Industry and Country Effects on Latin American Wages

<table>
<thead>
<tr>
<th>Model</th>
<th>R2</th>
<th>F-test (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALL SECTORS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1: only country dummies</td>
<td>0.20</td>
<td>13.80 (0.0000)</td>
</tr>
<tr>
<td>M2: only industry dummies</td>
<td>0.48</td>
<td>12.75 (0.0000)</td>
</tr>
<tr>
<td>M3: country &amp; industry dummies</td>
<td>0.69</td>
<td>33.72 (0.0000)</td>
</tr>
<tr>
<td>country dummies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>industry dummies</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MANUFACTURING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1: only country dummies</td>
<td>0.28</td>
<td>8.82 (0.0000)</td>
</tr>
<tr>
<td>M2: only industry dummies</td>
<td>0.24</td>
<td>5.54 (0.0000)</td>
</tr>
<tr>
<td>M3: country &amp; industry dummies</td>
<td>0.49</td>
<td>10.13 (0.0000)</td>
</tr>
<tr>
<td>country dummies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>industry dummies</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NON-TRADABLES &amp; SERVICES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1: only country dummies</td>
<td>0.17</td>
<td>6.78 (0.0000)</td>
</tr>
<tr>
<td>M2: only industry dummies</td>
<td>0.57</td>
<td>19.03 (0.0000)</td>
</tr>
<tr>
<td>M3: country &amp; industry dummies</td>
<td>0.77</td>
<td>24.27 (0.0000)</td>
</tr>
<tr>
<td>country dummies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>industry dummies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Country dummies alone account for 20 percent of the variance of the skill premia, and industry dummies alone account for almost 48 percent. Both sets of dummies explain around 69.2 percent of the variation in the industry-skill premia. The dummies are always jointly statistically significant. In this case, it appears that the industry dummies play a more relevant role than country dummies. It should be kept in mind, however, that the comparison of R2 is an informal way of assessing the role of the dummies, because it is
impossible to ascertain how national characteristics affect industrial structure and vice versa.\textsuperscript{24}

The results from the sample restricted to manufacturing sectors suggest that country dummies and industry dummies are equally important in explaining industry wage premia. As before, both sets of dummies are jointly significant. When non-tradables and services sectors are considered, the industry dummies appear to be much more relevant than the country dummies. Once again, the two sets of dummies are jointly significant. Hence the industry effects on industry-specific wage premia across countries for all industries seem partly driven by their importance in non-tradable sectors, rather than in manufactures. This preliminary evidence should at least provide food for thought in policy discussions about policies to promote certain manufacturing industries, because in these industries national characteristics seem to be at least as important as industry characteristics. In sum, this exploratory analysis reveals that, in Latin America, industry effects are more relevant than the country effects for the case of non-tradables and services, but both country and industry effects are equally relevant in explaining the skill premium in manufactures.

**Exports and Industry Skill Premiums**

To study the role of exports in shaping wages of skilled workers in Latin America, Brambilla, Lederman and Porto (2010) provide two sets of exploratory evidence. One examines the role of industry exports as a share of national GDP by industry, the other studies the role of export unit values (at the 2-digit level) in determining industry wage premia.

Table 4.5 reports the results concerning the role of the incidence of exports in sectoral GDP. The correlation between exports and industry wage premia is positive, and this correlation coefficient rises after controlling for industry effects (column 2) but disappears with country effects (columns 3 and 4). However, the positive effect of exports reappears after controlling for the level of development of each country (proxied by the log of GDP per capita) and national skill endowments (the log of the ratio of skilled -- with completed high school -- to unskilled workers). Moreover, the evidence suggests that richer countries pay higher skill premia, and, as expected, countries with relatively more workers with completed high school tend to pay lower skill premia.

\textsuperscript{24} In technical terms, to ascertain the extent to which the variance of country or industry characteristics explain the variance of skill premia we would need to know how much of the variance of national characteristics is explained by industry characteristics and vice versa. To come up with such estimates, we would need to make assumptions about the relative exogeneity of country and industry characteristics.
Table 4.5 Exports, Countries and Industries as Determinants of Industry-Skill Wage Premia

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log Exports/GDP</td>
<td>0.0028***</td>
<td>0.0033***</td>
<td>0.0004</td>
<td>-0.0002</td>
<td>0.0027**</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.0011)</td>
<td>(0.0011)</td>
<td>(0.0015)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>log GDP_pc</td>
<td></td>
<td></td>
<td></td>
<td>0.0284***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.004)</td>
<td></td>
</tr>
<tr>
<td>log Skilled/Unskilled</td>
<td></td>
<td></td>
<td></td>
<td>-0.014***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.004)</td>
<td></td>
</tr>
<tr>
<td>Country Dummies</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Industry Dummies</td>
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<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
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<td>273</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.03</td>
<td>0.31</td>
<td>0.43</td>
<td>0.58</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Standard errors in parenthesis. Significance at 1, 5 and 10 percent denoted by ***, ** and *

Table 4.6 shows the results regarding the role of export prices (unit values) on skill premia in Latin America. Neither unit values nor the dispersion of unit values explain the industry-skill premium. It is possible that this is a result of the noise in the unit values data. For instance, in specification C, where we trim the top and bottom 5% of the unit values, the dispersion in unit value becomes significant in some regressions. This hints that the scope of product differentiation could be related to the skill premium, probably because product differentiation is a skill-intensive activity.
A key finding from Table 4.6 is, however, that in all the models that control for unit values, sectoral exports are still an important factor in explaining the skill premium. Also, the magnitudes of the estimates are similar as those shown in Table 4.5. This means that the link between industry exports and industry skill premia is preserved after controlling for unit values. We interpret this result as a robustness check that supports the important role of exports in determining the premium paid to skills in Latin America.
It is possible that the quality of exports measured in terms of unit values can have important consequences for economic development even if they are not robustly associated with skill premia. The following chapter addresses the quality of trade from this perspective.
Part II: Beyond Goods
5. Heterogeneity in the Production of Goods: The How versus the What

The previous discussions of heterogeneity of country experiences with similar goods point to a larger conceptual issue: Is the good the relevant unit of analysis. We ask this question in three related respects. This chapter argues that production of a good may be done at a variety of technological levels and combinations of factors of production and this, in turn, may affect whether producing that good has any economy wide benefits or not. Chapter 6 draws on a recent literature that explores the extraordinary heterogeneity of quality, measured by price (unit values) within much disaggregated goods classifications. Finally, a brief chapter 7 asks, whether, in the globalized production networks where countries produce a fragment of the final good, does it make sense to talk about goods at all as opposed to tasks? In all cases, previous assumptions that if a good is exported from both the U.S. and Mexico, it represents the same economic activity, is unlikely to be the case. The importance for industrial policy is then that it may be less “what” is traded but “how” it is produced.

Not What, but How?

In each of the three previous sections the heterogeneity of experiences of countries presumably producing the same good emerged as central. In Natural Resources-Neither Curse nor Destiny Lederman and Maloney (2006 and 2009) argued that the huge historical variation in development experiences based on natural resources suggested that studying the variation in experience was more fruitful to investigate than the “average” tendency and notions of a “conditional curse” move in this direction. How countries leveraged their resources is as important as the resource endowments themselves. This finding enjoys substantial support outside of the curse literature. In the forestry industry, Blomstrom and Kokko (2006) demonstrated the sophistication of the Swedish forestry industry to be far higher than is seen in Chile or Brazil. Wright and Czelusta (2007) discuss “mineral underperformers” to describe Latin America’s low productivity, low exploration mining enterprises. Martin and Mitra (2001) using simple TFP regressions show that differential rates of productivity exist within manufactures and agriculture by country, suggesting that the phenomenon is more general. The good is the same, but the production technology broadly construed is not.

Rodrik and Hausmann’s model of rich country goods allows that goods can be produced at different levels of productivity, but the driving mechanism of their work is the productivity level of the country at the frontier – this makes PRODY the defining characteristic of the good. But what remains to be explored is whether the factors dictating the heterogeneity in performance within a good dwarf any effect arising from the effect arising from the high productivity of the country at the frontier associated with a good. The discussion in the previous chapter again suggests that these country effects are quite large.

One approach to the question that gets at measuring directly the “knowledge” content of a good is intuitive and explores the relationship between how much a country
exports of a good, and how much it appears to contribute to global knowledge around that good as measured by patents. Though patenting, in principle, can slow the spillovers that we are interested in, the goal here is simply to document that at least in this dimension of “learning” or “knowledge generation” countries exporting the same good differ radically.

Figure 5.1 shows the index of comparative advantage in innovation (IRCAI) in the production of Mexican Computers and Brazilian Aircraft (Lederman and Maloney 2006). This is the number of Mexican patents emitted in a sector over total number of Mexican patents, divided by the global analogue. That is, if Mexico with a large computer sector is producing relatively more patents in this sector than is the case globally, the IRCAI >1, then we say it has an innovation comparative advantage in the sector. However, in this case, the answer, is no. For a twenty year period, Mexico has shown a comparative disadvantage (less than 1) in innovation (as measured by patents) in the sector. This is a relative statement- where this country trades more is not where it innovates more. A similar finding emerges for aircraft in Brazil. In neither case is it easy to argue that any knowledge cluster in these countries corresponds to its largest exports.

