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Export Structure and Growth
A Detailed Analysis for Argentina*

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Abstract

This paper examines recent changes in the structure of Argentine exports and the implications for future growth. We find that the current export structure of Argentina is not conducive to future growth because it is dominated by "low-productivity" goods that tend to be exported by low-income countries. The productivity content of Argentine exports has increased recently although, as of 2004, these changes have been relatively minor. We identify products with characteristics similar to those currently exported by Argentina and which are more likely to foster growth because they would shift the structure of exports more the "efficiency frontier". Those products include chemicals and primary products with some degree of value added, including partly processed meat, fish and grains. If economic growth is to be fostered by developing new export products and by increasing the value added of existing exports, there will be a need for sector-specific analysis to address possible market failures. The analysis should focus on issues such as the provision of public goods needed for production (including infrastructure, but also complex intangibles such as sector-specific legislation), possible impediments to effective coordination, sector-specific and economy wide externalities, or barriers to information. This last source of potential market failure is critical to a successful policy framework for exports and growth.

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I. Introduction and Summary of Conclusions

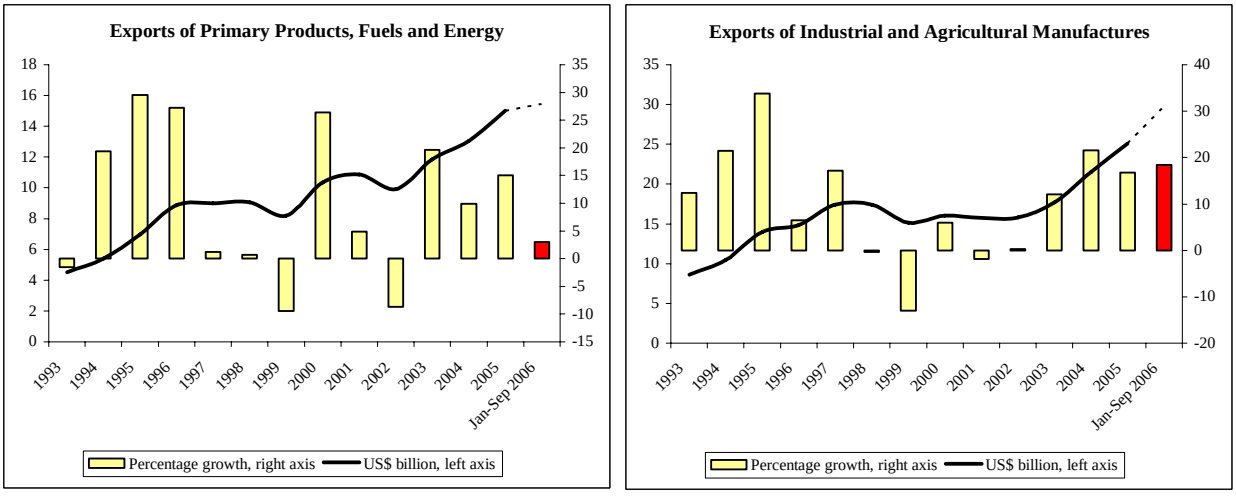
In recent years, the performance of Argentine exports has been particularly strong. Argentina has benefited from positive terms of trade shocks in some sectors but higher export volumes have been the most important source of export growth (Figure 1). In 2005, merchandise exports reached about US$40 billion, which is more than 50 percent above the peak prior to 2002. This trend continued in 2006: as of September exports of goods had grown by 12.3 percent.

Figure 1

2006 export values are based on January-September annual exports growth.
Source: Ministry of Economy and production, Argentina, and International Financial Statistics.

The improvement in export performance was accompanied by a drastic change in relative prices following upon the currency devaluation in 2002 which has significantly improved the competitiveness of Argentine exports overall. Aggregate export statistics show that the momentum of export performance has been sustained by manufactured goods which led exports growth in 2006 (Figure 2).

Figure 2
Evolution of Exports by Sector



2006 export values are based on January-September annual exports growth.
Source: Ministry of Economy and production, Argentina.

Looking beyond aggregate trends, this paper examines changes in the structure of Argentine exports, and their potential impact on future growth. To that end, we apply the conceptual

framework developed in Hausmann and Rodrik (2003) and Hausmann, Hwang and Rodrik (2006) (HHR). They define the "productivity frontier" of a country as the optimal composite of exports that would maximize prospective future growth. Countries that fall short of the productivity frontier have two basic channels through which they can grow. First, countries can grow by producing more of the same goods they have already been producing. Second, and more interestingly, countries can improve their growth prospects by developing new products that shift them closer to their productivity frontier. The analysis of HHR reveals that, if new products have a high productivity (i.e. they tend to be produced by countries with higher levels of income per capita) then the GDP of the country producing and exporting the new product eventually converges to that of the high income countries. Econometric analysis presented in this paper and in HHR show that productivity of exports is a statistically significant explanatory variable of GDP per capita growth, after controlling for initial GDP per capita, the human capital endowment and period-specific and country-specific dummies[1].

Market forces alone may not be sufficient to shift the structure of exports towards goods of higher productivity and thereby enhance growth prospects. Here, we mention some of the reasons why market forces alone may be insufficient and cite their main advocates. One reason is that the production of new goods would in many cases require product-specific public goods that are not always available. Even worse, the main provider of those goods, be it the public or the private sector may be unaware of the need for them. Examples of such goods are product or sector specific infrastructure as well as complex non-tangibles such as product-specific legislation. Failures of coordination may also prevent a new high-income product from developing (Morris and Shin 2000). Product-specific services and labor or managerial skills may never develop if there is no demand for them in the economy. At the same time a lack of those same product-specific services, labor and managerial skills may forestall the development of new products that depend upon them. The need for industry-specific learning (Arrow 1962, Bradhan 1970) may make it difficult to become a producer of new goods. Industry externalities (Jaffe, Trajtenberg and Henderson 1993) can make the introduction of new products path-dependent, possibly causing other failures of coordination. In other cases, a country may be "stuck" in a low-value-added equilibrium (Murphy, Schleiffer and Vishny 1989). Some analysts have cited the so-called o-ring effect whereby a small failure in the complex succession of processes needed to produce and export a new good successfully, might cause the whole process to fail (Kremer 1993 and Kremer and Maskin 1994). "Cost discovery" -- the learning process by which an entrepreneur discovers from experience the true cost of producing a new product -- may deter private sector investment in the development of new products (Hausmann and Rodrik 2003). Moreover, static comparative advantages might not necessarily bring about the best results in terms of growth performance. For example, spillovers in learning can make international trade of a less-developed country to be detrimental to growth (Young 1991). Furthermore, low-growth traps can result from static comparative advantages in sectors subject to lower endogenous growth rates (Matsuyama 1991).

In the present paper, we quantify several indicators proposed in HHR to measure the level of income or productivity embedded in Argentine exports and then we compare them with actual GDP per capita. According to the HHR empirical analysis, countries with a high level of export productivity relative to their actual GDP tend to have higher growth rates. In other words, the income content of exports tends to be a good predictor of future growth. If the structure of Argentine exports is changing towards goods of higher productivity (either by exporting more of the

[1] The results are robust to various estimation techniques and the inclusion of other variables as discussed in the last section of the paper.

relatively higher productivity goods already being exported or by exporting new high productivity goods) then, according to HHR, one could expect an increase in future economic growth.

In addition, we compute indicators ("distance" in HHR terminology) which measure the likelihood that new export products emerge. We apply the HHR analysis to Argentina and, for each product in the Argentine export basket, we measure the likelihood that new export products will appear given the density of the product space in which they are located. Thereby, we can identify goods currently exported by Argentina that can potentially develop into new products. Finally, in the last section we include an econometric analysis using cross country data aiming at testing the possible effect of export income on economic growth.

A detailed analysis of the structure of exports (4-digit, 1241 products) points to the following general conclusions:

- Exports in Argentina are highly concentrated. In 2004, the top ten products accounted for 57 percent of total exports and the top twenty accounted for 72 percent. Concentration has been increasing in recent years.
- As of 2004, the income content of Argentine exports was roughly the same as per capita GDP in PPP terms. According to the HHR analysis, this might suggest low expectations about future growth.
- However, the trend in the period 1994-2004 shows an improvement in growth prospects as can be inferred from the relation between the income content of exports and GDP per capita.
- Argentine exports include several high income industrial products, especially in such product groups as motor vehicles, chemicals, metals and pipes. However, high income exports are not limited to industrial products. They also include less-processed products and also primary products such as wheat, malt extract, frozen and filleted fish, and diary products, among others.
- About half of the "new" export products, that is, products that have shown the highest growth in export value in 2004 compared to the average level in 1994-1999, have a high income rating. Most of these high-income "new" products are complex industrial manufactured goods. However, the "new" products still represent a minor proportion of total exports. The 50 products with the highest growth rate in 2004 relative to the average of 1994-1999 represent only 1.2 percent of total exports.
- On average, the chances of developing new export products (measured by distance) improved slightly from 1994-2004. A decreasing trend during the first part of the period gave way to an increasing trend since 2000.
- Moreover, the average "distance" has been reduced for both high and low income export products (defined as upscale and downscale products respectively in HHR) through the 1994-2004 period.
- On the other hand, the average product income (ranked by the total value of the product exported) for upscale products has increased while that for the downscale products has decreased. Hence the range of ranked product income was wider in 2004 compared to 1994. In other words, there are more upscale goods with higher product income but also more downscale goods with lower product income.

- With respect to exports by sector, average product income has increased in most sectors while average "distance" has declined through 1994-2004. According to HHR, that suggests that the prospects for future growth have improved on average for most sectors in the economy.
- Given the current structure of Argentine exports, the products which have the best prospects in terms of their income content and the prospective costs of developing new products with similar characteristics include chemical products and primary products with some degree of value added, including partly processed meat, fish and grains.
- A variety of chemical products, some machinery and tools (printing machinery, auto parts, drawing machines, specialized tools) and optical goods (lenses, micro-optical) appear to have good prospects in terms of generating growth in the future given their high income content. Efforts should focus on removing obstacles that constrain their production. However, it seems less likely that these goods will lead to new products with similar characteristics.
- Primary products and minerals with little or no processing offer less promising growth prospects given their low income content. However, they may lead to new export products that have similar requirements with respect to physical and human capital, sector-specific financial facilities, institutional or regulatory requirements, infrastructure, supply chain characteristics and customer service etc.

II. Data

The dataset used in this paper is drawn from two different sources. The first one, used for most part of the analysis, is drawn from the Harmonized System (HS) of the United Nations Commodity Trade Statistics Database (COMTRADE) obtained through the WITS platform. Under the HS classification there are 1241 products at the 4-digit level and 97 sectors at the 2-digit level. For purposes of consistency the analysis was confined to countries that reported information for every year between 1994 and 2004[2] and for which data on GDP per capita were available from the World Development Indicators. This left us with 73 countries representing around 50 percent of total trade. For Argentina, the export value in the sample accounts for about 99.9 percent of total exports in every year.

The second dataset, used only for the econometric analysis, is drawn from the World Trade Flows dataset (Feenstra et al. 2005). This dataset comprises country-level trade flows under the 4-digit Standard International Trade Classification (SITC rev. 2) for the period 1962-2000. In this case as well, we restricted the sample to 91 countries that had information for every year between 1962 and 2000.

Given these restrictions on the samples, some of the calculations presented here may differ slightly from others which cover all countries. However, the difference is minor and a consistent sample of countries for every year avoids errors that may result from differences in country reporting from year to year. Most importantly, we avoid biases resulting from the fact that non-reporting countries are more likely to be low income countries. That same fact might possibly lead us to over-estimate the indices we present here, but it would not affect changes over time.

[2] 2004 is the most recent year available for most countries.

The sample used in the first part of this paper differs from the one used in Hausmann and Kingler (2006). They use a longer sample drawn from Feenstra et al (2005) for the first part of the period (1975-2000) and from COMTRADE for the last part (2000-2004). The two series are merged using observations from 2000 common to both series. Hence, their sample includes more countries and is scaled to match the levels in the first part of the sample, which explains some differences with our estimates.

III. Composition of Argentine Exports

We start by providing some stylized facts about the structure of Argentina's exports, both at the sector level and at the more disaggregated product level (4-digit code). Table 1 below shows the value of trade in 2004 for the 17 top 2-digits sectors, which make up 80 percent of total Argentine exports. There is a relatively high level of concentration of exports. The two top sectors alone (mineral fuels and oils and residues, and waste from the food industry) account for 27 percent of the total. When we expand the coverage to the top 5 sectors, exactly half of the value of exports has been accounted for.

Table 1
Argentina: Export Composition 2004, 2 Digit Level

Code	Sector Name	Trade Value $ '000	Share %	Cumm. Share %
27	Mineral fuels, oils & product of th	5,536,454	16.1	16.1
23	Residues & waste from the food indu	3,835,098	11.2	27.3
15	Animal/veg fats & oils & their clea	3,172,732	9.2	36.6
10	Cereals	2,688,226	7.8	44.4
87	Vehicles o/t railw/tramw roll-stock	2,047,796	6.0	50.4
12	Oil seed, oleagi fruits; miscell gr	1,833,068	5.3	55.7
02	Meat and edible meat offal	1,023,305	3.0	58.7
39	Plastics and articles thereof.	932,664	2.7	61.4
26	Ores, slag and ash.	914,096	2.7	64.1
41	Raw hides and skins (other than fu	817,447	2.4	66.4
03	Fish & crustacean, mollusc & other	787,196	2.3	68.7
84	Nuclear reactors, boilers, mchy & m	767,530	2.2	71.0
04	Dairy prod; birds' eggs; natural ho	651,486	1.9	72.9
73	Articles of iron or steel.	639,865	1.9	74.7
08	Edible fruit and nuts; peel of citr	598,931	1.7	76.5
72	Iron and steel.	571,391	1.7	78.2
29	Organic chemicals.	498,351	1.5	79.6
20	Prep of vegetable, fruit, nuts or o	443,953	1.3	80.9

Source: WITS Database-Comtrade

What is interesting about this breakdown is that, for the largest sector, mineral fuels and oils, Argentina is not a particularly large player in the world market according to 2004 data. Indeed, it only accounts for 0.8 percent of the total global exports, compared with Russia, Canada, Norway and Venezuela, each of which have on average more than 8 percent of the market. In contrast, Argentina is the world leader in some other sectors, and in many of them it constitutes the largest

exporter. For instance, Argentine exports account for more than 13 percent of total world exports in residues from the food industry, for 15 percent in animal fats and for 6 percent in cereals.

The majority of these top sectors comprise commodities and primary products, although there may be a manufacturing component in such sectors as 27, 23, 15, 10, 12, and 02 in Table 1, which together account for more than 50 percent of total exports. In fact, a significant portion of exports are derived from petroleum products, soy bean and its derivatives, cereals and bovine meat. The largest industrial manufacturing sector is vehicles, which accounts for around 6 percent of total exports, followed by plastics, with almost 3 percent of exports, and nuclear reactors and their components, with 2.2 percent of total exports.

From the more disaggregated data of Table 2, we can see that oil cake and other solid residues were the largest export of Argentina in 2004, accounting for more than 10 percent of exports with a total value of US$3.6 billion. However, it is interesting to note that this product is the only one of the top 50 export products belonging to this sector. This product by itself accounts for 93 percent of the exports within its own 2-digit category. The second and fifth products by rank are obviously closely related, although belonging to different groups. Again, the majority of export products are agricultural and commodity based, although automobiles, trucks and tubes and pipes account for 5 percent of total exports. We return to the analysis of these industrial products in a subsequent section below.