Figure 5.1. Brazil and Mexico: Has their Export Prowess Resulted in Revealed Comparative Advantage in Patents for Aircraft and Office Computing and Accounting Equipment?


While figure 5.1 is not encouraging for these large Latin American economies in the sense that industries that could be deemed sophisticated or “high-tech” and in which these countries have developed a presence in export markets do not seem to be the source of much innovation, more recent data can be used to assess more generally the
relationship between comparative advantage in trade and innovation, as well as the relationship between export market share and the patent market share. Perhaps there is no relationship, in which case to talk about manufacturing industries such as computers, electronics, and aircraft as being somehow superior in terms of their potential for providing knowledge spillovers or to protect rents emanating from the expected innovation with patents might not make much economic sense.

Figures 5.2a-5.2c show scatter plots of indexes of revealed comparative advantage in trade (considering both exports and imports, as in Vollrath 1991) and patenting. The latter varies between zero and infinity. The vertical and horizontal lines cutting through these graphs indicate the level of comparative advantage: a value greater than zero in trade indicates comparative advantage in trade, and a value greater than one in patents suggests comparative advantage in patenting. Hence countries in the upper right quadrant have comparative advantage in both; those in the lower left quadrant have neither. The data on trade cover the period 1980-2004 and the patent data cover 1963-2004. Using the same data (but not on imports), Figures 5.3a-5.3f show the relationship between country rankings in export market shares and patenting shares by sector. The economies of Latin America and the Caribbean are differentiated from the rest of the global samples in both sets of graphs.

The pictures about revealed comparative advantage in trade versus innovation tell a consistent story for the three sectors: the regional powerhouses in trade for each one of these potentially “high-tech” industries do not appear to have developed a corresponding comparative advantage in innovation. In the case of aircraft, Brazil appears in the upper left quadrant, indicating comparative advantage in trade but not in patenting. (The two LAC economies with comparative advantage in aircraft patents are Peru and Ecuador, which patented so little during 1963-2004, that a tiny number of patents assigned to this sector appear as having contributed a huge share of total patents. This small-numbers problem appears in the other sector graphs as well.) Likewise, in the case of electronics only Mexico and the Dominican Republic appear with a comparative advantage in trade but neither managed to develop an industry with innovation potential. (The regional observation in this graph with the small-numbers problem and in the lower right quadrant is St. Kitts and Nevis from the Caribbean.) Finally, the last graph in this series shows that neither Costa Rica nor Mexico developed an innovation-based computer industry, despite their stellar trade performance in this sector. Costa Rica in fact has received zero patents in this sector since 1997 when INTEL began operations. Hence the regions experience suggests that it is difficult to argue that comparative advantage in a high-tech sounding industry is synonymous with a knowledge industry.
Turning to the graphs under Figure 5.3, there does appear to be a positive relationship between a country’s ranking in terms of export market share and patent shares in all three sectors, even after excluding the high-income economies of the OECD. However, this partitioning of the data also suggests that the trading powerhouses of the region in each industry tend to underperform in terms of patenting, given their export performance. This is reflected in the fact that the aforementioned cases all appear above the fitted line, which reflects the correlation in the global sample between export and patent shares. Thus again we must conclude that what countries export do not necessarily reflect the sophistication of how they produce a given product. This might reflect that products can be exported from different locations that use fundamentally different technologies to produce a given product.

The bottom line of both exercises is to suggest that just producing a particular good, in both cases “high tech” goods like computers or aircraft, does not imply that similar productive activities are going on in two countries that produce them. This is relevant since producing goods differently also may imply differing externalities emerging from the production process. The case for industrial policy thus rests on showing not that individual goods have externalities, but, again, that the particular way of producing a particular good has externalities.
Source and Notes: Authors’ calculations, based on data from WITS (original data at the 3-digit level of the SIC classification) and patent data from the U.S. PTO (at the 3-digit level of the SIC of 2004). Countries with zero exports or patents are excluded; the rankings are for countries with some exports and patents. Higher numbers correspond to countries with higher exports or patents.
4. Export Heterogeneity along the Quality Dimension

This chapter continues exploring the heterogeneity found within goods, this time focusing on what has been called export quality. Within the most disaggregated export categories available, there is an extremely high variance of unit values—total export valued divided by quantity and this “price” has been broadly interpreted as a measure of “quality.” This wide range of quality within goods is thought to have far reaching implications for trade theory, and, potentially growth oriented trade policy. This chapter explores some of these issues through this lens. In particular, it allows us to revisit an analogous question to that asked further: How much of the quality of a country’s export basket is due to what it produces, and how much to how?

Schott (2004) has argued that the extraordinary heterogeneity within goods turns much of international trade theory on its head. He argues that much of what is confused for intra-industry trade is, in fact, trade in goods of distinct quality. Further, he argues that there is virtually no evidence for conventional considerations of comparative advantage in terms of the types of good produced, and everything in the quality. This puts him at the other extreme of views putting the homogeneous “good” at the center of the analysis. Mukerji and Panagariya (2009) have argued that this statement is too strong, noting that the US does not export two thirds of the products it imports. This would suggest that there is still a strong role for modeling what types of goods are exported. However, the point remains—there are many ways of producing even very narrowly defined goods.

From the development point of view that is of most interest here, Schott (2004) and Hummels and Klenow (2005) show that average unit values of export increase with level of GDP/capita. This suggests that export quality and its dynamics offer a potential window on the growth process and its drivers. At one extreme, Hallak and Sivadasan (2007) have argued that improvements in quality represent the accumulation of “caliber”, a factor of production distinct from what drives pure productivity growth. That is, a high productivity country can produce low quality. Sutton (1998) on the other hand, views both quality and productivity as emerging from the undertaking of research and development broadly construed. Either unit value dynamics can tell us something about the accumulation of whatever common factor drives both, or at very least we need to understand the dynamics of accumulating caliber which is likely to be highly correlated with productivity.

Beyond the question of what drives the level of quality that a country produces at, the fact that different goods exhibit very different lengths of their quality ladder raises a concern analogous to that traditionally found in the resource literature: As Hwang (2006) argues, if there exists a force for convergence that developing countries can exploit, then countries with small quality ladders (possibilities for productivity growth) presumably are

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25 See Aiginger (1997) Brooks (2006) and Hallak and Schott (2008), Verhoogen and Kugler (2008) Kandelwahl (2010) has argued that additional information on the relative demand for products needs to be incorporated to make true quality comparisons. For our purposes, we assume that, on average, the raw unit values capture differences in quality, albeit with measurement error.
more limited in growth potential. For instance, many developing countries specialize in commodities which, almost by definition, are more homogeneous and would, therefore have fewer possibilities for convergence effects than more differentiated products. Country growth rates more generally may, again, depend on which goods they produce.

In neither the case of differential potential for productivity growth or quality growth is there obviously a role for government intervention. There are no spillovers being postulated and, presumably, firms know the technology of production of their industry and make decisions accordingly. However, the exercise below allows us to focus on how much the growth in overall quality of a country’s basket, as a loose proxy for growth overall, depends on the goods it is producing vs. the environment in which it is producing them.

**How Does Latin America and the Caribbean compare in Export Unit Values?**

Figure 6.1a compares the median level of export unit values across regions for exports to the US. Since unit values come in their “units” – US per bushel, ton, car, bottle, etc. – we standardize by the quality leaders (90th percentile) within each product category to generate a measure of “relative quality.” Consistent with Schott’s finding, the rich countries of the OECD have the highest median relative quality level. LAC (Latin America and the Caribbean), MENA (Middle East and North Africa), and Sub Saharan Africa follow. Eastern Europe and Asia, including the rich countries of Asia (EAPH: Korea, Taiwan, Singapore, Hong Kong) and Emerging Asia (EAPL: China, Philippines, Malaysia, etc.) follow next. The LAC-East Asia counterintuitive finding was found independently by Schott (2003). Figure 6.1b disaggregates the Latin American and Caribbean region for reference. The peculiarly high values found for relative quality (and PRODY) in the Caribbean are discussed in Box 1.

At a product level, the graphs in Figure 6.1c offer a hyper-disaggregated view of 12 goods at the Harmonized system (HS) 10 level, the finest disaggregation available. The categories were selected on a combination of importance in the export basket of the LAC region and representativeness of certain types of goods. Turbofan airplanes are not common in the region, but Embraer’s success in Brazil does have importance as a potential sector that merits benchmarking.