Table 2
Argentina: Export Composition 2004, 4 Digit Level

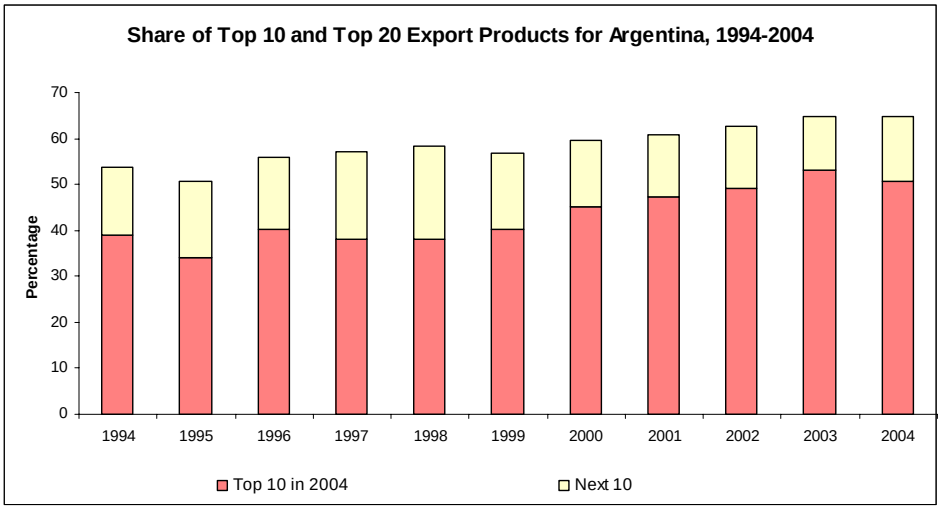
Code	Product Name	Trade Value $ '000	Share %	Cumm. Share %
2304	Oil-cake and other solid residues,	3,597,953	10.5	10.5
1507	Soya-bean oil and its fractions	2,335,749	6.8	17.3
2709	Petroleum oils and oils obtained fr	2,255,856	6.6	23.9
2710	Petroleum oils, etc, (excl. crude);	1,940,005	5.7	29.5
1201	Soya beans	1,740,114	5.1	34.6
1001	Wheat and meslin	1,365,480	4.0	38.6
1005	Maize (corn)	1,193,805	3.5	42.0
2711	Petroleum gases and other gaseous h	1,106,768	3.2	45.3
2603	Copper ores and concentrates	904,184	2.6	47.9
4104	Leather of bovine or equine animals	804,059	2.3	50.3
8703	Motor cars and other motor vehicles	676,554	2.0	52.2
8708	Parts and accessories of the motor	658,787	1.9	54.1
1512	Sunflower-seed, safflower or cotton	570,612	1.7	55.8
8704	Motor vehicles for the transport of	545,764	1.6	57.4
7304	Tubes,pipes and hollow profiles,sea	485,482	1.4	58.8
0202	Meat of bovine animals, frozen	421,734	1.2	60.0

Source: WITS Database-Comtrade

IV. Concentration Analysis

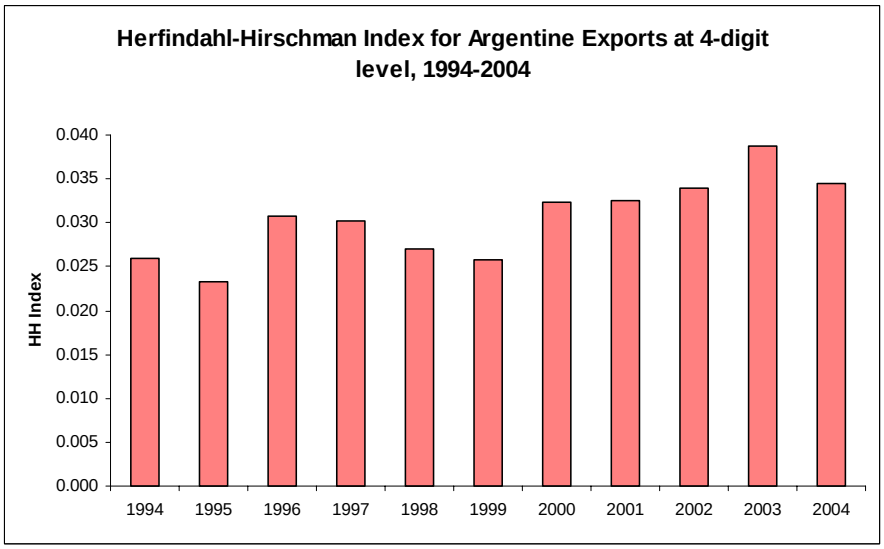
Figure 3 below presents a simple measure of concentration -- the total share of exports for the top 10 and top 20 products over a 10 year period. It can be observed that the level of concentration has been high through the period, and has increased over the last five years. In 1994 the top 10 products accounted for 39 percent of total exports while the top 20 accounted for 54 percent of total exports. In 2004, the proportions increased to 57 and 72 percent respectively.

Figure 3



In order to measure more accurately the degree of concentration of the Argentine exports, Figure 4 presents the Herfindahl-Hirschman Index (HHI) of concentration for each year between 1993 and 2004. The HHI is simply the sum of the squares of the shares of each product, and it ranges from 0 to 10,000 (if the shares are expressed as a percent) with higher values representing a higher concentration. Figure 4 presents the index for export groups at a 4 digit level. Since it covers 1241 product groups the absolute numerical scale of the index is very low.

Figure 4



Both graphs above show essentially the same pattern. Between 1994 and 1995 there was a reduction in the level of concentration, but it increased in 1996 and again in 2000. After that there was an upward trend which peaked in 2003 at the highest level in the last 11 years. Although there was a slight reduction in 2004, the HH Index was still higher than in previous years.

One reason for the increased the level of concentration during the last couple of years could be an increase in the relative importance of sectors that are themselves highly concentrated. Alternatively, the internal concentration within all categories may have increased, while the relative weights of the sectors have remained roughly constant. In order to test these alternative hypotheses, we calculate the within-sector HHI for each of the most important sectors in each of the years 1999, 2003 and 2004. The results are presented in Table 3.

Table 3

Argentina: Export Concentration by Sector

Product Code	Description	HHI 1999	HHI 2003	HHI 2004
27	Mineral fuels, oils & product of their distill	0.66	0.34	0.30
23	Residues & waste from the food indust; prepr a	0.78	0.87	0.88
15	Animal/veg fats & oils & their cleavage produc	0.38	0.53	0.52
10	Cereals	0.38	0.44	0.45
87	Vehicles o/t railw/tramw roll-stock, pts & acc	0.15	0.16	0.16
12	Oil seed, oleagi fruits; miscell grain, seed,	0.42	0.86	0.90
02	Meat and edible meat offal	0.32	0.48	0.48
39	Plastics and articles thereof.	0.04	0.06	0.07
26	Ores, slag and ash.	0.98	0.99	0.98
41	Raw hides and skins (other than furskins) and	0.48	0.42	0.42
03	Fish & crustacean, mollusc & other aquatic inv	0.19	0.26	0.21
84	Nuclear reactors, boilers, mchy & mech applian	0.03	0.03	0.03
04	Dairy prod; birds' eggs; natural honey; edible	0.33	0.32	0.36
73	Articles of iron or steel.	0.19	0.23	0.21
08	Edible fruit and nuts; peel of citrus fruit or	0.20	0.18	0.15
72	Iron and steel.	0.07	0.07	0.08
29	Organic chemicals.	0.05	0.06	0.05

The results show that the degree of concentration increased in the vast majority of sectors during 2003 and 2004 compared with 1999, when overall concentration was relatively low. The only major exception is mineral fuels, where concentration decreased significantly during the last few years. The results confirm that increased concentration within sectors account for the rise in overall concentration rather than changes in the relative shares of exports.

V. The productivity level of Argentina's Exports

Following the methodology developed in HHR, the "productivity" of each product group is defined as a weighted average of the per capita GDPs of countries that export the product. The formula is as follows:

$$PRODY_{productK} = \sum_{countriesC} \frac{(EXP_{productK,countryC}) / TotalEXP_{countryC}}{\sum_{countriesC} \left[(EXP_{productK,countryC}) / TotalEXP_{countryC} \right]} * GDPpercapita_{countryC}$$

where EXP is the value of exports in US dollars at the 4 digit level, and GDP per capita is the PPP adjusted GDP per capita expressed in 2000 constant terms for each country. Hence, the index

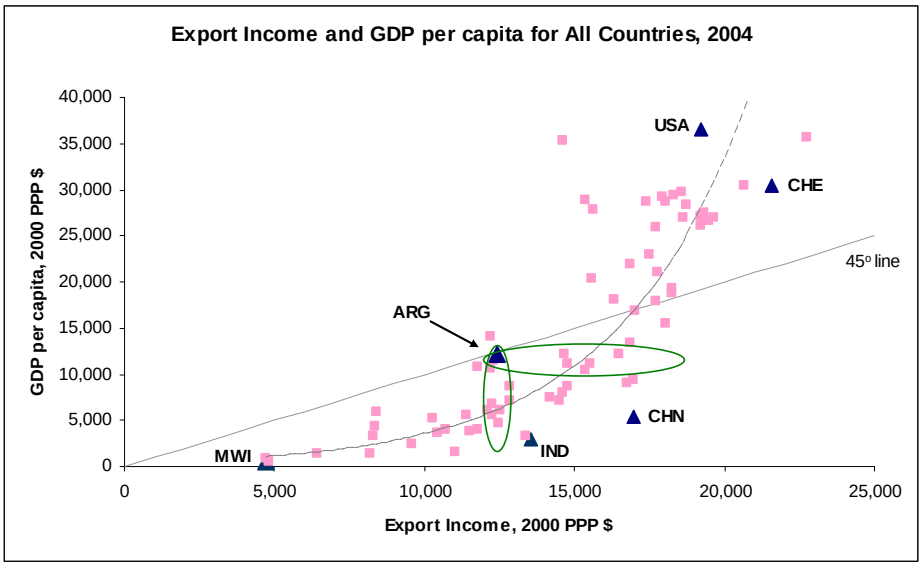
reflects a weighted average of per capita GDP where the weights reflect the "revealed comparative advantage of each country" in that particular product. Using "revealed comparative advantage" as a weight ensures that the ranking of products is not distorted by country size. The index is intended as a proxy for the level of productivity of each particular export product.

Based on these estimates, the export income for each country is calculated as a weighted average of the productivity of exports. Weights are defined as the share of each product in total exports of an individual country, as follows:

$$EXPY_{countryC} = \sum_{productsK} \left[(EXP_{productK,countryC}) / TotalEXP_{countryC} \right] * PRODY_{productK}$$

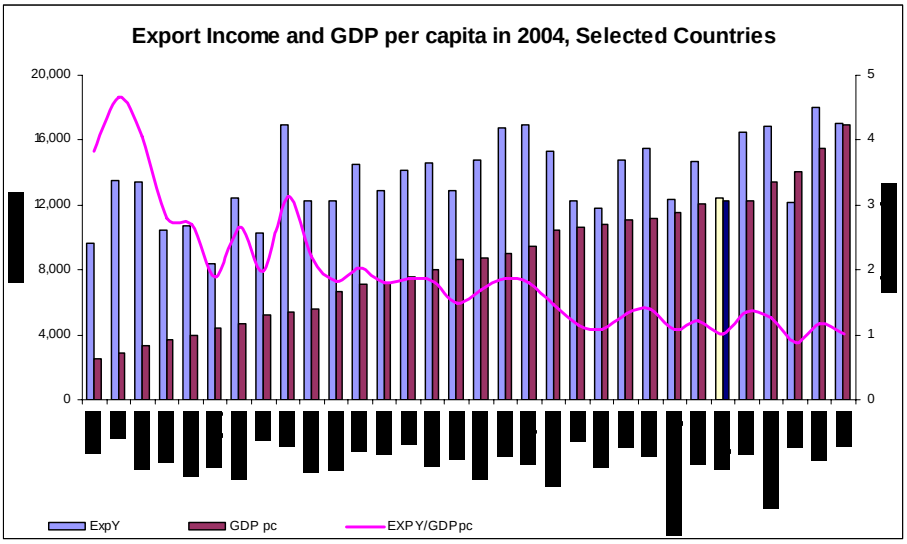
Figure 5 below shows GDP per capita and export income in 2004 for all countries in the sample. As can be observed in the graph, there is a positive and strong correlation between export income and GDP per capita. The relationship does not seem to be linear but it has a shape of half a U. Furthermore, there are some interesting and important "outliers" which support the argument that high-growth countries tend to have export incomes that are larger than their GDP per capita which, in turn, suggests that these values tend to converge over time. For example, the export income for China in 2004 was $16,967 compared to a PPP-adjusted GDP per capita of only $5,419. Similarly, in 2004 India had an export income equivalent to 4.7 times its GDP per capita ($13,550 and $2,907 respectively).

Figure 5



The export income for Argentina in 2004 was US$12,440.40 compared to a GDP per capita of US$ 12,225.00. Hence Argentina is in the group of countries which have an export income almost equal to their GDP per capita. This would indicate, following the argument of HHR, that the prospects for future growth in Argentina are not as good as some other countries. Furthermore, Argentina has an export income that is lower than that of countries with a similar level of GDP, such as Lithuania and Poland (see Figure 6 below). On the other hand, some countries that have a level of export income similar to that of Argentina have lower levels of GDP per capita. This applies to Tunisia, Colombia, Venezuela and El Salvador, among others. The conclusion would appear to be that Argentine exports are not particularly productive which, according to HHR, might imply lower growth prospects.

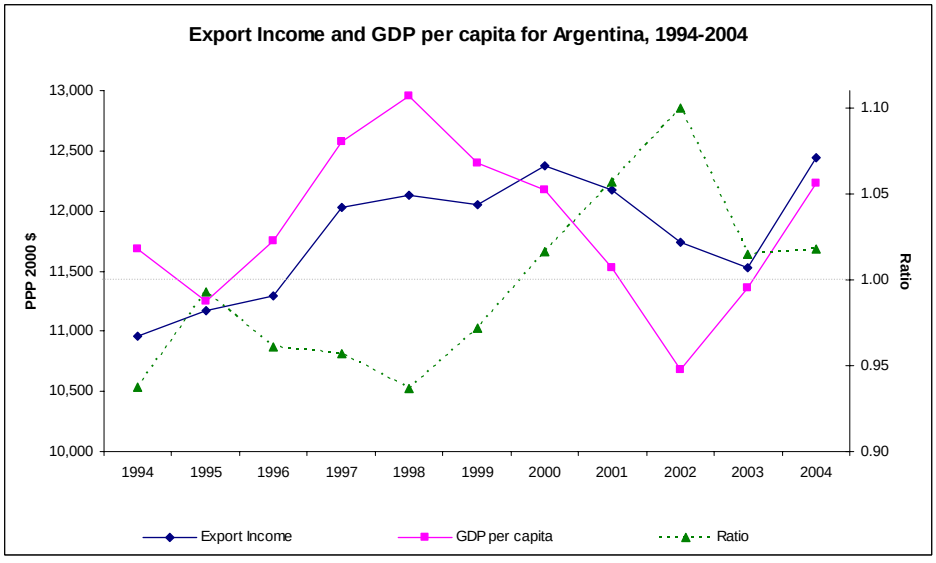
Figure 6



VI. Recent Changes in the Productivity of Argentine Exports

In this section we examine trends in Argentine export income during the last few years and analyze in more detail the productivity of the top Argentine exports. Figure 7 below plots Argentine export income, GDP per capita and their ratio for the period 1994-2004. During the 1990s the ratio was below one (i.e. export income was lower than GDP per capita) but for the last five years of the sample it was above one. Nevertheless, the main fact revealed by the graph is that Argentine export income has been very close to GDP per capita in the last 11 years. That may be undermining prospects for economic growth[3].

Figure 7



[3] As mentioned in the data section, the results presented here differ to some extent from those presented in Hausmann and Klinger (2006) due to the different samples used. However, observe that the differences are only in terms of levels and not in terms of the evolution. Moreover, the difference in levels does not affect the relative comparisons among countries since the differences are not country specific.

Next, we focus on a more detailed study of productivity by identifying the top 50 Argentine exports (Table 4) and the products that have experienced rapid growth in 2004 (Table 5). The assumption behind this analysis is that a country should be able to achieve higher export incomes either by exporting more of the high productivity products it is already exporting (and in which it is likely to have a comparative advantage), or by exporting new products in sectors that have higher productivity.

Columns 3 to 5 of Table 4 present the top 50 export products in 2004 for Argentina, their trade export value deflated at 2000 prices using the export price index, their share of total exports and their product income [4]. A number of product groups are highlighted. They represent products with a product income above the mean value for Argentina in 2004. The mean (US$16,548,) roughly corresponds to China's export income for that year and is well above the value of Argentina's export income. There are 15 products among the top 50 in this category which together account for 16 percent of total exports. The export products with the highest product income value for Argentina are unwrought aluminum, medicaments, malt extract, motor cars, parts and accessories of motor vehicles, cyclic hydrocarbons and polyethers. Together they account for 6.8 percent of total exports. Not all of the 15 high income products are from the same group; on the contrary there is one from each sector, with the exception of the products from group 87, related to the automobile industry, that together account for 5.5 percent of total exports.

[4] Distance and revealed comparative advantage (RCA), columns 6 and 7, are explained in detail in a subsequent section.

Table 4
Top 50 Exports for Argentina, 2004

Product code	Description	Export value	Exports share	Product income	Distance to export basket	RCA
		Thousands of 2000 US$	%	2000 PPP $	log (1/density)	
2304	Oil-cake and other solid residues,	3,493,158	10.60%	6,808	1.17	73.3
1507	Soya-bean oil and its fractions	2,267,717	6.88%	7,241	1.27	94.9
2709	Petroleum oils and oils obtained fr	2,190,152	6.64%	11,728	1.38	2.6
2710	Petroleum oils, etc, (excl. crude);	1,883,500	5.71%	11,940	1.51	2.5
1201	Soya beans	1,689,431	5.12%	6,378	1.04	24.4
1001	Wheat and meslin	1,325,709	4.02%	17,800	1.43	16.9
1005	Maize (corn)	1,159,034	3.52%	9,500	1.32	23.3
2711	Petroleum gases and other gaseous h	1,074,532	3.26%	12,728	1.27	2.8
2603	Copper ores and concentrates	877,849	2.66%	9,522	1.19	17.6
4104	Leather of bovine or equine animals	780,639	2.37%	10,992	1.42	11.9
8703	Motor cars and other motor vehicles	656,848	1.99%	20,342	1.87	0.3
8708	Parts and accessories of the motor	639,599	1.94%	19,283	1.86	0.7
1512	Sunflower-seed, safflower or cotton	553,993	1.68%	5,902	1.40	73.6
8704	Motor vehicles for the transport of	529,868	1.61%	18,342	1.63	1.7
7304	Tubes,pipes and hollow profiles,sea	471,342	1.43%	16,588	1.75	9.1
0202	Meat of bovine animals, frozen	409,451	1.24%	10,366	1.09	13.0
0201	Meat of bovine animals, fresh or ch	390,197	1.18%	11,002	1.40	8.0
0402	Milk and cream, concentrated or swe	383,984	1.16%	16,192	1.42	9.7
3004	Medicaments of mixed or unmixed pro	286,259	0.87%	22,396	1.78	0.4
3901	Polymers of ethylene, in primary fo	283,937	0.86%	16,372	1.52	2.9
3808	Insecticides, rodenticides... and s	283,841	0.86%	12,792	1.52	4.6
0304	Fish fillets and other fish meat, f	283,346	0.86%	17,852	1.38	7.5
7601	Unwrought aluminium	278,566	0.85%	22,980	1.41	2.6
0808	Apples, pears and quinces, fresh	236,939	0.72%	11,810	1.36	11.4
2204	Wine of fresh grapes, (incl. fortif	220,211	0.67%	8,722	1.39	2.5
0306	Crustaceans,fresh,chilled or frozen	211,458	0.64%	5,561	1.34	5.2
0805	Citrus fruit, fresh or dried	206,112	0.63%	13,357	1.31	7.2
1602	Other prepared or preserved meat, m	194,182	0.59%	16,472	1.39	7.8
2401	Unmanufactured tobacco; tobacco ref	178,762	0.54%	2,349	1.36	7.4
2009	Fruit juices (incl. grape must) and	176,590	0.54%	10,646	1.36	6.0
7210	Flat-rolled products of iron/non-al	166,921	0.51%	10,876	1.54	1.7
9401	Seats whether or not convertible in	138,063	0.42%	15,616	1.78	0.9
7108	Gold(platinum plated)unwrought,semi	135,417	0.41%	5,102	1.23	1.1
4703	Chemical wood pulp, soda or sulphat	133,279	0.40%	17,321	1.39	1.9
0303	Fish, frozen, (excl. those of 03.04	129,919	0.39%	17,851	1.43	3.6
2902	Cyclic hydrocarbons	126,708	0.38%	19,388	1.57	1.3
3907	Polyethers and epoxide resins; poly	123,855	0.38%	19,970	1.71	1.1
7209	Flat-rolled products of iron/non-al	123,172	0.37%	11,360	1.53	2.5
4011	New pneumatic tyres, of rubber	122,535	0.37%	15,163	1.68	0.8
0409	Natural honey	117,026	0.35%	9,870	1.47	33.8
1901	Malt extract; food preparations of	115,984	0.35%	20,808	1.54	4.3
2008	Fruit, nuts and other parts of plan	111,473	0.34%	12,471	1.44	5.2
1517	Margarine; edible preparations of a	111,155	0.34%	6,706	1.49	12.5
5105	Wool and fine or coarse animal hair	107,983	0.33%	10,292	1.40	14.8
0307	Molluscs & aquatic invertebrates,ne	105,602	0.32%	10,625	1.42	5.2
8409	Accessory parts suitable for engine	105,164	0.32%	18,364	1.89	0.6
0703	Onions, shallots, garlic, leeks...e	98,575	0.30%	10,652	1.36	10.0
2716	Electrical energy	94,784	0.29%	16,424	1.58	1.3
2905	Acyclic alcohols and their halogena	91,919	0.28%	13,157	1.48	1.8
3307	Shaving preparations, personal deod	84,953	0.26%	17,709	1.58	3.1

Source: Author's calculations based on WITS-Comtrade database

Figures 8 and 9 below show real exports and product income for the top 10 exports. The general trend is upwards especially after the year 2000. Product income seems to be increasing for some products and is somewhat flat for others. Notice that, as shown in Figure 9, there is only one product with product income higher than the 2004 mean throughout the period; all others have product income smaller than the Argentine export income.

Figure 8

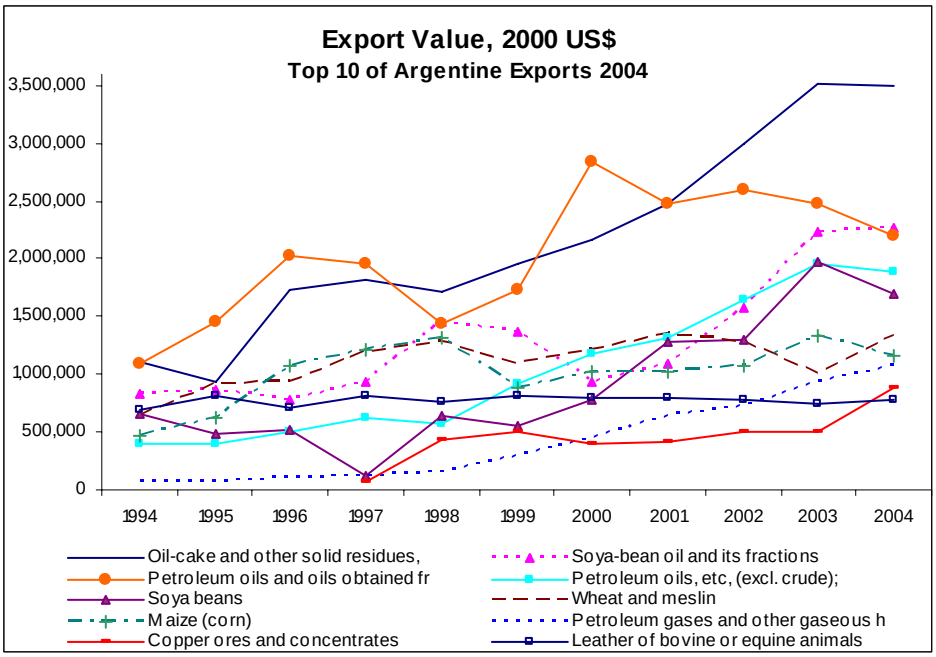
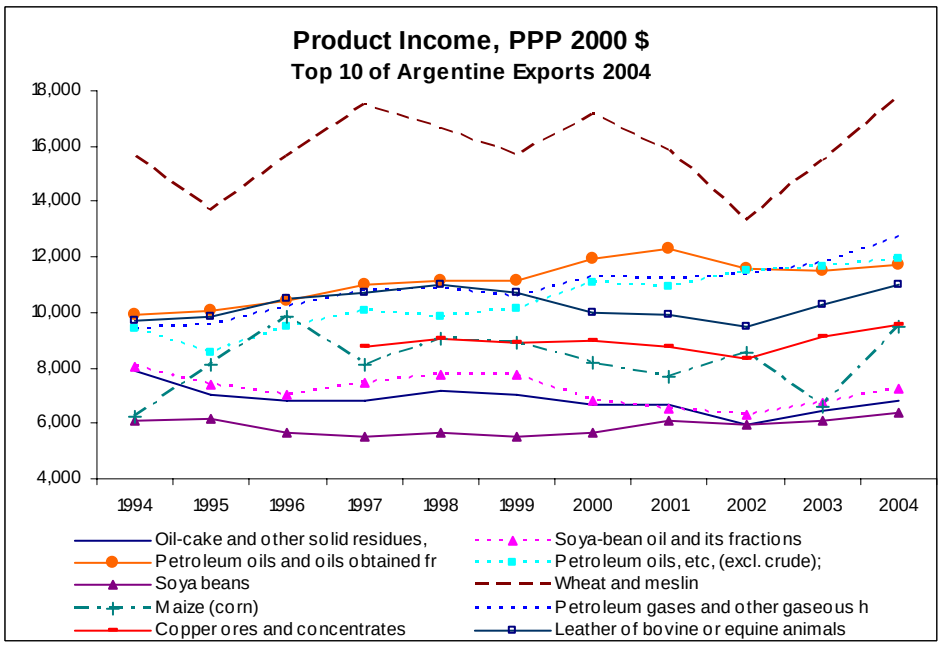


Figure 9



In the following figures we show the performance of high-productivity goods among the top 125 Argentine exports, which account for 20.88 percent of total exports, in terms of their trade value, their export share, their product income and "distance". The first graphs in figures 10 to 12, show high-productivity products from the top 25 Argentine exports. The second graphs show high-productivity products from the top 50 that were not already included in the previous graph.

Subsequent graphs follow a similar sequence. In Figure 10 one can observe that the real export value of high productivity goods grows steadily over the period with few exceptions. Also, looking at Figure 11, one observes that the shares of the products have tended to converge in each graph except for the top 25 products. That indicates that, none of the most high-productivity products, are increasing as a share of total exports. In terms of product income, depicted in Figure 12, there has been an increasing trend with very few exceptions.