The first thing to note is that the implicit length of the quality ladder as measured along the vertical axis varies substantially by product. Gold and silver bullion, for example, are concentrated between .8 and 1 with very little vertical differentiation. Footwear, men’s shirts, and even micro processors show values from .1-.2 to substantially over 1. In general, we may expect that commodities, almost by definition, would have less room for vertical differentiation and this is largely true. Gold, silver, bananas, fuel oil have relatively short quality ladders. Latin America’s concentration in commodities, therefore, may explain its relatively high overall quality. On the other hand, this does not extend to all resource based goods: the variance in peeled, frozen, shrimps and prawns, wine and coffee is similar to, for instance, passenger vehicles and aircraft. Overall, however, once we control for the goods produced, LAC’s ranking falls to third lowest suggesting that the commodity impact is important.
Even casual perusal of these figures will bring some anomalies to light that point to the difficulty of interpreting unit values. First, the data record imports from countries regardless of whether or not the goods are produced there. Hence, Singapore is a high quality exporter of coffee (and, as we saw in chapter 3, at time asses, mules and hinnies) when, in fact, it these are re-exports through an entrepôt. Relatedly, we may also be including more than one level of the production process. Sweden, in fact, has the highest unit value for coffee (truncated) but this appears to be due to the fact that a particular Swedish company selects and brands the beans it re-exports. Second, despite the very high level of disaggregation, there may still be heterogeneity of production along several dimensions besides the most obvious (see Khandelwal 2008 and Hallak and Schott 2008), and a high price unaccompanied by substantial sales may reflect other factors that may not actually reflect quality. Third, within a category, countries may export a variety of qualities of wine, exploiting different submarkets, and this may drop the average value far below the “peak” value for country. New Zealand chose to enter the market at a high price point and hence does not export the cheaper varieties that Chile, Argentina or, for that matter, France do. Finally, it worth highlighting that it is not clear that being in “high price” goods is obviously better. As Mukerji and Panagariya (2009) note, the US produces goods at a huge variety of quality levels suggesting that exporting low quality goods to certain markets is also profitable as well. All these caveats acknowledged, the fact that on average, rich countries produce higher quality goods than poor countries nonetheless does suggest that, in the aggregate, there is a link.

These complexities are clearly reflected in Latin America’s exports depicted in figures 1c, even though the region’s overall performance broadly reflects its level of development. For shrimp and prawns, the region with the exception of Brazil, is in the upper half of the distributions. For wine, it is squarely in the center. Mexico is exporting expensive wines, but these are few and more of boutique interest than mass production along the lines of Italy, which shows substantially lower relative quality. In commodities such as silver, gold, LAC is predictably close to the frontier. In footwear, the region is represented across the ladder with Colombia and Jamaica near the bottom and Chile, Salvador, and Argentina closer to the top. Salvador raises the same issue, to be taken up more in the next chapter, about the degree to which we consider maquila exports of advanced country firms a product of local “caliber” vs. simply the assembly of high quality products designed elsewhere. The case with men’s shirts is similar. Again, Colombia is near the bottom and Mexico, Chile, Argentina, and Peru in the middle. Costa Rica and Argentina are in the upper half for a specific type of micro-chip, again, very likely representing MNC influence; Mexico is closer to the bottom. A similar issue is found in passenger cars. We find Mexico above South Korea, but below the other world producers. But what does this really mean? Mexico exports Volkswagen Jettas to the US while Germany produces the higher end Volkswagens in Germany. To the degree that these are the same company, clearly, the implicit “caliber” is the same and attributable to Germany, and less to Mexico. Embraer is squarely in the middle of unit values for nonmilitary turbofan airplanes although clearly substantial differences in characteristics may make comparisons problematic.
Figure 6.1a Relative Quality by Region 1990-2001

Figure 6.1b Region and Country Relative Quality
Figure 6.1c: Relative Quality Ladders for Top Latin American Exports and Representative Products

(Quality is measured by export unit values standardized by the 90th percentile of each product)
Note: Top 10 exports for top 10 LAC countries, plus textiles, wine, and microchips. Relative unit values by country. Countries are ranked by relative unit values.
Unit Value Dynamics

For this study Krishna and Maloney (2010) examine the dynamics of export unit values – the process of change in quality, if you will. This is useful for three reasons. First, their work can be seen as the dynamic analogue to Hummels and Klenow (2003) and Schott (2004) – we know that the unit values of exports of rich countries are higher than those from developing economies, but what are the forces driving this pattern? Second, the analysis of the dynamics of export unit values allows us to examine whether some products offer better prospects for development via improvements in unit values. Third, it allows us to identify what fraction of aggregate unit value growth is due to goods composition, and what fraction to country specific characteristics.

Figure 6.2a shows the rate of growth of unit values and 6.2b disaggregates by countries within Latin America. The OECD shows the highest rate of quality growth
something that, given the higher level of relative quality, indicates that quality is *diverging* across time. However, seemingly paradoxically, there is evidence of convergence *within products*-countries further from the quality frontier do grow faster in that good than those closer. Thus, the differential position of Latin America and MENA, relative to the high-income countries of East Asia (Hong Kong, Taiwan, Korea, and Singapore) might explain why they grow more slowly as Hwang suggests. To the degree that LAC and MENA are near the frontier in their basket of, largely, natural-resource driven goods, they get much less of a catch up convergence “kick”.

**Figure 6.2a Quality Growth by Region 1990-2001**
However, two other factors that appear of importance emerge from the regression analysis. First, controlling for products, while not changing the fact that there is
divergence, greatly reduces the gap in growth rates between the OECD and other regions. This suggests that what goods countries are in does matter to unit value. Second, controlling for the basket of goods, there is a large positive free standing OECD effect unrelated to position along the quality ladder. That is, even if the OECD and developing countries produced the same goods, the OECD would grow substantially faster, even given their closer proximity to the frontier. This is clear from Figure 6.3 which controls for product composition. The only coefficient that is above average (zero) is that of the high-income OECD countries. Aside from LAC, the coefficients for the remaining regions are lower than zero indicating that on average their growth rate is below average. Clearly, the large fall in the gap between OECD and LDC growth rates suggests that the composition of the basket matters to overall growth rates. However, the fact that we still see divergence after controlling for them suggests that country characteristics remain very important confirming, again, that how each good is produced matters greatly.

What Affects the Growth of Unit Values? Countries versus Industries

What factors could influence the rate of growth in unit values? Consistent with findings from the productivity literature, exposure to international competition appears to stimulate quality upgrading manifested in rising unit values. Fernandes and Paunov (2008) confirm that firms more exposed to trade have higher product quality with Chilean data. The export demand effects are similar. Iacovone and Javorcik (2008) find that Mexican plants invest in product quality upgrading before they export. The destination market also seems to influence the level of quality. For the U.S., in that aggregate, Waugh (2008) found that export unit values rise with the income level of the destination market and Bastos and Silva (2008) find the same for Portuguese exports. These findings are consistent with different qualities being targeted to distinct submarkets and that as Waugh argues, higher levels of quality allow access to more submarkets. Overall, the traditional prescriptions of increasing competition and opportunities to export, especially to wealthier markets, would work in favor of raising quality.

Krishna and Maloney (2010) explore the mystery of the previous section: although within products there is convergence across countries, without product specific effects we see unit value divergence. That is, countries with higher levels of relative quality appeared to raise their quality faster than those with lower levels. This resonates with the very weak findings of convergence in the growth literature more generally and recalls the debate about why this should be the case. It has been suggested, for instance, that poor countries with low levels of physical and human capital may also lack the incentives for rapid accumulation of these factors, thus perpetuating their low income

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26 This is consistent with Bustos (2010) who added a measure of technological choice to the Melitz framework and found that, for Argentina, reduction of import tariffs by its MERCOSUR partners increased both the probability of firm entry into these export markets and spending on technology.

27 Relatedly, Brambilla, Lederman and Porto (2010) find that Argentine manufacturing firms paid higher average wages and hired more skilled workers upon shifting their exports from Brazil to high-income markets (the U.S. and Europe) during the Brazilian devaluation of 1999. And these changes in skill utilization by firms were associated with exports with higher unit value variances than other exports.
levels. In turn, low rates of return to accumulable factors of production are explained by the lack of important economic and political institutions such as a system assuring property rights and mechanisms for the efficient enforcement of contracts.

However, a key impediment may be an inability to take on larger, riskier projects and hence enjoy high returns on investments. Following Acemoglu and Zilibotti (1997), a literature has moved the inability of poor countries to diversify risk combined with the indivisibility of many projects, as the central explanation for the perverse phenomenon of both low growth and high volatility.28 There is evidence in support of this view in Figure 6.4. Here we plot the country growth rate of unit values and their variance across the decade of the 1990s. What emerges is a striking and statistically significant relationship between the two: countries with riskier exports (measured by the dispersion of unit values) enjoy higher growth of unit values. Perhaps more importantly, the poor countries are in the lower part of the risk-return profile. It is important to emphasize that this says nothing about the overall portfolio of exports which also depends on the co-movements of unit values across goods– richer countries may, overall, have a lower risk portfolio of exports. This issue will be dealt with in chapter 7.

Figure 6.4: Unit Values: Drift and Standard Deviation, 1990-2001 (Quantile Regression)

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28 Do and Levchenko (2008) also postulate a model where financial services are endogenous and hence countries producing low finance intensive goods will have financial markets that cannot support taking on more risky goods. A related literature is reviewed and the empirical validity of the Acemoglu and Zilibotti (1997) theory is tested by Lederman and Xu (2010) – see Chapter 7 in this report.
This relationship continues to hold when we control for the goods countries export. That is, a rich country producing the same good as a poor country would still take on riskier investments, and experience faster growth in quality. However, it appears that there is a strong risk-return profile in goods too. And here, it is manufactures, particularly electronics and the like, that have the highest variance and natural resources that show the lowest. This stands in stark contrast with the stylized fact that natural resources have more volatile price movements. In fact, as discussed in chapters 2 and 7, it is the lack of diversification, and not the intrinsic risks associated with these goods that drive that result. But it also suggests that getting into the higher risk goods is important for development.