Figure 10

Top Argentine Exports: High Productivity Products, Export Value 2000 US$

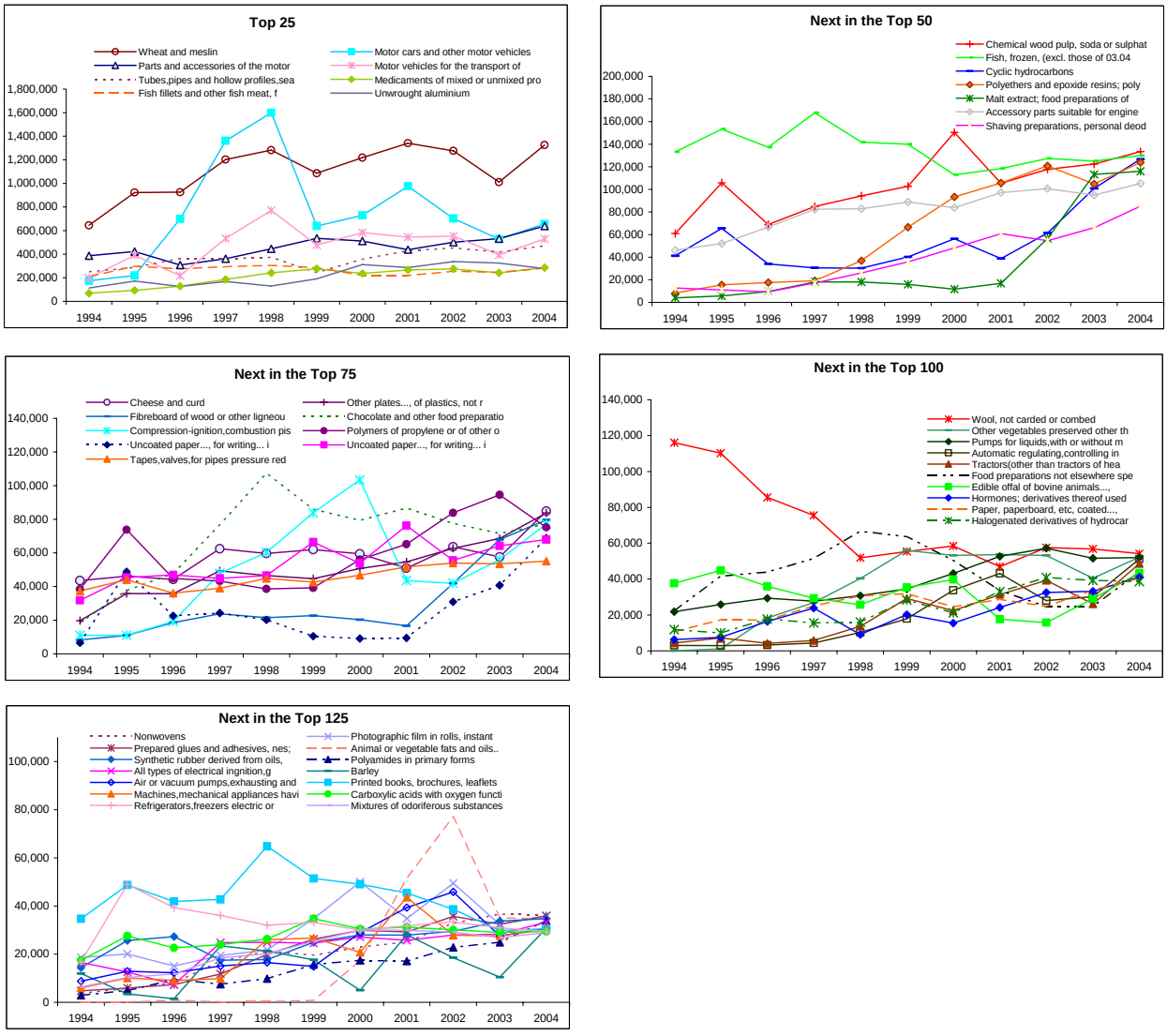
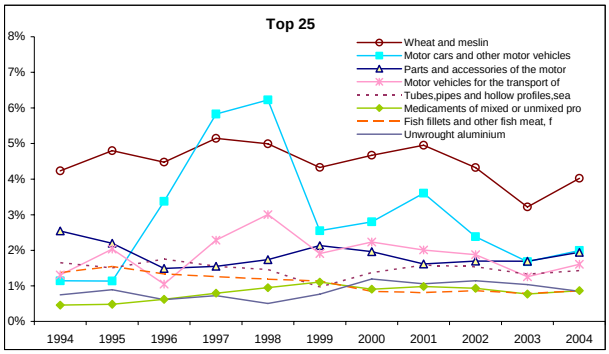
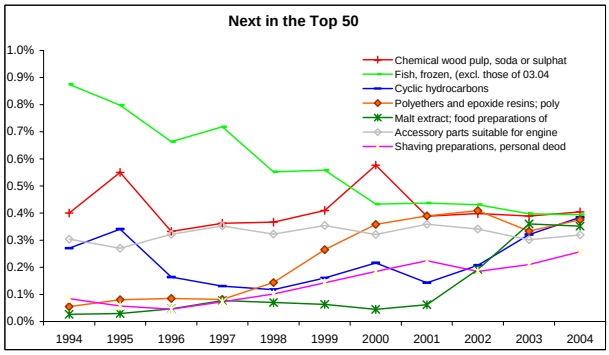
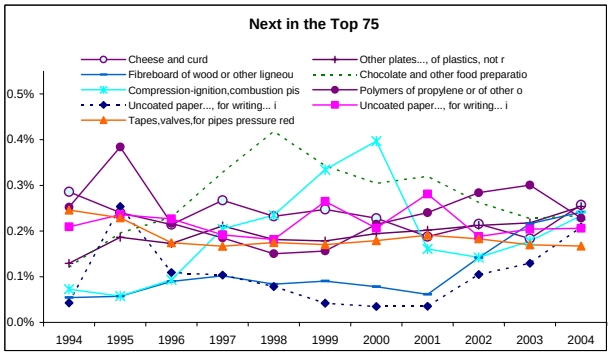
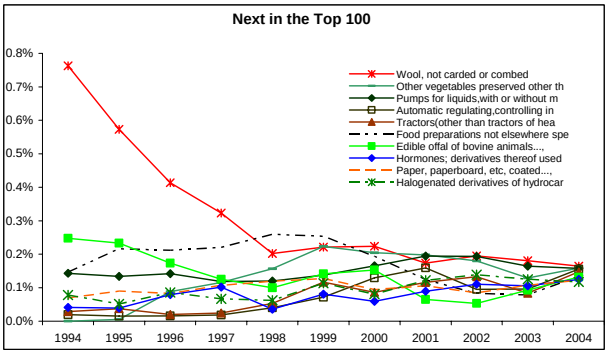


Figure 11
Top Argentine Exports: High Productivity Products, Share of Total Exports %









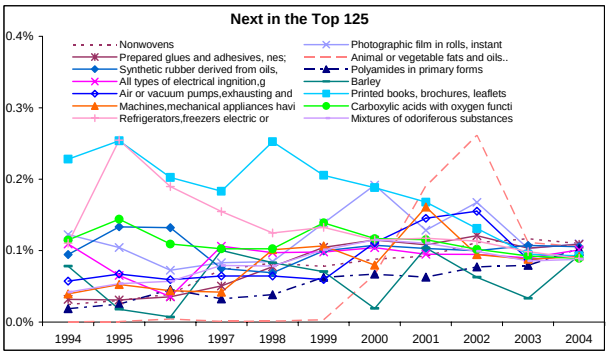
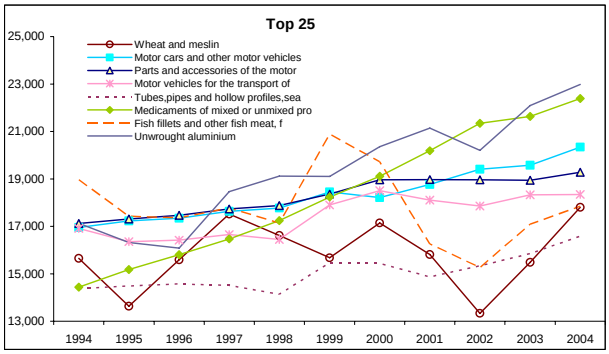
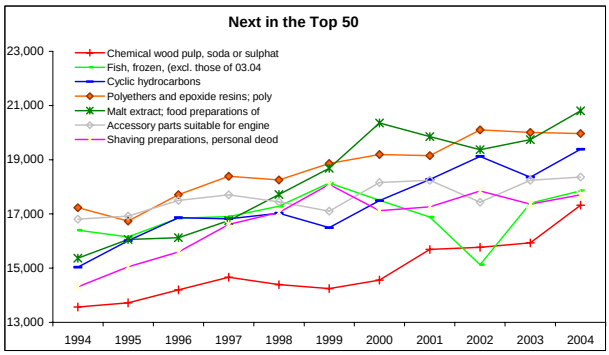
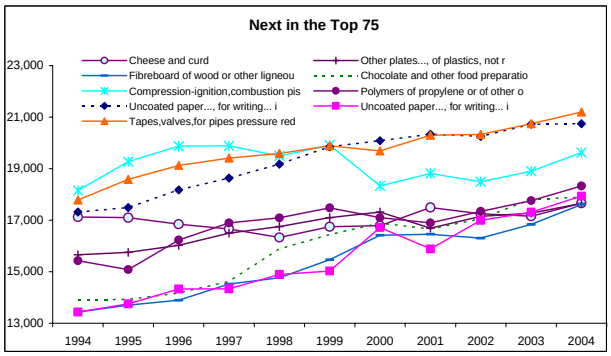
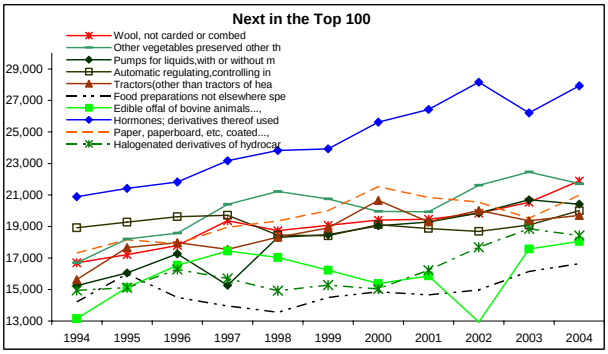


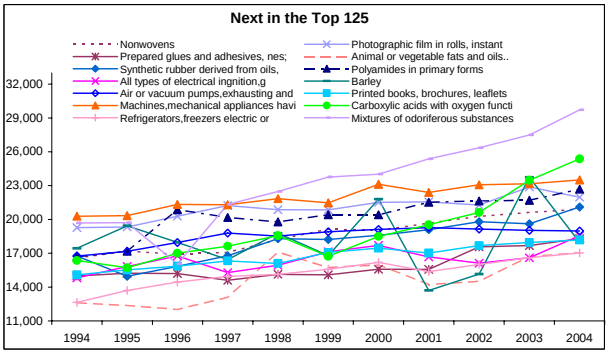
Figure 12
Top Argentine Exports: High Productivity Products, Product Income PPP 2000 $











Finally, we explore the extent to which products that experienced high growth in 2004 have high levels of productivity. In order to identify "new" exports, we rank products according to the growth of their export value in 2004 in relation to the average value between 1994 and 1999. We chose this period of reference to exclude the effects of the recent Argentine crisis. Some "new" export products had not even been exported before 2000 resulting in high growth rates. Most of the "new" export products constitute a very low share of total exports. Altogether they sum to only 1.2 percent of total exports in 2004. The ranking of the top 50 high-growth products is presented in Table 4. The products belong to a variety of sectors, although there is some small degree of concentration in groups such as edible fruits and nuts, ores, natural or cultured pearls, precious stones, iron and steel, lead, inorganic chemicals, compounds of precious metals, wood and articles of wood, and nuclear reactors, boilers, and related machinery. Also, it is important to point out that

half of the products in the list have high productivity levels as it is shown by the groups highlighted in Table 5. Not surprisingly, most of these products reflect a higher level of industrial manufacturing.

Table 5
High Growing Argentine Exports 2004

Growth Ranking	Code	Description	Growth* %	Export value Thousands 2000 US$	Exports share %	Product income 2000 PPP $	Distance to export basket	RCA	Exports ranking	Product income ranking	Distance ranking	RCA ranking
1	1514	Rape, colza or mustard oil and frac	-	3,903.5	0.012%	18,610.3	1.70	0.52	370	433	355	286
1	2609	Tin ores and concentrates	-	0.3	0.000%	2,152.0	1.83	0.00	1109	1132	580	1066
1	2705	Coal gas, water gas, producer gas a	-	0.2	0.000%	11,700.8	2.03	0.00	1117	903	921	1053
1	7101	Pearls natural,cultured,graded/ungr	-	0.1	0.000%	25,758.7	2.26	0.00	1122	42	1089	1133
1	6906	Ceramic pipes,conduits,guttering an	-	0.0	0.000%	24,232.9	1.97	0.00	1136	88	820	1129
2	2616	Precious metal ores and concentrate	37,021,669	9,233.8	0.028%	3,808.7	1.25	4.78	248	1118	14	66
3	5802	Terry towelling and similar woven t	987,501	8,141.6	0.025%	9,557.8	1.57	15.44	260	1013	198	21
4	2619	Slag, dross, etc, from the manufact	312,733	104.5	0.000%	17,404.9	1.72	0.23	851	545	395	429
5	4405	Wood wool; wood flour	115,375	6.8	0.000%	19,097.5	1.85	0.03	1034	397	611	801
6	8108	Titanium and articles thereof,inclu	32,833	1,824.6	0.006%	26,442.1	2.13	0.25	474	29	1027	408
7	2814	Ammonia, anhydrous or in aqueous so	31,916	17,853.1	0.054%	11,256.5	1.35	1.75	171	935	30	144
8	7106	Silver(plated with gold,platinum)un	22,786	3,276.0	0.010%	10,584.2	1.77	0.15	398	967	464	514
9	3102	Mineral or chemical fertilizers, ni	16,798	83,049.2	0.252%	11,811.9	1.49	4.01	53	892	113	79
10	5305	Coconut, abaca, ramie, etc, not spu	15,891	3.2	0.000%	6,035.9	1.98	0.02	1062	1092	841	855
11	0812	Fruit and nuts,provisionally preser	15,782	116.9	0.000%	1,091.1	1.60	0.21	838	1138	230	447
12	0814	Peel of citrus fruit or melons, fre	11,792	847.3	0.003%	6,402.5	1.40	5.46	576	1084	57	59
13	7801	Unwrought lead	10,968	21,266.6	0.065%	12,885.9	1.44	2.78	154	837	80	104
14	6113	Garments made up of knitted or croc	10,246	39.4	0.000%	16,027.0	2.06	0.03	930	642	961	838
15	1518	Animal or vegetable fats and oils..	8,221	34,804.1	0.106%	17,059.2	1.60	16.35	108	574	221	18
16	9204	Accordions and similar instruments;	5,078	1.4	0.000%	13,019.8	2.16	0.00	1088	831	1044	1007
17	3815	Reaction initiators, accelerators a	5,036	23,015.1	0.070%	24,007.6	2.03	0.98	145	100	928	205
18	7118	Coin	3,768	358.6	0.001%	19,459.4	1.80	0.38	700	371	529	338
19	7804	Lead plates,sheets,strip and foil;l	3,700	559.9	0.002%	25,015.9	1.97	0.76	625	63	821	229
20	7609	Aluminium tube or pipe fittings(cou	3,229	5,117.0	0.016%	17,120.5	1.62	3.64	324	567	250	87
21	0104	Live sheep and goats	3,205	1,358.7	0.004%	11,657.3	1.55	0.57	518	907	163	270
22	2707	Products of the distillation of coa	2,962	38,239.2	0.116%	9,834.8	1.42	1.39	98	1003	72	165
23	8602	Other rail locomotives;locomotive t	2,448	68.8	0.000%	13,904.1	1.91	0.01	891	776	722	920
24	0810	Other fruit, fresh, nes	2,131	16,523.9	0.050%	15,656.3	1.42	1.21	184	669	71	184
25	0811	Fruit and nuts, frozen	1,909	8,744.5	0.027%	10,855.1	1.49	1.46	253	955	115	159
26	0210	Meat and offal, salted... or smoked	1,899	2,477.4	0.008%	25,177.6	1.67	0.22	437	56	326	439
27	7004	Drawn glass and blown glass,etc.	1,877	37.4	0.000%	12,282.9	2.01	0.03	932	872	899	800
28	7225	Flat-rolled products of other alloy	1,790	662.9	0.002%	21,528.7	2.08	0.02	603	229	975	902
29	9706	Antiques of an age exceeding one hu	1,737	305.3	0.001%	28,434.8	2.18	0.03	716	10	1057	803
30	2817	Zinc oxide; zinc peroxide	1,662	4,431.6	0.013%	10,561.2	1.49	2.23	349	969	109	123
31	5609	Articles of yarn, strip, etc, twine	1,609	215.1	0.001%	17,413.4	1.88	0.32	765	544	679	359
32	1105	Flour, meal, flakes, granules and p	1,500	2,716.1	0.008%	22,264.0	1.50	2.17	422	176	124	128
33	7001	Cullet and other waste and scrap of	1,466	85.8	0.000%	16,047.8	1.88	0.08	866	641	685	635
34	8906	Other vessels including warships,li	1,413	76.0	0.000%	17,889.0	1.71	0.02	882	501	364	846
35	2517	Pebbles, gravel, etc; macadam of sl	1,405	650.9	0.002%	12,891.7	1.82	0.12	607	836	568	558
36	0404	Whey and other natural milk constit	1,385	20,699.1	0.063%	21,298.1	1.51	2.79	157	243	132	102
37	2102	Yeasts; other single-cell micro-org	1,364	11,836.9	0.036%	10,530.8	1.55	3.31	213	972	167	92
38	7224	Other alloy steel in ingots etc.sem	1,350	16,090.4	0.049%	17,720.7	1.71	2.60	188	515	375	112
39	2818	Artificial corundum; aluminium oxid	1,338	656.2	0.002%	22,188.8	1.65	0.02	605	182	289	864
40	6803	Worked slate and articles of slare	1,301	740.8	0.002%	19,070.2	1.64	0.28	590	401	276	389
41	4409	Wood, continuously shaped along any	1,244	36,245.1	0.110%	10,282.8	1.49	2.18	102	989	111	127
42	8004	Tin plates,sheets and strip of a th	1,231	0.9	0.000%	15,868.5	1.76	0.01	1094	648	446	956
43	7806	Other articles of lead	1,165	177.9	0.001%	15,610.4	1.71	0.29	791	673	368	382
44	8444	Machines for extruding,drawing,text	1,125	1,532.6	0.005%	24,070.5	2.44	0.49	498	96	1131	289
45	6809	Articles of plaster or of compositi	1,061	9,166.7	0.028%	10,780.8	1.57	1.99	251	958	183	133
46	8404	Auxiliary plant for use with boiler	972	1,077.2	0.003%	20,423.2	1.77	0.35	549	300	470	347
47	7206	Iron,non-alloy steel in ingots/othe	968	79.1	0.000%	9,498.8	1.77	0.09	878	1018	468	620
48	5206	Cotton yarn, with <85% cotton, not	955	1,546.5	0.005%	16,736.2	1.75	0.52	494	599	437	285
49	4503	Articles of natural cork	953	1,942.5	0.006%	16,740.3	1.80	0.52	467	598	534	284
50	2939	Vegetable alkaloids and their salts	912	1,088.6	0.003%	19,114.9	2.07	0.17	547	396	969	485