The disaggregation into product and country effects is, at some level, less interesting than it first appears since, in all likelihood, the same factors dictating that lower risk projects were taken on within goods are dictating that poor countries do not take on riskier goods.

What are these potential factors? The financial sector has emerged as central to diversifying these risks and fomenting high rates of growth. Greenwood and Jovanovic (1990) argue that financial intermediaries encourage high-yield investments and growth by performing dual roles: pooling idiosyncratic investment risks and eliminating ex-ante downside uncertainty about rates of return. Obstfeld (1994) sees international asset trade as encouraging all countries to shift from low-return, safe investments toward high-return, risky investments. Grossman and Razin (1985) argue that multinational corporations may take on more risky production techniques within a country because they are more diversified internationally than locals firms. In the area of trade, Baldwin (1985) argues that the differential ability of investors to diversify leads the country with better capital markets to exports the ‘risky’, and hence higher-return, good. However, finance need not be the only barrier to countries taking on riskier projects. To the degree that Pasteur is right that “chance favors the prepared mind,” an inability to resolve the well-known market failures and again, indivisibilities surrounding innovation and R&D would leave poorer countries restricted to less complex, and less risky products (for a recent application that emphasizes appropriation externalities over finance, see Hausmann, Hwang and Rodrik 2007). Further, as Acemoglu, Johnson and Robinson etc (2003) and Levchenko (2007) argue, weak supporting institutions that either exclude entrepreneurs, create additional uncertainty in the rules of the game, or make managing the implications of loss (for instance, bankruptcy laws) would also cause countries to specialize in lower risk goods. In the end, finance, barriers to R&D, and institutions are likely to be highly related.

The association of increasingly complex or involved products suggests that the diversification channel need not be the only financial barrier, and that barriers need not, in fact, originate in the financial sector. Kletzer and Bardan (1987) argue that more sophisticated manufactured finished products require more credit to cover selling and distribution costs than primary or intermediate products, hence imperfections in credit markets, even where technology and endowments are identical, can lead to specialization of countries with higher levels of sovereign risk or imperfect domestic credit markets in less sophisticated products. Beck (2002) builds a model where manufacturing, due to exhibiting increasing returns to scale, is more finance intensive due to increasing returns to scale.

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To date, the evidence of these effects, while compelling, has been largely historical and anecdotal. For the 100 data points available, financial depth, the degree of resolution of market failures in innovation, and institutional soundness, all when taken alone, influence a country’s position on the risk return frontier. However, in combined regressions that attempt to control for the strong correlations of these variables with development, the sample is severely restricted, and the correlations become less clear. R&D emerges as the most robust proxy although it pushes the data too hard to assert that failures in the resolution of appropriation or other externalities are the principal or sole barrier for the emergence of high-risk exports with potential for fast unit-value growth. Financial depth also enters although less significantly, but still is viable as an explanation. Hence thus far, we are tempted to conclude that national and industry-neutral policies might be preferred over the old style IPs that would demand that the public sector choose the high-risk, high-drift product to subsidize, but we also acknowledge that such policies might have differential effects across products as they would disproportionately stimulate the emergence of these types of products.

**Entry and Exit Patterns**

The preceding analysis has not taken into account the dynamic nature of the composition of regional export baskets. That is, quality may also increase with the introduction of new goods of higher relative quality. This section conducts an analysis of the entry and exit patterns of goods in regional export baskets. “Entries” are comprised by goods not traded from 1990-1995 and traded at least three times from 1996-2001 and “Exits” by goods traded at least three times from 1990-1995 and not traded from 1996-2001. “Incumbent” goods are goods traded at least three times in the 1990-1995 period.

The median ratio of incoming to incumbent goods for the non-OECD regions is 1.03 and the median ratio for the OECD (high-income) is equal to 1.06. This implies that new goods enter at approximately the same level as existing goods within the region – but also that new goods enter at higher quality levels in richer countries than in poorer ones. At the upper end of the distribution, the quality ratio of entering to incumbent goods is larger for the non-OECD regions suggesting a degree of convergence at the top end of the quality distribution between OECD and non-OECD countries.
Figure 6.5 Incoming Ratio by Region (25, 50, 75th percentiles)

Figure 6.5 disaggregates this by region presenting the ratio at the 25th, 50th (median) and 75th percentiles. As compared with the previous results where we had roughly equal ratios of OECD (high-income) and non-OECD at the 50th percentile, we find important regional differences. Compared to the OECD, Central Asia and the East Asia Pacific regions are 10 to 20% lower at the median, while Eastern Europe and South Asia are roughly 10% higher. LAC, MENA, and Sub-Saharan Africa are all roughly similar to the OECD at the 50th percentile level. These counterintuitive findings are perhaps somewhat allayed by what is happening at the upper ends of the distribution. Though both East Asias have lower median ratios, at the 75th quantile East Asia (high-income) equals that of the top performers and East Asia (low-income) is respectable as well. Arguably, the faster growing areas may have a broader distribution of exporters coming on line– many reflecting their relatively low average level of “caliber” but some being global superstars as well who are “leapfrogging.” Eastern Europe stands out as having its entire distribution shifted right with quantiles showing ratios 30-50% higher than the OECD. Since the period covered begins after the fall of the Berlin Wall, this may be suggesting that the pre-liberalization level of “caliber” or general technological sophistication could very broadly support goods of higher quality and some superstars, and that liberalization made this possible. Contrarily, Central Asia is largely shifted, or at least compressed left and Africa is of a similar character– modest median growth and no superstars.

Micro level work commissioned by this study broadly confirms these patterns of entry and exit and add further complexity to the dynamics. Lederman, Rodriguez-Clare and Xu (2010) confirm that, in Costa Rica, new products enter at about 90% of the typical (median) incumbent basket. Alvarez and Fuentes (2008), using a rich dataset of
Chilean exporters during the period 1991-2001, identify four stylized facts. First, every year a large number of new exporting relationships are initiated, but they represent a small share in the total value of exports. Second, survival rates seem to be very low. After one year, around one quarter of new exporters is still exporting, but in the next year, only about 12% retains the same status. This survival rate declines steadily over time. Third, entry is generally associated with higher unit values. This would be consistent with the idea that new exports are high-quality products compared to incumbent export products. However, this quality differences tend to decrease over time and eventually disappear three years after entry. Fourth, there are significant differences across sectors and, in particular, within sectors. Reference-price and differentiated products show a higher price in the year of entry and it takes longer for them to converge to the incumbent prices, while in the case of homogenous goods, the new exporters enter with a higher price but rapidly converge to the price of the incumbents.

**Conclusion**

This chapter has viewed export quality through the lens of the unit value. This literature has documented a high degree of heterogeneity in prices even within very finely disaggregated goods and that, on average, this measure of “quality” rises with level of development. The dynamics of unit values hence offers a window on broader development issues.

The chapter finds that there is a convergence dynamic– within a good, countries farther from the frontier will, all things equal, experience faster growth rates of their export unit values. In this sense, LAC is at a bit of a disadvantage in its concentration in commodities, which tend to have shorter quality (unit value) ladders. Further, we do find evidence that goods matter. Many manufactures appear to offer greater opportunities for investments that will yield more rapid growth in quality.

That said, two observations must be made. First, what is not clear is that there is a market failure here that would dictate that the Latin American and Caribbean economies should be specialized in goods that defy their comparative advantage in commodities. Lower possibilities for unit value growth may translate into lower profitability, but there is no obvious externality that the market cannot see and which must be corrected. Moving into other non-commodity goods against a country’s comparative advantage will likely involve welfare losses.

Second, and critically related to the previous point, we find that the convergence effects are swamped by idiosyncratic regional factors which make the OECD (high-income) continue to grow relatively faster, even controlling for goods. That is, even if LAC had the OECD basket of goods, it would perform much worse. This again points to the “how” and not just the “what” of export decisions although, as of now we can only speculate on the factors undermining the region’s performance. However, numerous behind-the-border factors, such as the resolution of market failures in technology, the depth of financial markets, and the quality of institutions appear to be relevant. Further, the literature is put an emphasis on human capital accumulation generally as a key
promoter of quality. Hence it seems that national sector-neutral policies, the anti-thesis of old-style IPs based on picking winners, can help development precisely because they may have disproportionately positive effects on riskier goods that appear to experience fast growth rates in unit values.

30 In a paper commissioned for this study, Waugh (2009) offers a general equilibrium theory of the supply and demand for product quality, and international trade that sees quality as an important feature to understanding bilateral trade volumes. He argues that intermediate goods are available in different quality and this quality is complementary to domestic human capital: skilled workers are better able to use higher quality intermediate goods. Higher human capital countries are able to produce all levels of quality for export, poor countries only those at the lower end of the spectrum. Introducing quality in his simulations, he is able to replicate up to 75% of the observed variation in the volume of bilateral trade compared to the model with no quality considerations.
Annex 1: Country Composition of Regional Categories

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<tr>
<th>AUSTRALIA</th>
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7. Goods or Tasks?