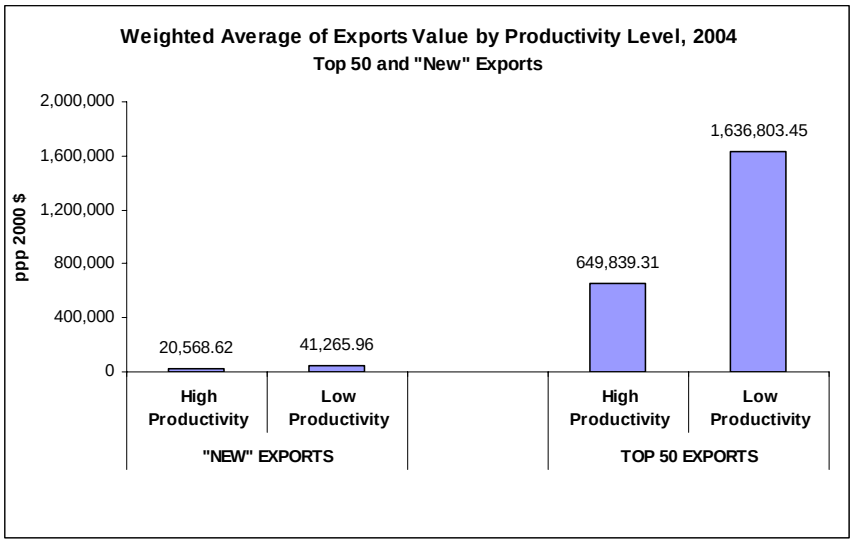
* Growth was calculated between 2004 and the average value of the 1994-99 period

Source: Author's calculations based on WITS-Comtrade database

Figures 13 and 14 summarize the findings of this section. They show the export value and product income in 2004 for Argentina weighted by export shares. Products are ranked according to high and low productivity for the top 50 larger exports and for the top 50 "new" exports. In Figure 13 we observe that the export value of the low productivity goods is, on average, double the value of the high productivity goods. Specifically, it is 2.5 times higher for the top 50 and 2 times higher for

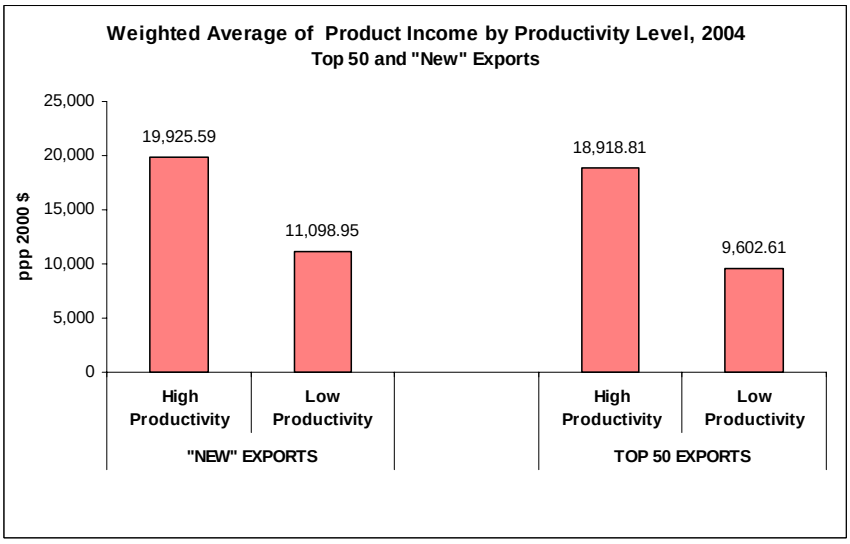
the "new" exports respectively. Also, notice that the value of the top 50 exports is 40 and 32 times higher than the value of "new" exports for both the low and high productivity categories respectively.

Figure 13



In terms of product income, in Figure 14 shows that the low productivity goods have a product income 49 smaller than the high productivity goods in the case of the top 50 products. For the "new" exports, low productivity goods have a product income 44 smaller than the high productivity goods. Interestingly, when comparing these two rankings, there is not much of a difference within the productivity groups. That is, the ratio of the top 50 exports to the "new" exports is 0.87 for the low productivity goods and 0.95 for the high productivity goods.

Figure 14



VII. Proximity of goods to the Argentine Export Basket

In this section we construct a measure of "distance" of each Argentine product with respect to the world export basket. This measure is important because, as the HHR model argues, firms are more likely to move to new products if the "distance" is low. Knowing what goods are close to the export basket and which of those ones have high productivity might be important in terms of assessing growth prospects. Following Hausmann and Klinger (2006), "distance" is estimated as shown below.

$$Dist_{ict} = \log\left[\frac{1}{Density_{ict}}\right], \qquad Density_{ict} = \left[\frac{\sum_j \varphi_{ijt} x_{cjt}}{\sum_j \varphi_{ijt}}\right]$$

As shown in the formula above, the density measure for country c is calculated as the summation of the pairwise proximity (φ_{ij}) of each product that has revealed comparative advantage (RCA) in that country relative to the summation of the pairwise proximity of all products in the world market. This pairwise proximity is estimated as the minimum of the conditional probability of a product i having revealed comparative advantage given that product j has too, as can be seen in the formulae below.

$$\varphi_{ijt} = \min\left\{P\left(x_{it} \mid x_{jt}\right), P\left(x_{jt} \mid x_{it}\right)\right\}$$

$$x_{ict} = \begin{cases} 1 & if \quad RCA_{ict} > 1 \\ 0 & otherwise \end{cases}$$

$$RCA_{ict} = \frac{xval_{ict} \Big/ \sum_i xval_{ict}}{\sum_c xval_{ict} \Big/ \sum_i \sum_c xval_{ict}}$$

The intuition behind the density measure is that it reflects the degree in which a good exported by Argentina is in close proximity to the world's export basket, making it easier for firms to adopt new products and export them. Hence, under this framework, the probability of exporting a good in the future depends on how close is a good to the current country's export basket.

In Figure 15 we plot the average distance for Argentine export products where the dotted lines indicate the standard deviation. As can be observed, the average shows a decreasing trend over the period, although during 2000-03 presented a notorious increase that was reverted in 2004.

Figure 15

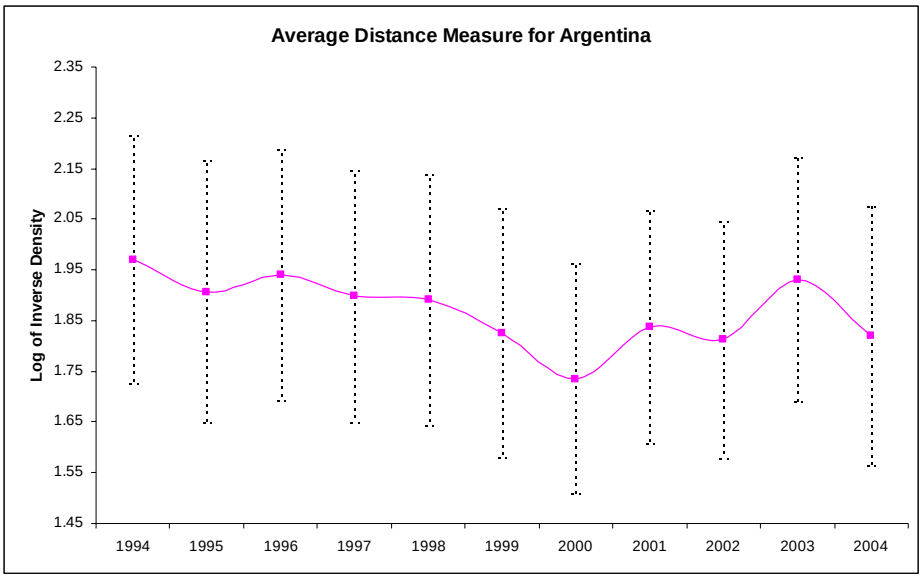
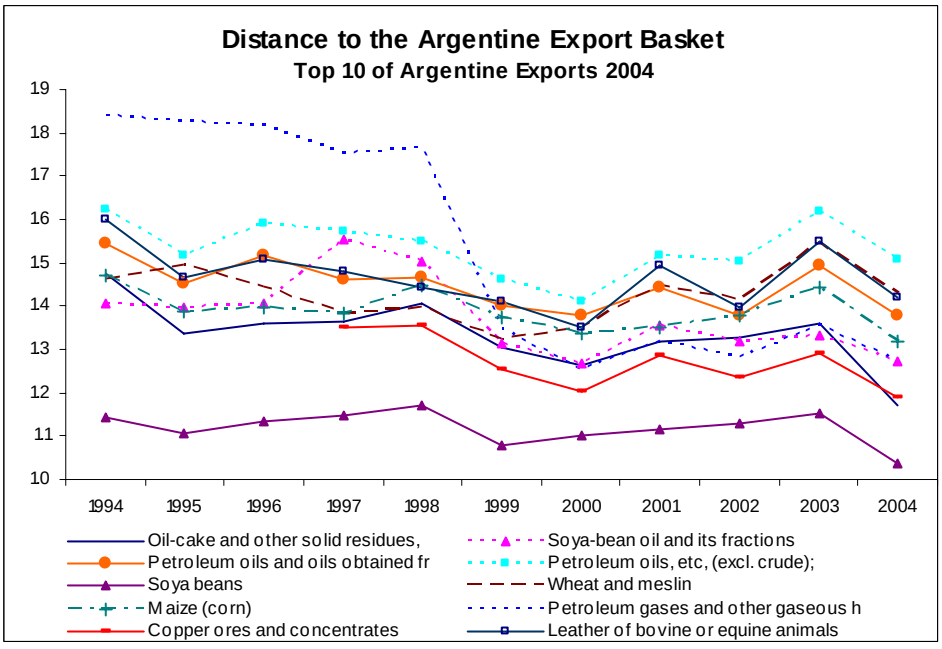


Figure 16 shows how "distance" has changed for the top 10 export products. As can be observed, it is generally flat although with a slight downward trend over the period. Also, notice that the mean distance for these 10 products is around 1.4, except for soy beans which is around 1.1. Finally, notice that the distance of petroleum gases shows a sharp decrease in the late nineties, reflecting a possible "catching up".

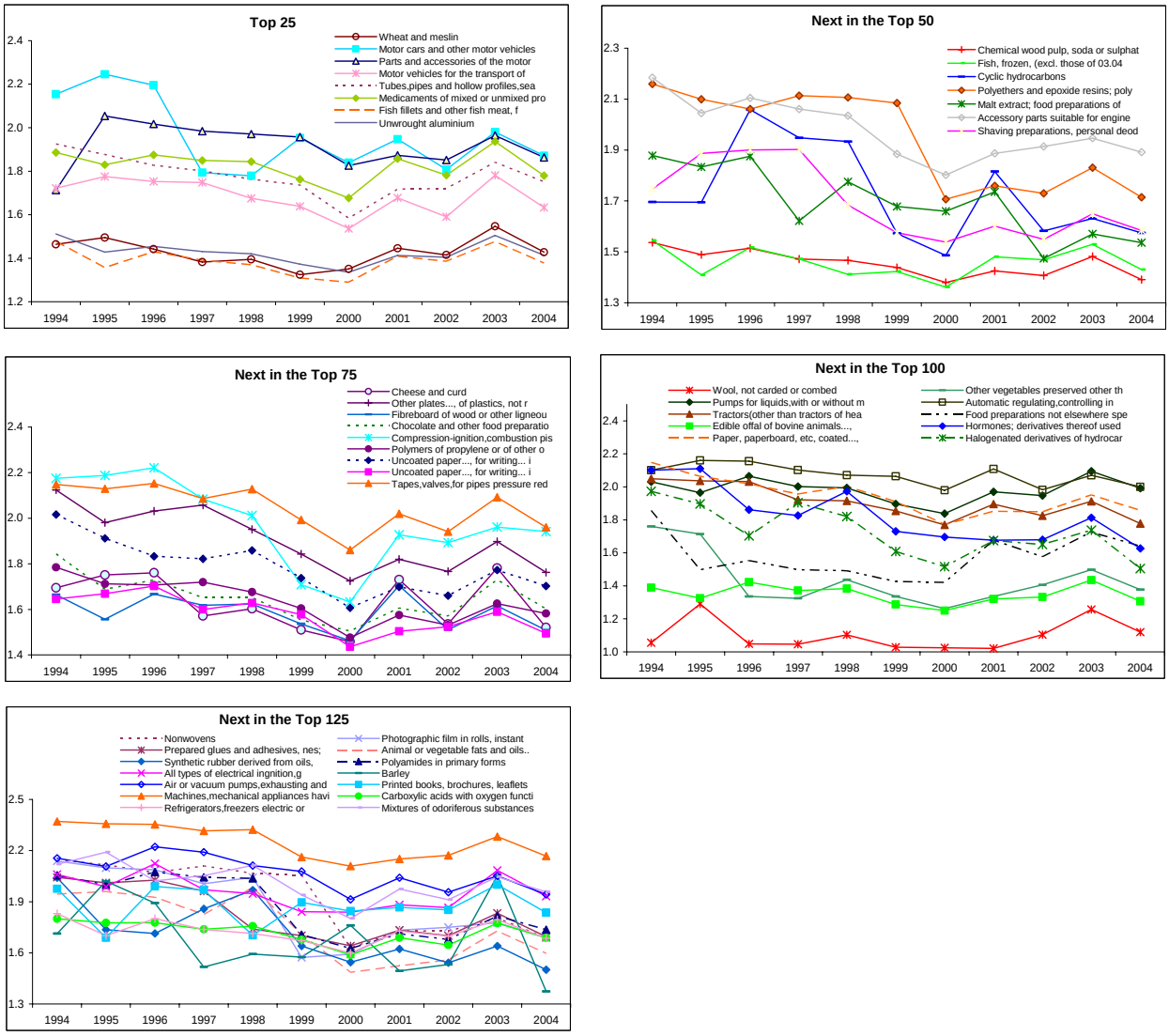
Figure 16



In Figure 17, we present "distance" for the high-productivity goods analyzed in the previous section. As can be observed in the graphs, the distance to the Argentine export basket seems to have been stable during the entire period for most products. However, when looking more carefully

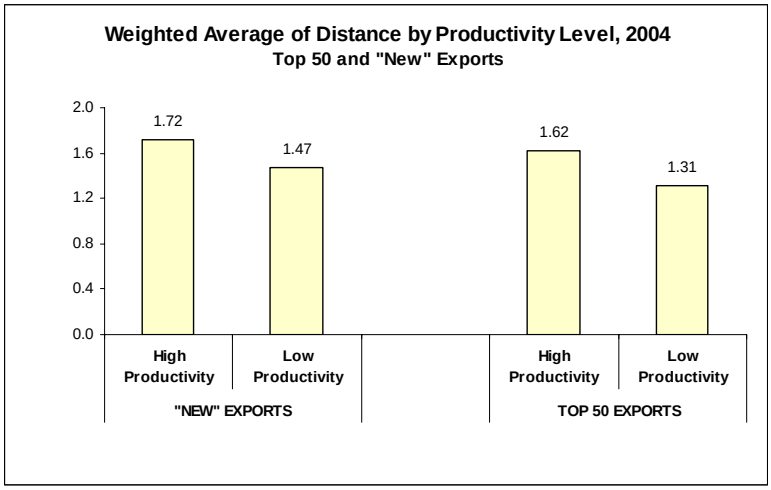
it seems that, for many products, distance was decreasing until year 2000 and then increasing again for some, (although not reaching the high levels observed in the early nineties) and remaining flat for others for the rest of the period. In general, a decreasing trend means that relatively higher productivity goods are getting slightly closer to the Argentine export basket.

Figure 17
Top Argentine Exports: High ProductivityProducts, Distance (log inverse density)



When comparing the distance of high-productivity and low-productivity Argentine exports it is clear that those with low productivity are closer to the world export basket. Specifically, low productivity goods have a distance that is 19 and 15 percent smaller than the high productivity goods for both the top 50 exports and the "new" exports, as shown in Figure 18. On the other hand, when comparing the two rankings, one finds that the top 50 products are, as expected, closer to the Argentine exports basket than the "new" products, although not by much. The ratios are 0.89 and 0.94 for the low and high productivity goods respectively.

Figure 18

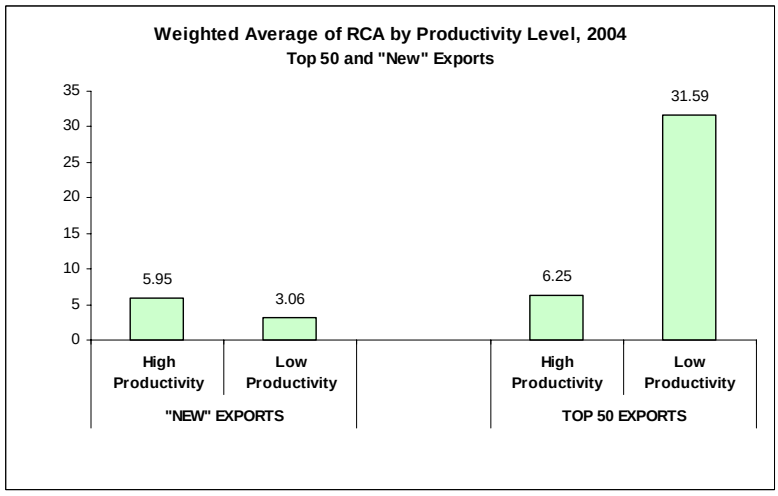


Regarding the relationship between RCA and product income, observe in Table 4 that Argentina does not have revealed comparative advantage for many of the high-productivity goods. For products where Argentina has a RCA the product income is generally low. However, notice that it has a considerable RCA for wheat, aluminum, fish, tubes and pipes all of which are of high productivity.

Furthermore, in Figure 19, we present the weighted average of RCA separately for the top ranked 50 and for the top ranked "new" exports, both grouped according to high and low productivity. As can be observed, Argentina has on average five times more revealed comparative advantage for the low productivity goods within its top 50 exports. It is important to notice though, that for the top 50 high productivity exports the weighted average RCA is greater than unity which means that Argentina is not without some comparative advantage in these products too.

In contrast, when looking at the "new" exports, the high productivity goods have a level of RCA twice that of the low productivity products. Actually, the level is very close to that of the top 50 high productivity goods. Conversely, the RCA level of the low productivity "new" exports is one-tenth of that of the low productivity top 50 exports.

Figure 19

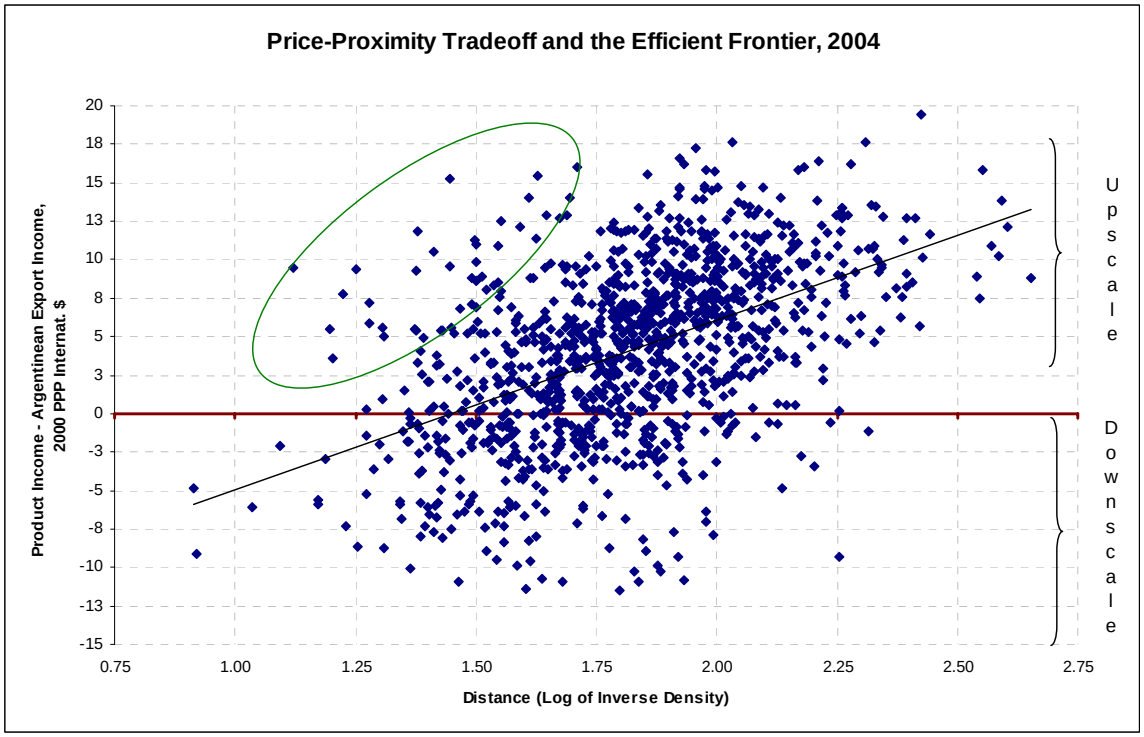


VIII. Productivity-Proximity Tradeoff and the Efficient Frontier

As discussed in HHR, there is a tradeoff between product income and distance. Countries are more likely to produce and export goods that are close to what they already produce but those products might not be of high value. There is a choice between producing the goods that are close to the production frontier but with lower product value, and producing high product value goods that are further away from the production frontier. Hence, there is a tradeoff between exporting goods that are relatively "easy" for the country to export even though they have less impact on economic growth, or producing and exporting goods that will induce greater economic growth but are more "difficult" to produce. However, HHR also argue that there is an efficiency frontier where some goods are close to the export basket but still show high product income. In the subsequent analysis we apply these concepts to the Argentine case and look at the particular goods that could reflect the tradeoff as well as those close to the efficiency frontier.

In order to illustrate this tradeoff, in Figure 20 we plot the product income of each product exported by Argentina minus the corresponding Argentine export income against their distance to the world export basket for 2004. The idea behind subtracting export income from the product income of each product is to give a sense of the attractiveness of each good with respect to the trade-weighted average product currently exported. For example, the greater this difference the more attractive is the product and the smaller the difference the less attractive it is. Using HHR terminology, we will apply the term "upscale products" those whose difference is positive and "downscale products" those whose difference is negative.

Figure 20



In Figure 20 above, there is a clear positive relationship between the two variables reflecting the tradeoff between product income and distance. That is, there are many products very close to the world export basket but whose product income is very low, and there are many others away from the world export basket but whose product income is very high. However, notice that there are some products, (inside the oval), that are close to the export basket and whose product income is quite high. These are the products at the efficiency frontier. Examples of these three categories are presented in the table below.

Table 6

Productivity-Proximity Tradeoff and the Efficient Frontier: Argentine examples

Upscale and far away	Downscale and close	Efficient frontier
2843 Colloidal precious metals; their co	0201 Meat of bovine animals, fresh or ch	0101 Live horses, asses, mules and hinni
2930 Organo-sulphur compounds	0202 Meat of bovine animals, frozen	0203 Meat of swine, fresh, chilled or fr
2934 Other heterocyclic compounds	0205 Meat of horses, asses, mules or hin	0204 Meat of sheep or goats, fresh, chilled
2935 Sulphonamides	0306 Crustaceans, fresh, chilled or frozen	0206 Edible offal of bovine animals...,
3707 Chemical preparations for photograp	0503 Horsehair and waste	0304 Fish fillets and other fish meat, f
3911 Petroleum resins..., polysulphides.	0506 Bones and horn-cores	0305 Fish, salted, dried...;smoked fish; fi
4812 Filter blocks, slabs and plates, of	0510 Ambergris, castoreum, civet and mus	1003 Barley
6702 Artificial flowers, foliage and fru	0703 Onions, shallots, garlic, leeks...e	1004 Oats
7101 Pearls natural, cultured, graded/ungr	0713 Dried leguminous vegetables, shelle	1007 Grain sorghum
7410 Copper foil(whether or not printed	0808 Apples, pears and quinces, fresh	1105 Flour, meal, flakes, granules and p
8113 Cermets and article thereof, includi	0813 Fruit, dried, nes	1204 Linseed
8209 Plates, sticks, tips unmounted, of sin	0903 Mate	1214 Swedes, mangolds...and similar fora
8443 Printing machinery; machines for use	1005 Maize (corn)	1502 Fats of bovine animals, sheep or go
8444 Machines for extruding, drawing, text	1006 Rice	1503 Lard stearin, lardoil, oleostearin,
8456 Machines-tools for working any mate	1201 Soya beans	1605 Crustaceans... and other aquatic in
8457 Machining centres, unti construction	1202 Ground-nuts, not roasted or otherwise	2004 Other vegetables preserved other th
8458 Lathes fr removing metal	1507 Soya-bean oil and its fractions	2301 Flours, etc, of meat, fish, etc, un
8461 Machine-tools for planing, shaping,g	1515 Other fixed vegetable fats and oils	2829 Chlorates, perchlorates; bromates,
8464 Machine-tools for working stons, cer	1521 Vegetable waxes (excl. triglyceride	2840 Borates; peroxoborates (perborates)
8515 Electrical brazing, welding machines	2009 Fruit juices (incl. grape must) and	2937 Hormones; derivatives thereof used
9002 Lenses, prisms, mirrors, other such el	2204 Wine of fresh grapes, (incl. fortif	3001 Glands, etc, dried; extracts of gla
9011 Micro optical compounds(microscopes	2207 Ethyl alcohol, undenatured of >=80%	3502 Albumins, albuminates and other alb
9101 All types of portable watches with	2304 Oil-cake and other solid residues,	3913 Natural polymers and modified natur
9102 All types of portable watches other	2305 Oil-cake and other solid residues,	4102 Raw skins of sheep or lambs, but no
9104 Instrument panel clocks, similar typ	2308 Vegetable materials, waste, residue	4703 Chemical wood pulp, soda or sulphat
9109 Clock movements, complete and assemb	2401 Unmanufactured tobacco; tobacco ref	5101 Wool, not carded or combed
9111 Watch cases and parts thereof	2528 Natural borates and concentrates; n	7601 Unwrought aluminium
	2603 Copper ores and concentrates	
	2616 Precious metal ores and concentrate	
	2709 Petroleum oils and oils obtained fr	
	2810 Oxides of boron; boric acids	
	2814 Ammonia, anhydrous or in aqueous so	
	5105 Wool and fine or coarse animal hair	
	7108 Gold (platinum plated) unwrought, semi	

The upscale products which are far away from the world export basket are mainly chemical products, metals and related products, machinery and other high-tech products, so these are either valuable in their own right or they are industrial goods. On the other hand, the downscale products that are very close to the world export basket are mainly animal and vegetable products, prepared food, textiles and minerals. Finally, observe that products at the efficiency frontier are chemical and plastic products but also animal and vegetable products, prepared food, textiles and minerals. Therefore, interestingly, there is an important similarity between these two categories that might be exploited to enhance economic growth.

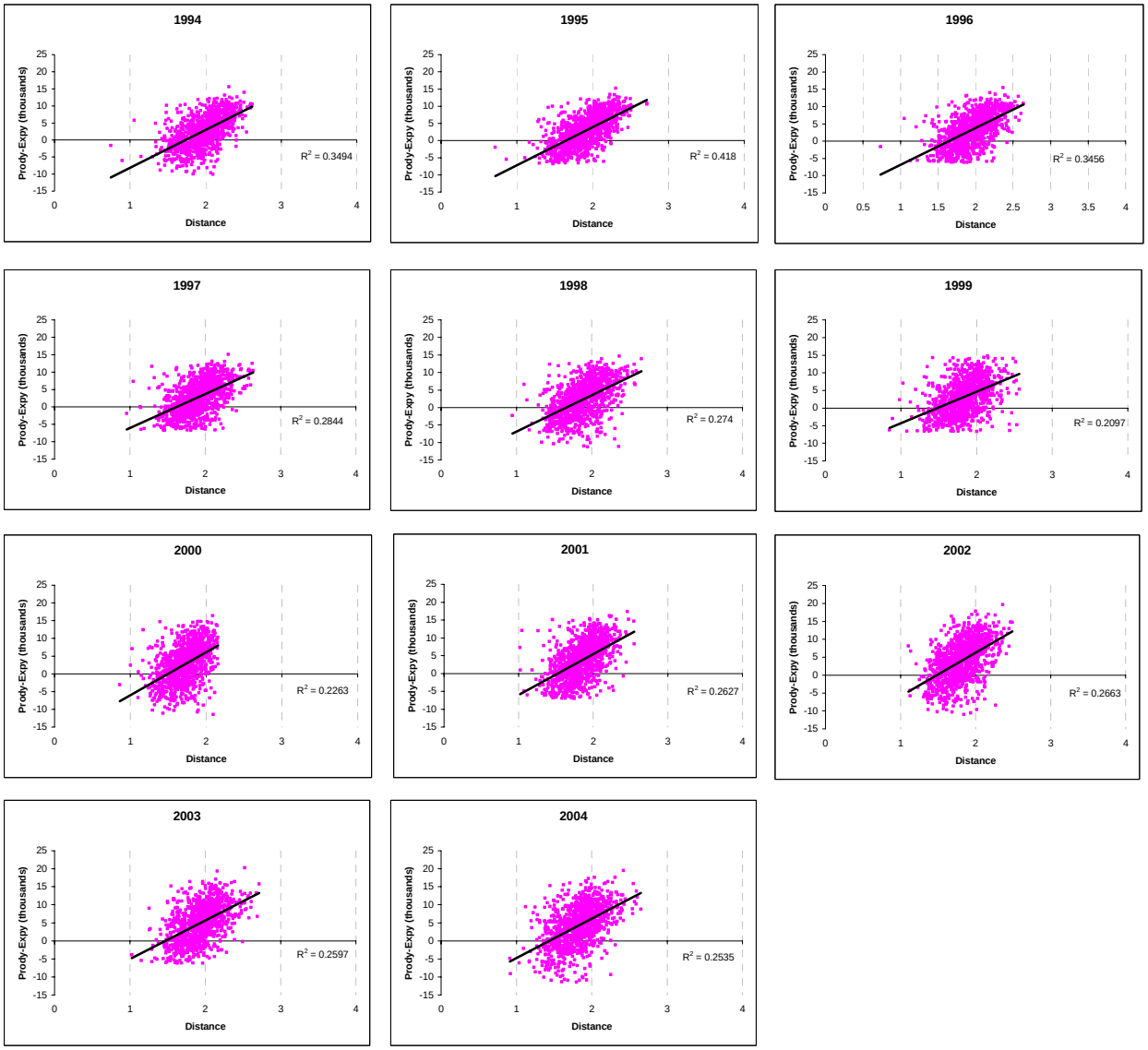
Furthermore, it is important to mention that some of the products at the efficiency frontier are not industrial goods but primary goods, contradicting the so-called "primary products curse".