In the previous chapters, we have assumed that a country exporting a particular good is, in fact, producing all of that good. However, in the era of globalized production where production is fragmented and allocated among distinct countries, this need not be true. In this case, the findings of chapter 5 about different production technologies, and differing degrees of knowledge generation in the computing industry, for example, may be driven not by differing production processes, but rather that countries like Mexico are simply providing a last stage of a production process that is, in fact, not the one associated with skilled labor or patenting. That is, rather than talking about trade in goods, we should be talking about trade in tasks.

Box 7.1: Who Makes the iPod?

Each import of a finished iPod into the US contributes roughly $150 to the China-US bilateral trade deficit. Frequently, this kind of product is considered a desirable “high tech” product with likely high knowledge spillovers.

Yet in this era of extraordinarily fragmented production process and extended value chains, how much really accrues to China. Following the value added requires information not easily available, but Linden et al (2007) conclude that it is not very much.

Of the $299 retail price in the US, $163 was captured by US companies and workers; $75% for distribution and retail, $80 to Apple for inventing and overall coordination of production, and $8 to various component makers. Japan earned about $26 through the Toshiba disk drive. In the end, less than 1% of the value added of the iPod accrued to China and it is largely assembly work.

This question is nowhere clearer than in the goods that have become icons of the current Chinese miracle. Box 7.1 suggests that, though China exports the iPod to the US, only 1% of the value added it generates accrue to China. Further, this is largely assembly work, arguably indistinguishable from the textile assembly work done in the next factory over. As Goh Keng Swee, Singapore’s one time Minister of Finance (1970) commented “... the electronic components we make in Singapore require less skill than that required by barbers or cooks, involving mostly repetitive manual operations.31

This is a more general issue. Figure 7.1 at a very aggregate level shows that some of the highest PRODY goods are, in fact, those with relatively little value added.

Electronic products have only 22%. Disaggregating further, Table 7.1 shows that electronics and other “high tech” products are at the bottom of the VA contribution list: Computers contribute only 4.6%. At the high end are a variety of natural resource and industrial “basics” like chemical fertilizers, metal processing, and the like. The development impact of a unit gain in productivity is going to be larger in these goods. Further, when the literature talks about “moving into high value added products” it needs to be more precise. For China this would imply moving out of Computers and into Hemp Textiles.

**Figure 7.1: PRODY vs. Value Added in China**
Table 7.1 China: 10 Exports with the Lowest Domestic Value Added

<table>
<thead>
<tr>
<th>Product</th>
<th>Value Added</th>
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<tbody>
<tr>
<td>Electronic computer</td>
<td>4.6</td>
</tr>
<tr>
<td>Telecommunication equipment</td>
<td>14.9</td>
</tr>
<tr>
<td>Cultural and office equipment</td>
<td>19.1</td>
</tr>
<tr>
<td>Other computer peripheral equipment</td>
<td>19.7</td>
</tr>
<tr>
<td>Electronic element and device</td>
<td>22.2</td>
</tr>
<tr>
<td>Radio, television, and communication equipment</td>
<td>35.5</td>
</tr>
<tr>
<td>Household electric appliances</td>
<td>37.2</td>
</tr>
<tr>
<td>Plastic products</td>
<td>37.4</td>
</tr>
<tr>
<td>Generators</td>
<td>39.6</td>
</tr>
<tr>
<td>Instruments, meters and other measuring equipment</td>
<td>42.2</td>
</tr>
</tbody>
</table>

China: 10 Exports with the Highest Domestic Value Added

<table>
<thead>
<tr>
<th>Product</th>
<th>Value Added</th>
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</thead>
<tbody>
<tr>
<td>Agriculture, forestry, animal husbandry and fishing machinery</td>
<td>81.8</td>
</tr>
<tr>
<td>Hemp textiles</td>
<td>82.7</td>
</tr>
<tr>
<td>Metalworking machinery</td>
<td>83.4</td>
</tr>
<tr>
<td>Steel pressing</td>
<td>83.4</td>
</tr>
<tr>
<td>Pottery, china and earthenware</td>
<td>83.4</td>
</tr>
<tr>
<td>Chemical fertilizers</td>
<td>84.0</td>
</tr>
<tr>
<td>Fireproof materials</td>
<td>84.7</td>
</tr>
<tr>
<td>Cement, lime and plaster</td>
<td>86.4</td>
</tr>
<tr>
<td>Other non-metallic mineral products</td>
<td>86.4</td>
</tr>
<tr>
<td>Coking</td>
<td>91.6</td>
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</tbody>
</table>


An emerging literature in international trade on the implications of such a shift in emphasis. (See, for example, GrossmanRossi-Hansberg 2006,2008, Antràs, Garicano and Rossi-Hansberg 2006,Baldwin and Robert-Nicoud 2010) and a whole new set of questions is likely to arise as a result. For instance, Kobrin (2008) argues that as processes are fragmented, the possible spillovers expected from producing certain goods are reduced as only specific assembly tasks are transferred. He argues that core-periphery arguments may gain in relevance as a result.

The observation that the appropriate focus is on the type of value added being contributed by the country rather than the good showing up on its export ledgers hence goes far beyond Hausmann and Rodrik’s effort to classify goods by PRODY. All of our previous discussions of characteristics inherent to goods should, ideally, be discussed in the context of specific tasks that may or may not be unique to a particular good, and, again, how a country approaches these tasks. To modify our previous conclusion, it may not be which task you undertake per se, but rather how you do it.

In a sense, this resonates with Rodrik’s (2006) own diagnosis of China’s success and may partly explain why the EXPY indicator is not a robust predictor of economic
growth: “China has steadily moved away from being simply an assembler of components. Increasingly, production is integrated backwards and the supply chain is moving to where the assembly is undertaken. So China’s success in consumer electronics is based on its ability to make a productivity jump” (Rodrik 2006, p 18). This ability to make a productivity jump he does not see as inevitably intrinsic to the good. He is clear that China has engineered the incentives facing FDI with precisely this goal in mind in contrast to a more passive approach by Mexico which also assembles electronic goods. Again, even a focus on “high tech” tasks would be potentially misleading: It is not just the product or task, but how it is done. Mexico produces computers with few patents, South Korea produces them with large numbers of patents. The former, as China, viewed FDI primarily as a source of jobs and eventually tax revenues, the latter as a vehicle to learn from. What the non-significance of EXPY may be saying, consistent with the results from the previous chapter, is that these environmental incentive effects, in fact, wash out any good specific effect captured in PRODY.
8. Trade Quality as Portfolio Diversification

Previous chapters discussed notions of trade quality related to the types and prices (or unit values) of exported products. However tempting it might be to focus industrial and other policies solely on the development of specific products or sectors, such policies can change the overall pattern of trade, which itself might affect national welfare and growth prospects. This chapter reflects this view of the quality of trade; it emphasizes the overall distribution of export revenues across all potential export products.

When the overall distribution of export revenues is considered as a policy objective, it becomes clear that traditional notions of industrial policy might be passé. That is, the slogan “picking winners” becomes more than a challenge for the foresight of central planners with good intentions; it becomes a potentially harmful approach that could increase rather than decrease export concentration.

With the aim of clarifying various challenges related to traditional industrial policies focused on specific goods or sectors, we first discuss how development can be viewed as a process of economic diversification. In turn, the chapter briefly revisits potential market failures that could justify public interventions to stimulate private-sector investments in product innovation and diversification. The discussion reviews the main theoretical arguments, but also acknowledges that the evidence on market failures is indirect at best.

A second tour of the so-called “curse of natural resources” through the lens of export concentration is also warranted, and we address the concern that concomitant export concentration could affect economic welfare through macroeconomic volatility. New empirical evidence provided by Lederman and Xu (2010) is briefly discussed, followed by a survey of the emerging literature on how export concentration can be seen as an outcome of volatility, focusing on the role of exchange-rate volatility as a determinant of the composition of exports, with important policy implications.

The chapter concludes with discussions about two broad policy questions: (1) Can industrial policies correctly choose winning export products, and (2) should such policies focus on narrow sectors? The evidence discussed in this chapter can support certain types of industrial policies, namely interventions that focus strictly on portfolio diversification of exports, but also orthodox policies related to financial market development, trade liberalization, and other reforms that can reduce barriers to the emergence of exportable products.

Development as Diversification

The seminal article by Imbs and Wacziarg (2003) analyzed the process of diversification across income levels. The data on production and employment concentration across countries gathered by these authors suggested a robust pattern whereby economic diversification increases with the level of development, until reaching
a relatively high level of GDP per capita, after which economies become increasingly specialized. This finding was provocative as it contradicted a basic tenet of neoclassical trade models, which predict that specialization produces improvements in economic efficiency and thus development.

Klinger and Lederman (2004, 2006) were among the first papers to study the empirical relationship between diversification, export-product discoveries and the level of development. Figure 8.1 illustrates the main findings. The graph shows the (normalized) predictions from three econometric estimations of export diversification (the H index discussed earlier), the number of export discoveries observed during 1994-2003, and, for comparison, national patent counts (granted by the U.S. Patent and Trademark Office to inventors residing in a given country) as a quadratic function of GDP per capita (PPP). Unlike the exponentially positive trajectory of patenting activity, export discoveries tend to peak at a low level of income per capita, and fall monotonically with development thereafter. The Imbs-Wacziarg U-shape function of concentration is apparent in the trade data; diversification peaks around $20,000 (PPP) and rises thereafter.\footnote{Cadot, Carrere and Strauss-Kahn (2010) later confirmed the findings in Klinger and Lederman (2004, 2006) regarding the U-shape relationship between export concentration and GDP per capita and asked “what’s behind the hump?” which is of import mainly for high-income countries.}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure8_1.png}
\caption{Diversification & Innovation}
\label{fig:figure8_1}
\end{figure}

Source: Klinger and Lederman (2006), based on data from UN COMTRADE and World Bank.
Market Failures in Product Innovation and Diversification

Numerous models in the literature suggest that market failures inhibit the discovery process, thereby constraining diversification and thus possibly development. In the words of Harrison and Rodriguez-Clare (2009) “...just as R&D subsidies are appropriate responses to innovation spillovers, policies to promote entry into new industries are appropriate to deal with information spillovers associated with the discovery of new profitable activities” (p. 2).

One such model is Hausmann and Rodrik’s model of “Economic Development as Self-Discovery” (2003). This model suggests that while factor endowments explain broad patterns of production across countries, production functions for goods at a disaggregated level are not known a priori. However, once an entrepreneur has an experiment that pays off and ‘discovers’ a profitable product, others can easily imitate their success, free-riding on the initial investments in experimentation and driving down the entrepreneur’s profits. The result is a market failure, whereby entrepreneurs are not able to reap the full benefits of their discovery investment, and will consequently under-invest in experimentation. As there is social value in discovering what can be produced in each country setting, and yet competition can lead to underinvestment in the experimentation required to make these discoveries, there is scope for public intervention.

Vettas (2002) suggested another model with uncertain demand, which must be discovered. Furthermore, foreign demand is itself an increasing function of past sales due to learning on the part of consumers (up to a maximum point, which is not predictable a priori). However, the initial investment required to penetrate a new market, stimulate demand, and learn the market’s potential size will suffer from the same appropriability problem: imitators can free ride, leading to underinvestment in demand discovery by entrepreneurs, thus justifying public subsidies for entry into new markets.

Based on a similar argument of free-riding on market-cultivating expenditures, originally advanced by Bhagwati (1968), Mayer (1984) presented a model of foreign-market cultivation that assumes actual consumption experiences are required to learn about a commodity’s qualities. The model indicates that subsidization of infant-exporters is a first-best policy. Another extension relates to foreign standards, as in Granslandt and Markusen (2000). When attempting to export a good to a foreign market, the first entrant will have to make the initial investments in product and process redesign to meet foreign product-safety standards. However, market failures will arise if redesigns are non-excludable, as free-riding will reduce returns of the first entrant.

Scarce Evidence of Market Failures

While interesting, these models have not been subjected to systematic empirical testing. This is likely due in part to a lack of disaggregated worldwide production data, combined with no obvious method of testing for the presence of these market failures. Some recent research has attempted to identify market failures in product innovation indirectly by studying how competition affects product innovation by countries or firms.
Klinger and Lederman (2006) studied how the profitability of exports interacts with barriers to entry in shaping the probability of export-product innovation within sectors across countries. Their results, which were robust to various specifications controlling for country-specific effects among others, suggested that for a given rate of export growth, the probability of product innovation increases with barriers to entry (proxied by the standard indicators from the Doing Business database). This counter-intuitive result can be interpreted as evidence of market failures: If there were no appropriability problem, then barriers to entry should be associated with lower rather than higher probabilities of export-product discoveries.

Another indirect test for the existence of market failures is related to how firms react to the activities of their domestic competitors. If innovation by others leads to firm innovation, then it is possible that social benefits of product innovation by a firm can exceed the private benefits. Lederman (2010) studies product innovation by firms with data from 68 countries, covering more than 25,000 firms in eight manufacturing sectors. The author assesses the predictions of inter-disciplinary research on innovation by firms. The econometric evidence suggests that globalization and local knowledge (proxied by the accumulated stock of patents granted to local inventors) increase the likelihood that firms will introduce new products. By contrast, domestic regulatory impediments to competition are not robustly correlated with product innovation. That is, both trade liberalization and innovation effort (at the country level) seems to promote product innovation by incumbent firms, but barriers to firm entry are unrelated to product innovation, on average.

Harrison and Rodriguez-Clare (2009), besides discussing the theoretical merits of various types of market failures for justifying trade protection (which are never first best; direct subsidies are), ask the ever enduring question about policy effectiveness: “While a number of market failures could justify government intervention in theory, one key question is whether IP [industrial policy] has worked in practice.” We address this question in a novel albeit indirect approach, which is consistent with the notion of quality of trade being related to the overall concentration of trade at the end of this chapter.

**Natural Resources, Export Concentration and Volatility**

Lederman and Maloney (2007) pointed out that the curse of natural resources could be a myth. Of particular relevance here is the finding that the most robustly negatively correlated indicator of natural resource exports with economic growth is the share of natural-resource exports in total merchandise exports. Lederman and Maloney (2008) subsequently showed that this indicator is not a good theoretical proxy for abundance of natural resources – it is a measure of export concentration. In the cross-country growth regressions presented in Lederman and Maloney (2007), the curse vanished after controlling for the Herfindahl index of export concentration. If export concentration is associated with macroeconomic volatility, as will be analyzed below, then it is possible that countries might face a curse of concentration rather than a curse of natural resources per se. Even if macroeconomic volatility does not directly affect economic growth, for a given rate of income or consumption growth, volatility dampens social welfare.
The paper by Lederman and Xu (2010) commissioned for this report studies the correlates of macroeconomic volatility and assesses the validity of two complementary hypotheses: (1) Commodity dependence can exacerbate macroeconomic uncertainty through a structural channel whereby export concentration leads to terms-of-trade volatility, which is then manifested as volatility of the growth of income or consumption per capita. This hypothesis is consistent with the well known literature on the Dutch Disease, whereby natural resource discoveries (booms) are associated with general equilibrium effects (price and income effects) that reduce the size of the tradable sector, which has traditionally been associated with a process of deindustrialization (see, e.g., Corden 1984). (2) Commodity dependence is associated with institutional weaknesses that make governments incapable of managing external volatility, and thus commodity-dependent economies can experience a pronounced transmission of terms-of-trade volatility into income and consumption volatility. This hypothesis is consistent with the so-called “voracity effect” created by natural-resource windfalls, which has been associated with the worsening of public institutions (Lane and Tornell 1999).

A first pass at the data is not conclusive, especially for the sample of Latin American and Caribbean economies. Table 8.1 contains the necessary descriptive statistics. It shows volatility indicators, namely the standard deviation of the annual growth of each variable during 1980-2005, of average external prices (export, import and terms of trade indexes, which are weighted averages of unit values of exports and imports). It also contains volatility indicators for real (PPP adjusted) GDP and consumption per capita, as well as for various potential covariates of macroeconomic volatility, including trade openness, financial development, and rule of law (as a proxy of the quality of public institutions) at the beginning of the period under study, 1980-2005.

Table 8.1. Natural Resources, Macroeconomic Volatility and Trade Concentration, 1980-2005

<table>
<thead>
<tr>
<th></th>
<th>Global Sample</th>
<th>Latin America and Caribbean (LAC)</th>
<th>Latin American and Caribbean Net Exporters of Energy and Mining</th>
<th>Other Net Exporters of Energy and Mining</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obs.</td>
<td>Mean</td>
<td>Obs.</td>
<td>Mean</td>
</tr>
<tr>
<td><strong>Volatility Indicators</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Export price index</td>
<td>139</td>
<td>0.132</td>
<td>19</td>
<td>0.133</td>
</tr>
<tr>
<td>Import price index</td>
<td>139</td>
<td>0.113</td>
<td>19</td>
<td>0.112</td>
</tr>
<tr>
<td>Terms of trade</td>
<td>139</td>
<td>0.091</td>
<td>19</td>
<td>0.094</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>155</td>
<td>0.059</td>
<td>21</td>
<td>0.043</td>
</tr>
<tr>
<td><strong>Other Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>0.375</td>
<td>21</td>
<td>0.091</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------</td>
<td>-------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>Net exports of mining per worker</td>
<td>151</td>
<td>0.087</td>
<td>22</td>
<td>0.172</td>
</tr>
<tr>
<td>Export concentration</td>
<td>153</td>
<td>0.321</td>
<td>22</td>
<td>0.313</td>
</tr>
<tr>
<td>Import concentration</td>
<td>155</td>
<td>0.137</td>
<td>22</td>
<td>0.128</td>
</tr>
<tr>
<td>Trade over GDP in 1980</td>
<td>109</td>
<td>63.634</td>
<td>20</td>
<td>52.066</td>
</tr>
<tr>
<td>Private credit over GDP in 1980</td>
<td>107</td>
<td>30.979</td>
<td>21</td>
<td>27.528</td>
</tr>
<tr>
<td>Rule of law index in 1982-84</td>
<td>118</td>
<td>3.072</td>
<td>22</td>
<td>2.359</td>
</tr>
</tbody>
</table>

Source: Lederman and Xu (2010).