What is important for economic growth is the product income of the goods in the export basket regardless of the sector or industry to which they belong.

In Figure 21 below, we present the same graph as in Figure 20 for every year from 1994 to 2004. As can be observed, the average distance in 1994 for the upscale products is 2.05 while for 2004 it is 1.87. For the downscale products the average distance is relatively lower being 1.79 for 1994 and 1.65 for 2004. So, it seems that on average, both there are both upscale and downscale products close to the Argentine export basket.

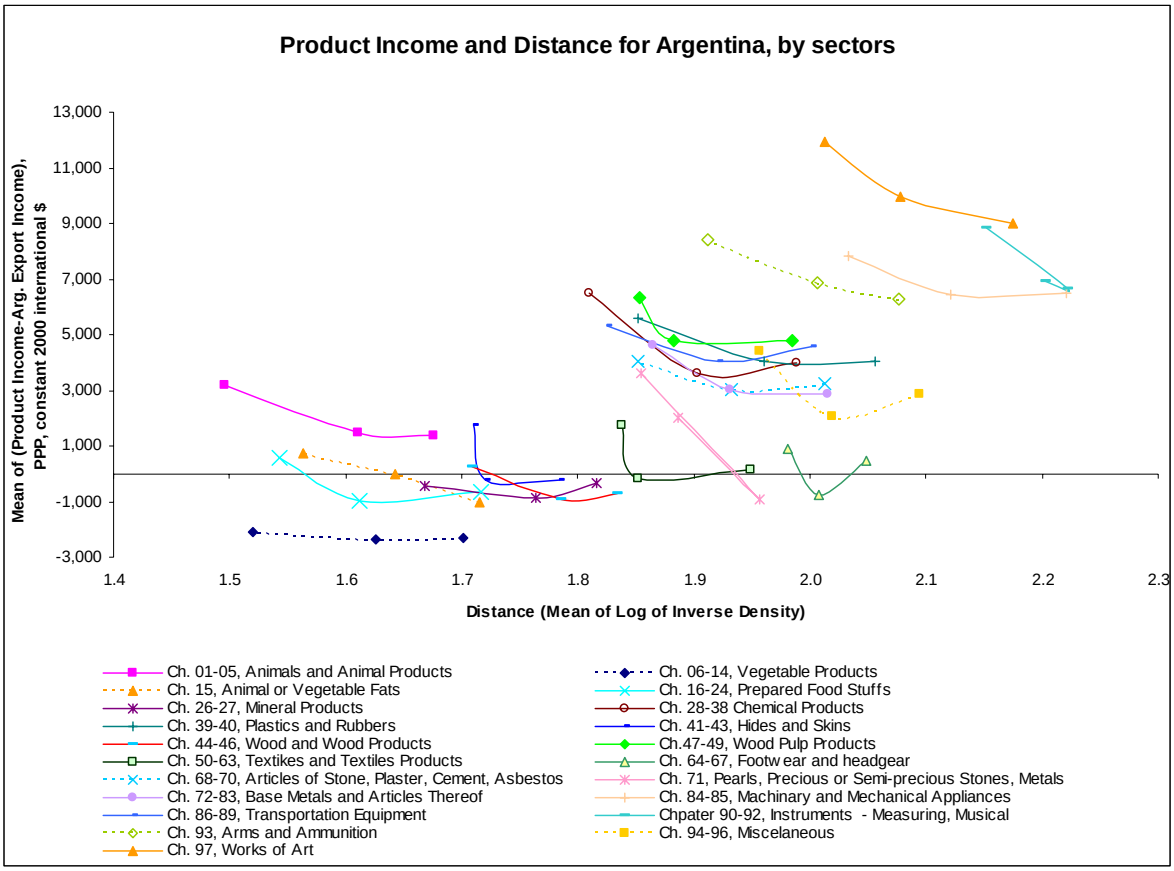
On the other hand, the average product income (weighted by export income) for the upscale products was $4.948 in 1994 and $6.524 in 2004 while for the downscale products these values are $-2.862 and $-3.486 respectively. These numbers mean that the range of weighted product income widened in 2004 compared to 1994. That is, there are more upscale goods with higher product income but also downscale goods with lower product income.

Figure 21
Visual Open Forest for Argentina



Also, it can be observed from Figure 22 that there a general trend across sectors whereby the distance has been reduced and the product income has increased. In this graph, the rightmost point for all series corresponds to year 1994, the middle one to year 1998, and the leftmost point to year 2004.

Figure 22



IX. Effect of Export Income on Growth: Econometric Analysis

In this section we examine in more detail the relationship between economic growth and export income. Specifically, we estimate the effect of EXPY on growth of GDP per capita applying different econometric techniques at the cross-section and panel level. For the former we use the measures calculated using the COMTRADE dataset and for the latter we calculate PRODY and EXPY using the World Trade Flows dataset (Feenstra et al. 2005) described in Section II.

Cross-national Analysis

All specifications include the initial level of GDP per capita and EXPY in logs as covariates. Additionally, we include in some specifications the log of average number of years of secondary school attained as proxy for human capital[5], the Rule of Law Index as proxy for institutional quality,

[5] Similar results are obtained including years of primary school attained instead.

the log of domestic credit as percentage of GDP as proxy for financial depth, and an index of export diversification[6].

Table 7 shows OLS and Instrumental Variables estimates. As can be observed from the OLS estimates presented in columns (1) to (5), EXPY has a significantly positive effect on growth that is robust to the inclusion of other covariates. However, notice that the magnitude of the effect varies between 0.035 and 0.043, being invariant only to the inclusion of the Rule of Law Index. Regarding the effect of other covariates on growth, the initial level of GDP per capita is always negative and significant. The human capital variable and the Rule of Law Index have a robust positive and significant effect on growth as expected. Domestic credit and export diversification are insignificant in all specifications[7].

The last five columns of Table 7 show IV estimates where log of population and log of land area were used as instruments[8]. We choose these instruments following HHR (2006) who argue that specializations patterns depend on idiosyncratic elements and fundamentals like human capital and labor force size. HHR base their excludability restriction in the fact that there has not been found yet any empirical evidence of scale effects in growth models[9], then arguing that population size and land area, as proxies of country size, are plausible instruments for EXPY[10].

By looking at the IV estimations in Table 7 one can observe that, as is generally the case, the standard errors are much bigger (almost double) compared to the OLS estimations, although the EXPY point estimates are relatively close to the previous estimates. Notice, however, that the effects of the other covariates continue to be robust (except for GDP per capita in some specifications). The specification tests presented at the bottom of the table are useful to shed light on understanding these results. The overidentification test fails in practically all cases. Moreover, the identification tests are rejected at only 5 and 10 percent of significance level. Suspecting weak instruments problem we run the Stock-Wright S-statistic to do weak-instrument-robust inference and find that EXPY is significant at 5 and 10 percent level in most cases[11].

Given that the EXPY might affect growth differently depending on the level of income of the economies we run two sets of experiments. First, as shown in Table 8, we run the same specifications as before but excluding from the sample high-income economies according to The World Bank classification. The OLS estimates on the restricted sample are very similar to the ones encountered in Table 7. Yet, the coefficients of EXPY are smaller in some specifications. Also, the estimates are in general less precise, possibly due to the smaller sample size. On the other hand,

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[6] The diversification index is defined as 1-Herfindahl Index following Hwang (2006). The source for GDP per capita and domestic credit as percentage of GDP is the Penn World Tables. For the average years of schooling we used the Barro-Lee dataset. See Barro and Lee (1994,2000)

[7] Credit is significant only when schooling is not included. Other specifications and test are available upon request from the authors.

[8] These variables were extracted from the Penn World Tables.

[9] For this purpose HRR cite Rose, Andrew K. "Size Really Doesn't Matter: In Search for a National Scale Effect", NBER Working Paper No. 12191, April 2006.

[10] HHR show a regression showing the correlation between EXPY and the instrument set and find land area and population to be significant. In our estimations, though, land is only slightly significant in the first stage of the specification presented in column (6). We run a test for the redundancy of this variable and fail to reject it in all specifications. Also, we run the IV regressions excluding land from the instrument set and got very similar results, except that the point estimates of both EXPY and GDP per capita were very small and the latter was no longer significant.

[11] We obtained the same results when running the Anderson-Rubin test with the exception of column (6) in Table 10, which rejects the null at 1% of significance level.

observe that the IV estimates of EXPY are now significant and higher than those of the OLS estimates. Looking at the bottom of Table 8, the under and weak identification tests are rejected. But, just as in the full sample case, the overidentification tests are rejected which again casts doubts on the instrument set.

Second, to overcome the small sample problem and have a better insight on the effect of EXPY on growth for different income-level economies we include dummies indicating the type of economy and these interacted with EXPY. The coefficients of the interactions tell us the specific effect of EXPY on growth given the economy's level of income relative to high-income economies. The results of these estimations are shown in Table 9. In the OLS estimations, the biggest and most significant positive effect of EXPY is on growth in lower-middle-income economies, followed by the effect in lower-income economies. The point estimates for the lower-income economies are actually half the ones of the lower-middle-income economies, after controlling for institutional quality, financial depth and export diversification. The effect of EXPY on growth in upper-middle-income economies appears to be insignificant.

In columns (6) to (10) of Table 9 we present the IV estimates for this exercise. The estimates are far more imprecise and in most cases they have increase dramatically. Looking at the specification test, in one hand, we cannot reject the null hypothesis of weak identification and, in the other hand, we reject the overidentification test. Finally, the weak-instrument-robust inference tells us that EXPY is significant at 5 and 10 percent level.

Panel Level Analysis

In view of the fact that the relationship between EXPY and growth is more likely to be one of long term and aiming at obtaining more efficient and consistent estimates, we present in what follows estimation results using panel data. We construct 5-year, 8-year and 10-year panels spanning from 1962 to 2000 using Feenstra et al. (2005). In the next set of tables we present results of OLS, IV, OLS-Fixed Effects and GMM estimations for the full sample as well as for the sample excluding high-income countries. All estimations include human capital and initial GDP per capita as additional covariates. The OLS estimates although informative, are likely to be biased since they do not take into account the potential endogeneity of EXPY nor the unobserved time-invariant country characteristics that might affect growth. We can correct the first problem by making use of IV estimators (2SLS) where the same variables as in the cross-section analysis would serve to instrument EXPY. But by only using this technique, however, we do not solve the problem of unobserved time-invariant characteristics. On the other hand, we can estimate a Fixed Effects model to correct for the second problem but we still need to correct for the potential endogeneity of EXPY. Also, we cannot estimate an IV model with fixed effects using the variables employed earlier as instruments since these are practically time invariant and therefore they get differenced out under this estimation approach. Given that finding more suitable instruments represents an extremely difficult task, we apply the System-GMM technique suggested originally in Arellano and Bover (1995) and fully developed in Blundell and Bond (1998). The advantage of this technique, designed to estimate dynamic panel data models, is that addresses both problems. It consists of setting a system of equations in differences and in levels and using lagged levels and the first lag of the first-differences of the endogenous variables as instruments in these equations respectively in addition to allowing for fixed effects. This approach has become very popular in growth-related empirical work, examples are Caselli (1996), Levine et al (2000), Loayza et al (2004), HHR(2006), among others.

Table 10 presents the results of the different estimation methods. As can be observed, the effect of EXPY on growth is positive and significant in the OLS estimation and very similar to the cross-section estimates. The IV estimate is significant in this case although twice the size of the OLS estimate. Here once again, the Hansen J-statistic test for overidentification is rejected which casts doubts on the specification of the model. The FE estimate of EXPY is considerably smaller and insignificant.

In the next columns of Table 10 we present five different specifications using System-GMM techniques which treat all covariates as potentially endogenous and include their lags and first-differences as well as the log of population and land area as instruments[12]. Column (4) includes lags of second and higher order of the variables in levels in the instrument set, additional to the first-difference and other mentioned instruments. The resulting point estimates of EXPY are within the range of the cross-section analysis, 0.041. Nonetheless, the crucial assumption of non-second-order serial correlation of the residuals is violated invalidating the use of second period lags in the instrument set[13]. Moreover, by looking at other test not reported in the tables, the model seems to be saturated by the large number of instruments. In columns (5) and (6) we present results using lags of third and higher order and fourth and higher order, respectively. In both cases, the models fail to reject the test of lack of second-order serial correlation of the residuals in the first-difference residuals validating the use of these lags as instruments. The point estimates of EXPY in these specifications are higher than in the previous case: 0.046 and 0.051 respectively.

In order to avoid saturation of the model, several authors have proposed the use of a collapsed version of the original instrument set[14]. The estimations in column (7) and (8) of Table 10 incorporate this modification. The EXPY estimates are very close to the ones obtained before, but in both cases the overidentification test is rejected. Moreover, in column (7) the AR(2) is rejected, just as expected given the results from column (4).

Table 11 presents the same estimations as Table 10 but excluding from the sample the high-income economies. In general the results are similar to those of the full sample analysis, although somewhat mixed in terms of the magnitude. In the case of the FE estimation, the coefficient of EXPY increases to 0.026 and becomes significant at 10 percent. In Table 12 we present the estimations for the 8-year and 10-year panel for the full sample and in Table 13 for the restricted sample. By and large, the results are very similar to those of the 5-year panel. In the GMM estimations, there is no evidence of second-order autocorrelation of the residuals in first difference validating the use of lags of second order as instruments.