The first three columns contain the data from the global sample, followed by the data from Latin America and the Caribbean (LAC). The last six columns show the corresponding statistics for the sample of LAC and non-LAC net exporters of mining and energy commodities. It turns out that all LAC net exporters of mining and energy were also net exporters of agricultural commodities during 1980-2005.

The data does not support the view that LAC or LAC exporters of natural resources suffered from unusually high external volatility. In contrast, non-LAC net exporters of mining and energy did in fact face higher export and import-price volatility than the global and LAC samples. This group of countries also had export structures that were significantly more concentrated. Partly because the descriptive statistics are inconclusive, it is necessary to assess the validity of the hypotheses linking natural-resource dependence and volatility with multivariate econometric estimations.

Figure 8.2 illustrates the relationship between merchandise export-revenue concentration and terms of trade volatility. The positive correlation between these variables appears to be strong, although it does not hold in the previous comparison between LAC net exporters of energy and mining and the overall sample of countries from the region.
The econometric evidence provided by Lederman and Xu (2010) from a cross-section of countries with data from 1980-2005 suggests that the structural hypothesis is valid, but not necessarily the macroeconomic mismanagement hypothesis, even though the test for the former entails multiple estimations and the latter can be estimated in a single model. To the extent that this evidence can be interpreted as causal relationships, the main policy challenge for commodity dependent economies seems to be related to industrial policies that may be able to stimulate export diversification but not traditional industrial policies focused on specific sectors or products. In contrast, the fiscal and monetary policy management required to ameliorate the transmission of external terms-of-trade volatility are better known, and the evidence suggests that the curse does not systematically operate through this channel, because the pass-through of external terms of trade volatility into GDP growth volatility does not rise with the level of net exports of natural resource or energy and mining products. The following paragraphs discuss relevant econometric estimates, focusing strictly on the issue of endogeneity, although the results seem to be robust to the inclusion of a plethora of control variables, including import concentration, financial development, institutions (proxied by law and order), the ratio of trade over GDP, and even GDP per capita, among other controls.

Table 8.2 presents econometric estimates provided by Lederman and Xu (2010), which simultaneously explore the determinants of merchandise export-revenue concentration, terms of trade volatility, and GDP-per-capita growth volatility. The model of export concentration suggests that it is positively correlated with net exports of energy
and mining commodities, but negatively correlated with net exports of agricultural products. In addition, concentration appears to fall with the size of a country’s labor force and its level of development (as in Acemoglu and Zilibotti 1997). That is, poor, small and mineral-abundant economies (or that depend on mining for foreign-exchange earnings) tend to have high levels of export concentration.

Regarding the determinants of terms of trade volatility, it is noteworthy that net exports of mining have not effect after controlling for export concentration. Hence mining exports appear to have only an indirect effect on terms of trade volatility via their effect on concentration. Similarly, net exports of natural resources seem to have no direct effect on GDP-per-capita volatility.

Table 8.2. Determinants of Export Concentration and GDP Growth Volatility, 1980-2005 (3SLS estimates)

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>Export Concentration</th>
<th>Terms-of-Trade Volatility</th>
<th>GDP-per-Capita Growth Volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export concentration</td>
<td></td>
<td>0.351**</td>
<td></td>
</tr>
<tr>
<td>(0.000)</td>
<td></td>
<td>(0.000)</td>
<td></td>
</tr>
<tr>
<td>Net exports of energy and mining per worker</td>
<td>0.040**</td>
<td>0.004</td>
<td>-0.003</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.170)</td>
<td>(0.154)</td>
<td></td>
</tr>
<tr>
<td>Net exports of agriculture per worker</td>
<td>-0.036*</td>
<td>-0.000</td>
<td>-0.002</td>
</tr>
<tr>
<td>(0.022)</td>
<td>(0.941)</td>
<td>(0.456)</td>
<td></td>
</tr>
<tr>
<td>Labor force (log, initial)</td>
<td>-0.058**</td>
<td>0.015**</td>
<td>-0.005**</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td></td>
</tr>
<tr>
<td>GDP per capita (log, initial)</td>
<td>-0.065**</td>
<td>-0.002*</td>
<td></td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.030)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geographic trade over GDP</td>
<td>-0.002*</td>
<td>0.310**</td>
<td>0.257</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.000)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: ** and * represent statistical significant at the 1 and 5 percent levels. Cross-equation error correlations are assumed to be unstructured. All explanatory variables, except the dependent variables (export concentration, terms of trade volatility, and GDP-per-capita growth volatility) are assumed to be exogenous. Volatility is measured by the standard deviation of the annual growth rate of each variable during 1980-2005. The “first-stage” estimates are not reported. P-values appear inside parentheses and correspond to standard errors adjusted for degrees of freedom due to finite-sample assumptions. “Initial” means that the observation is from 1980; the results correspond to cross-sectional estimates for 1980-2005. Intercepts are not reported.  
Source: Lederman and Xu (2010).

Notwithstanding the evidence discussed above, readers may have doubts about the direction of causality in the empirical analysis. Hence it is worthwhile to think more carefully about these issues, especially regarding the policy implications that could be derived from the potential effect of macroeconomic volatility on the structure of trade.
Volatility as a Determinant of Export Structure and Financial Development

An extension of the neoclassical framework that also considers the composition of trade as an endogenous outcome allows for other country characteristics, besides factor endowments, to affect the composition of trade. Lederman and Xu (2007), for example, provided evidence showing that the structure of the trade balance (i.e., net exports by types of goods) is affected by institutional features, infrastructure, the level of innovation, and even macroeconomic volatility, even when natural resources, physical and human capital also play a role.

A long literature has studied the impact of exchange rate volatility and exchange rate regimes on trade flows (Clark et al. 2004). The initial motivation behind this literature was the idea that, in absence of access to hedging mechanisms, risk-averse exporters would be adversely affected by currency risk and exports would be reduced (Clark (1973)). This simple mechanism rests on a series of assumptions and has been challenged both theoretically and empirically. Overall, the current consensus seems to be that there is at most a weak negative effect of exchange rate volatility on aggregate trade flows.

The emphasis that the literature has put on the volume of trade has overlooked the impact of exchange rate volatility on the composition of trade. There are several reasons, both theoretical and empirical, to believe that the structure of trade may be significantly affected by changes in the level of currency risk. On the theoretical side, various models emphasize that exchange rate volatility may have differential effects across firms depending on their ability to hedge the currency risk. For instance, Clark (1973) highlights the importance of the use of imported inputs as a natural hedge against fluctuations on the exchange rate. More recent papers also discuss the role of currency derivatives in reducing exposure to exchange rate risk (Wei (1999)). Other recent papers, such as Caballero and Lorenzoni (2007) emphasize the degree of financial constraints as a determinant of a firm's ability to survive persistent fluctuations in the exchange rate.

Empirically, Broda and Romalis (2003) and Clark et al. (2004) show that firms producing homogeneous goods tend to be relatively less affected by exchange rate volatility than firms producing differentiated products. This paper studies the impact of exchange rate volatility on the structure of trade. It starts from the simple premise that exchange rate volatility should affect relatively more those firms and industries with less ability to hedge this risk, and it focuses on a specific aspect of industry heterogeneity that has not been directly addressed in the existing literature: the natural hedge against exchange rate fluctuations provided by the correlation of a good's price with a country's nominal exchange rate. Intuitively, firms exporting goods whose international price commoves negatively with the home country's nominal exchange rate are naturally protected against exchange rate risk and, therefore, if this risk matters they should be relatively less affected by exchange rate volatility. The possibility that this natural hedge offers some protection to firms is supported by existing evidence that firms whose income is positively correlated with the exchange rate, such as those in more tradable
sectors, have a higher fraction of foreign-currency denominated liabilities (Bleakley and Cowan 2008). If this mechanism is empirically relevant, the structure of trade should naturally shift towards industries producing goods that offer a natural hedge against exchange rate fluctuations in countries with high exchange rate volatility.

Raddatz (2009) formally tested this hypothesis using data on the composition of exports of 106 countries across 752 commodities during 1984-2000, and the correlation of these commodities global unit values and each of these countries nominal exchange rates. The idea that the price of some goods may be correlated with fluctuations in the nominal exchange rate has been has present in the recent literature on commodity currencies (Cashin et al. 2004, Chen and Rogoff 2003), which are currencies whose value fluctuates with the average price of the commodities exported by the country. Typical examples of commodity currencies are New Zealand and Australia. Because of this correlation, the price in local currency of these commodities and of any other sector whose price is correlated with them will be stable relative to other products. 2

The importance of the natural hedging mechanism emphasized in this paper as a source of comparative advantage will likely depend on the availability of other forms of hedging. For this reason, the paper controls for the availability of currency derivatives to assess the quantitative importance of the mechanism we emphasize. Moreover, in as much income uncertainty will impact financially constrained firms the most, we would expect that un-hedged exchange rate uncertainty will have a larger effects in countries with underdeveloped financial systems.

The results from Raddatz (2009) indicate that the natural hedge against exchange rate volatility provided by a negative correlation between a commodity's international price and a country's nominal exchange rate matters for that country's export patterns, even after controlling for other standard determinants of export composition, such as the factor endowments and the export patterns of countries with similar income levels.

The quantitative implications of the results in Raddatz (2009) is that a standard deviation increase in exchange rate volatility, corresponding to 60 percentage points, would lead to an increase of ten percentage points in the within-country export share of a commodity at the 25th percentile of correlation relative to that of a commodity at the 75th percentile of correlation. This difference is about 15 percent of the typical difference in shares across commodities. The mechanism is even stronger to explain differences in the share of global exports of a given commodity captured by a country. In this case, a similar increase in volatility would result in a relative increase of two percentage points in favor of the sector with a strong negative correlation, which corresponds to ten percent of the typical growth difference between sectors at the 25th and 75th percentile of export growth shares. Moreover, these growth differences translate into large share differentials in steady state, resulting in an interquartile relative share increase of 40 percent. Similar results are obtained when comparing the role of natural hedging across exchange rate regimes instead of using an ex-post measure of exchange rate volatility.
A commodity's natural hedge is related to its importance in a country's commodity basket mainly under flexible exchange rate regimes. A series of robustness tests show that these results are not crucially driven by specific measures, countries, or commodities. Digging deeper into the drivers of the main result, additional evidence discussed in Raddatz (2009) suggests that a commodity's natural hedge has a discontinuous impact on its export share. A commodity whose price exhibits a small negative or positive correlation with a country's nominal exchange rate is only marginally favored or affected in terms of its weight on the country's exports basket, but the relevance of natural hedge increases more than proportionally for commodities with large correlations. Having a large negative or positive price correlation confers an important competitive advantage or disadvantage, respectively.

The results also show that the importance of a natural hedge against exchange rate fluctuations is inversely related to the availability of formal hedging instruments. Perhaps more importantly, a well developed market for foreign exchange rate derivatives associated to a given country's currency weakens the relation between a commodity's price's correlation with the country's exchange rate and its importance on the country's export basket in high exchange rate volatility environments. Broader measures of the development of financial markets do not seem to have such an effect on the importance of natural hedge for export composition, suggesting that the relevant dimension of financial development for this mechanism is the widespread availability of exchange rate derivatives.

From a policy perspective, the findings by Raddatz (2009) remind us of the endogeneity of the composition of exports, and show that it is affected by factors beyond standard relative factor abundance and that are related to the ability of firm's to cope with the risks associated with exporting. If in fact what you export matters, as conjectured by Hausmann et al. (2007), addressing some of these financial market imperfections may be a better way to move towards a first best export composition than engaging in industrial policy. In particular, the development of exchange rate derivatives plays an important role in weakening the relation between a sector's natural hedge and export composition.

Nonetheless, in the spirit of giving IP a chance, we now focus on the possibility of flawless IP succeeding in picking winning export products.

**The Distribution of Manufactured Exports**

Easterly, Resheff and Schwenkenberg (2009) show that manufacturing export success shows a remarkable degree of specialization for virtually all countries. Manufacturing exports in each country are dominated by a few “big hits”, which account for most of export value and where the “hit” includes both finding the right product and finding the right market. The specificity and description of the “hits” are far from intuitive. Out of 2985 possible products and 217 possible destinations, Egypt gets 23 percent of its total manufacturing exports from exporting one product -- “Ceramic bathroom kitchen sanitary items not porcelain” -- to one destination -- Italy, capturing 94 percent of the Italian import market for that product. Fiji sends “Womens, girls suits, of cotton, not knit” to the US (14 percent of Fiji manufacturing exports, 42 percent of US
imports of that product). The Philippines get 10 percent of their manufacturing exports from sending “Electronic integrated circuits/microassemblies, nes” to the US (80 percent of US imports of that product). Nigeria earns 10 percent of its manufacturing exports from shipping “Floating docks, special function vessels nes” to Norway, making up 84 percent of Norwegian imports of that product.

Examining the top pairs of what one would think would be fairly similar countries reveal a surprising diversity of products and destinations. Why does Colombia export paint pigment to the US, but Costa Rica exports data processing equipment, and Peru exports T-shirts? Why does Guatemala export candles to the US, but El Salvador exports toilet and kitchen linens? Why does Honduras export soap to El Salvador, while Nicaragua exports bathroom porcelain to Costa Rica? Why does Cote d’Ivoire export perfume to Ghana, while Ghana exports plastic tables and kitchen ware to Togo? Why does Uganda export electro-diagnostic apparatus to India, while Malawi exports small motorcycle engines to Japan? The remarkable specialization across products and destinations shows up in high concentration ratios. The top 1 percent of product-destination pairs account for an average of 52 percent of manufacturing export value for 151 countries on which we have data.1

The difference between successful and unsuccessful exporters is found not in the degree of specialization, but in the scale of the “big hits.” For example, a significant part of South Korea’s greater success than Tanzania as a manufacturing exporter is exemplified by South Korea earning $13 billion from its top 3 manufacturing exports, while Tanzania earned only $4 million from its top 3. The bad news is that the probability of finding a big hit ex ante decreases exponentially with the magnitude of the hit. We show that the upper part of the distribution of export value across products (defined both by destination and by six-digit industry classifications) is close to following a power law. On average across our sample, the value of the 10th ranked good-destination export category is only one tenth of the top ranked good-destination export category (the corresponding median is lower – one fourth – because of the skewness of this number in our sample). The value of top ranked good-destination export category is on average 770 times (median 34 times) larger than the 100th ranked good-destination export category. In this paper we will estimate just how much the entire distribution of export values within each country is explained by a power law, and will place it in context of a trade model with demand and productivity shocks.

Now, suppose that without government failures old-style IP succeeds in pre-selecting the big hits. Given the strong stylized facts discussed above, would this policy also succeed in diversifying the export portfolio of a small, under-developed economy with abundant natural resources? As far as we know, there is not existing evidence or theoretical framework that could help us understand how the emergence of one big hit affects other existing exports and the prices of their required factors of production. The following chapter returns to the policy challenges and tradeoffs that perhaps should be kept in mind in the pursuit of pro-diversification policies.
8. Conclusion and Policy Reflections

Does what you export matter? Our answer can be broken down into several parts although our bottom line is that “How you export matters more.”

First, what you export probably does matter. Externalities and rents exist and there is no reason to believe that they are associated with all goods equally. In the former case, there is clearly an argument for interventions to encourage such more than the market would naturally do.

Second, the literature still offers us no confident policy guidance on what those goods might be. Measurement of externalities is notoriously difficult and this report has argued that the shortcuts offered to get around this measurement issue - showing that goods thought *a priori* to have externalities positively affect growth-, have proven weak reeds for policy makers to lean on. The advice to stay out of natural resource industries, and get into high tech industries, those which rich countries already produce, or those offering potential to enter new industries, either does not prove robust empirically or, where no empirical test is offered, raises substantial conceptual concerns. Perhaps the market is missing good opportunities, but it is not clear, at this point that government can see them any more clearly.

Third, the policy debate needs to focus far more on the vast heterogeneity of experiences within any given sector. While the report has shown that there is no robust evidence of a resource curse, there definitely are countries which appear to have suffered as a result of having resources as well as tremendous success stories. The production technologies used to produce a good, and the “knowledge intensity” of that process can vary greatly across countries. The returns to skilled labor vary as much across countries as across goods. The range of quality within much disaggregated categories of goods is so large that some have argued that understanding the allocation of quality across countries is more germane than that of goods. Finally, in a very fragmented global production system, identical goods on the export registers can mask different stages of the production process undertaken in each country. Some countries invent cutting edge computers, some merely assemble them and these are distinct tasks with, in all likelihood, different potential for externalities.

The lack of robust empirical indicators to help select products for special treatment and the overwhelming evidence of heterogeneity within goods should shift the debate to understanding how countries can produce whatever it is they produce in ways that more effectively drive development. More generally, the process of moving toward frontier productivity, quality, or tasks can be viewed through the standard convergence puzzle: why, given the global stock of knowhow, do not developing countries more rapidly catch up? This leads us almost immediately back the underlying factor endowments of a country very broadly construed. Asking why some countries produce only low quality wine is as likely to be asking about the quality of winemakers, their use of modern technologies, and the availability of suitable infrastructure in that country as the *terroire*. Asking why one country produces ten times more patents per exported
computer than another is a question about the quality of the scientific human capital and the functioning of the national innovation system.

Fourth, diversification, to a point, does appear important to reducing the negative externality posed by terms of trade volatility. But here again, the extraordinary concentration of exports in a few product-destination pairs suggests that picking a basket of goods with particular co-variances among them is likely also to be difficult. Providing a fertile business environment where new industries can establish roots is likely to be the best bet.

Both conclusions imply an important role for government, even if not for picking goods or tasks. Market failures abound in the provision of infrastructure, the accumulation of human capital, in the establishment of trade networks, and the creation and management of ideas. Appropriation externalities in the discovery process, and in the adaptation of new processes and technologies to existing industries are well documented. All these, suggest “horizontalish” policies that seek to raise the overall ability of a country to increase productivity, quality or move to more sophisticated tasks. We use this term because, even though no attempt is made to target sectors, industries benefit differentially from the general provision of any factor. Resolving coordination failures within existing industries also requires government intervention. In sum, we would argue that what can be more confidently argued is that how you export matters is central that this, rather than what, should be the focus of policy makers.
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