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[12] The results presented here are two-step estimates. The one-step estimates are very similar and we do not include them to preserve space.

[13] For the lags of the endogenous variables to be valid instruments they need to be uncorrelated with the residuals in first differences. In order for these ortogonality conditions to hold, it is assumed that the residuals are serially uncorrelated and the initial conditions are predetermined. In cases where the former condition is not satisfied but rather the residuals follow a MA(q) process, with $q \geq 1$, only the lags of order $2+q$ and further of the endogenous variables are valid instruments.

[14] In a collapsed instrument set the moment conditions are applied such that each of them correspond to all available periods instead of each moment condition corresponding to a particular time period as is originally the case. Hence, by collapsing the instrument matrix we make the number of moment conditions independent of the number of time periods whereas in the original case the number of moment conditions increases more than proportionally with the number of time periods. Loayza et al (2002), Beck and Levine (2004), Carkovic and Levine (2005) and Roodman (2006) use this approach.

Discussion and comparison with HHR's results:

In the econometric analysis presented above we follow closely HHR (2006). In this subsection we compare our results to those in HHR and mention some differences in the assumptions made. In the cross-section analysis, HHR construct EXPY by using the average of PRODY for 1999-2001 while we use the current PRODY for every year. Additionally, HHR uses the COMTRADE database for the periods 1992-2003 and 1994-2003 whereas we use the same data source from the period 1994-2004. In terms of the specifications our estimates include additional covariates such as domestic credit as percentage of GDP, an export diversification index, and in some of them we also include type-of-economy dummies. HHR discuss briefly, though, the inclusion of some variables as robustness checks and mention not finding major changes in their results. Also, they present separate panel estimates for different subgroups of countries according to their income level.

Our OLS estimations are similar to those of HHR however somewhat stronger in terms of both magnitude and significance. In the IV estimations we do not find any significant effect and given the specification tests we find the model behaves rather poorly. HHR, although having very similar specification tests, find EXPY to have a significant and bigger effect than in their OLS estimates. Finally, in contrast with HHR we find that human capital and the Rule of Law index are significantly positive and robust to all specifications. It is most likely that these small differences in results are due to the different approaches employed in constructing EXPY.

For the panel regressions both papers use the World Trade Flows database and we find that the estimations results are very similar. In the GMM estimations for example, in the 5-yr panel we find that point estimates are between 0.046 and 0.051 compared to 0.0446 in HHR and in the 10-year panel the estimates are the same 0.044, although, in both panels our estimates are more precise. In regards to the different effects of EXPY on growth according to the economies' income level, we find the effects to be important for both the lower-income and lower-middle economies, although much stronger for the latter. We do not find any effect for the upper-middle economies. HHR in their corresponding exercise get very similar results although finding some effect for the upper-middle income economies when using IV techniques.

To summarize, the econometric analysis presented here and in the HHR (2006) paper constitute evidence of EXPY having a robust positive effect on growth. The magnitude of the effect, however, depends very much on the specifications and estimation methods employed. As discussed above, in the cross-section analysis the OLS point estimates go from 0.035 in our estimates to 0.047 in HHR estimates. While in the panel estimations the EXPY coefficient goes from 0.034 using OLS to 0.046 using System-GMM. The corresponding numbers in HHR are 0.029 and 0.045 respectively. Furthermore, the effect of EXPY seems to be stronger for lower-middle-income economies and somewhat important for the lower-income economies. These results however, should be taken with caution due to the fact that our sample is restricted to countries reporting information in every year which decreases the representation of lower-income economies in the sample[15].

[15] In our cross-section sample the lower-income economies account for only 7% of the sample, while the lower-middle and upper middle account for 25% each, and the high-income economies for the remaining 44%. In the panel regressions the distribution is rather different, the lower-income economies account for 20%, the lower-middle for 30%, the upper-middle for 18% and the high-income economies for 32%. The HHR panel sample seems to have a similar distribution, although with similar participation of the upper-income and high-income economies (around 25%).

Table 7
Cross-national Growth Regressions 1994-2004

	(1) **OLS**	(2) **OLS**	(3) **OLS**	(4) **OLS**	(5) **OLS**	(6) **IV**	(7) **IV**	(8) **IV**	(9) **IV**	(10) **IV**
Log of GDP pc 1994	-0.012**	-0.017***	-0.022***	-0.022***	-0.022***	-0.008	-0.014	-0.019**	-0.020**	-0.022**
	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.011)	(0.008)	(0.009)	(0.009)	(0.010)
Log of EXPY 1994	0.043***	0.035***	0.035***	0.038***	0.040***	0.032	0.024	0.024	0.030	0.039
	(0.015)	(0.012)	(0.012)	(0.012)	(0.014)	(0.030)	(0.024)	(0.025)	(0.024)	(0.033)
Log of % secund. school att. 1985		0.008**	0.006*	0.006*	0.006*		0.009**	0.007*	0.007*	0.006*
		(0.003)	(0.003)	(0.003)	(0.004)		(0.004)	(0.004)	(0.004)	(0.004)
Rule of Law Index 1996			0.007**	0.008**	0.008**			0.007**	0.007**	0.007**
			(0.003)	(0.003)	(0.003)			(0.003)	(0.003)	(0.003)
Domestic credit provided by banking sector, % of GDP				-0.000	-0.000				-0.000	-0.000
				(0.000)	(0.000)				(0.000)	(0.000)
Diversification (1 - Herfindahl Index)					-0.011					-0.011
					(0.023)					(0.032)
Constant	-0.275***	-0.183**	-0.134*	-0.152*	-0.166*	-0.204	-0.111	-0.062	-0.106	-0.159
	(0.092)	(0.078)	(0.079)	(0.082)	(0.087)	(0.188)	(0.152)	(0.158)	(0.153)	(0.202)
Observations	73	59	59	59	59	71	58	58	58	58
R-squared	0.21	0.25	0.32	0.34	0.34	0.21	0.24	0.30	0.33	0.34
First stage F-statistic of excluded instrument p-value (H0: underidentified/weakly identified)						0.019	0.018	0.019	0.021	0.089
Hansen J statistic p-value (H0: instruments are valid and correctly excluded -overidentification test)						0.130	0.042	0.025	0.009	0.012
Stock-Wright S-statistic p-value (H0: all endogenous regressors==0 and overid. rest valid, weak-instrument-robust inference)						0.149	0.098	0.054	0.014	0.023

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Instruments for IV regressions: log of population 1994 and log of land area

Table 8
Cross-national Growth Regressions 1994-2004 - Restricted Sample: Non-high-income Economies

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) IV	(7) IV	(8) IV	(9) IV	(10) IV
Log of GDP pc 1994	-0.010	-0.020***	-0.023***	-0.022***	-0.022***	-0.015*	-0.021**	-0.025***	-0.025***	-0.025***
	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)
Log of EXPY 1994	0.044**	0.036**	0.032**	0.030**	0.035**	0.058***	0.041**	0.040*	0.040*	0.049**
	(0.017)	(0.014)	(0.015)	(0.014)	(0.016)	(0.021)	(0.019)	(0.020)	(0.020)	(0.022)
Log of % secund. school att. 1985		0.011**	0.008	0.008	0.009		0.011**	0.007	0.007	0.008
		(0.004)	(0.005)	(0.005)	(0.005)		(0.005)	(0.005)	(0.005)	(0.005)
Rule of Law Index 1996			0.012**	0.012**	0.012*			0.012**	0.012**	0.012*
			(0.005)	(0.006)	(0.006)			(0.006)	(0.006)	(0.006)
Domestic credit provided by banking sector, % of GDP				0.000	0.000				0.000	0.000
				(0.000)	(0.000)				(0.000)	(0.000)
Diversification (1 - Herfindahl Index)					-0.021					-0.031
					(0.035)					(0.036)
Constant	-0.295***	-0.169**	-0.104	-0.090	-0.117	-0.380***	-0.203*	-0.154	-0.153	-0.203
	(0.103)	(0.082)	(0.101)	(0.095)	(0.105)	(0.130)	(0.110)	(0.128)	(0.128)	(0.143)
Observations	45	33	33	33	33	45	33	33	33	33
R-squared	0.26	0.35	0.46	0.46	0.47	0.24	0.35	0.45	0.45	0.46
First stage F-statistic of excluded instrument p-value (H0: underidentified/weakly identified)						0.000	0.000	0.000	0.000	0.000
Hansen J statistic p-value (H0: overidentified)						0.037	0.011	0.007	0.007	0.003
Stock-Wright S-statistic p-value (H0: all endogenous regressors==0 and overid. rest valid, weak-instrument-robust inference)						0.027	0.011	0.011	0.008	0.008

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Instruments for IV regressions: log of population 1994 and log of land area

Table 9
Cross-national Growth Regressions 1994-2004, Including Type of Economy Dummies

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) IV	(7) IV	(8) IV	(9) IV	(10) IV
Log of GDP pc 1994	-0.016*	-0.023***	-0.026***	-0.026***	-0.026***	-0.008	-0.013	-0.024***	-0.025***	-0.023***
	(0.008)	(0.006)	(0.007)	(0.006)	(0.006)	(0.015)	(0.018)	(0.007)	(0.007)	(0.008)
Log of EXPY 1994	-0.001	0.003	-0.010	-0.006	-0.006	-0.101	-0.127	-0.016	0.015	-0.052
	(0.022)	(0.022)	(0.024)	(0.024)	(0.025)	(0.192)	(0.251)	(0.092)	(0.082)	(0.112)
Log of EXPY 1994 * Dummy Low- Income Economy	0.051**	0.035	0.045*	0.042*	0.045**	0.151	0.156	0.049	0.021	0.086
	(0.021)	(0.021)	(0.022)	(0.022)	(0.022)	(0.183)	(0.234)	(0.086)	(0.078)	(0.105)
Log of EXPY 1994 * Dummy Lower-Middle-Income Economy	0.061**	0.074***	0.083***	0.081***	0.082***	0.205	0.197	0.083	0.055	0.119
	(0.030)	(0.026)	(0.027)	(0.028)	(0.028)	(0.208)	(0.250)	(0.094)	(0.085)	(0.114)
Log of EXPY 1994 * Dummy Upper-Middle-Income Economy	0.038	-0.003	0.015	0.015	0.017	0.093	0.110	0.009	-0.026	0.057
	(0.027)	(0.029)	(0.033)	(0.032)	(0.030)	(0.188)	(0.264)	(0.114)	(0.099)	(0.135)
Dummy Low- Income Economy	-0.494**	-0.348*	-0.439**	-0.417**	-0.442**	-1.429	-1.478	-0.477	-0.220	-0.823
	(0.193)	(0.194)	(0.206)	(0.203)	(0.199)	(1.732)	(2.205)	(0.819)	(0.739)	(0.986)
Dummy Lower-Middle-Income Economy	-0.584**	-0.705***	-0.784***	-0.766***	-0.772***	-1.933	-1.859	-0.785	-0.516	-1.124
	(0.278)	(0.241)	(0.251)	(0.256)	(0.257)	(1.961)	(2.365)	(0.882)	(0.802)	(1.068)
Dummy Upper-Middle-Income Economy	-0.367	0.007	-0.151	-0.156	-0.177	-0.896	-1.066	-0.098	0.234	-0.551
	(0.249)	(0.270)	(0.304)	(0.300)	(0.275)	(1.791)	(2.506)	(1.077)	(0.938)	(1.272)
Log of % secund. school att. 1985		0.009***	0.007**	0.008**	0.008**		0.013	0.008*	0.008**	0.009*
		(0.003)	(0.003)	(0.003)	(0.003)		(0.009)	(0.004)	(0.004)	(0.005)
Rule of Law Index 1996			0.007*	0.007*	0.007**			0.007	0.005	0.009
			(0.004)	(0.004)	(0.003)			(0.005)	(0.005)	(0.007)
Domestic credit provided by banking sector, % of GDP				-0.000	-0.007				-0.000	-0.007
				(0.000)	(0.027)				(0.000)	(0.031)
Diversification (1 - Herfindahl Index)					-0.000					-0.000
					(0.000)					(0.000)
Constant	0.190	0.191	0.329	0.299	0.309	1.068	1.319	0.376	0.098	0.715
	(0.175)	(0.184)	(0.205)	(0.207)	(0.204)	(1.727)	(2.215)	(0.853)	(0.763)	(1.023)
Observations	73	59	59	59	59	71	58	58	58	58
R-squared	0.31	0.42	0.46	0.47	0.47	0.05	0.07	0.45	0.45	0.43
First stage F-statistic of excluded inst. p-value (H0: weakly identified)						0.000	0.625	0.715	0.628	0.736
Hansen J statistic p-value (H0: overidentified)						0.517	0.053	0.029	0.037	0.037
Stock-Wright S-statistic p-value (H0: all endogenous regressors==0 and overid. rest. valid, weak-instrument-robust inference)						0.336	0.062	0.040	0.047	0.045

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Instruments for IV regressions: log of population 1994 and log of land area

Table 10
5-year Panel Growth Regressions

	(1) **OLS**	(2) **IV**	(3) **FE**	(4) **GMM**	(5) **GMM**	(6) **GMM**	(7) **GMM**	(8) **GMM**
Log of GDP pc, beg. period	-0.014***	-0.027***	-0.039***	-0.017***	-0.015**	-0.019***	-0.012	-0.007
	(0.003)	(0.005)	(0.007)	(0.006)	(0.007)	(0.005)	(0.008)	(0.007)
Log of EXPY, beg. period	0.034***	0.071***	0.017	0.041***	0.046***	0.051***	0.038**	0.035**
	(0.006)	(0.017)	(0.012)	(0.013)	(0.016)	(0.015)	(0.015)	(0.017)
Log of % secund. school att., beg. period	0.005***	0.001	-0.003	0.006	0.004	0.007	0.008*	0.009
	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.005)	(0.007)
Constant	-0.170***	-0.380***	0.221**	-0.206**	-0.268***	-0.291***	-0.223**	-0.247**
	(0.034)	(0.101)	(0.091)	(0.086)	(0.099)	(0.107)	(0.095)	(0.115)
Observations	620	604	620	604	604	604	604	604
Number of group(ecode)			79	77	77	77	77	77
Instruments				91	70	52	31	28
R-squared	0.45	0.40	0.52					
First stage F-statistic of excluded instrument p-value (H0: underidentified/weakly identified)		0.000						
Hansen J statistic p-value (H0:overidentified)		0.009		0.750	0.320	0.213	0.019	0.022
Stock-Wright S-statistic p-value (H0: all endogenous regressors==0 and overid. rest. valid, weak-instrument-robust inference)		0.000						
AB test for AR(2) in first diff. p-value (H0: No autocorrelation)				0.066	0.179	0.785	0.063	0.192

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All equations include period dummies. IV regressions use log population and log land area as instruments. FE regressions include dummies for countries. GMM is Blundell-Bond System GMM estimator using lagged growth rates and levels as instruments as well as log population and log land area.

Table 11
5-year Panel Growth Regressions, Restricted Sample: Non-high-income Economies

	(1) OLS	(2) IV	(3) FE	(4) GMM	(5) GMM	(6) GMM	(7) GMM	(8) GMM
Log of GDP pc, beg. period	-0.015***	-0.029***	-0.043***	-0.029***	-0.016**	-0.024***	-0.031***	-0.019***
	(0.004)	(0.006)	(0.009)	(0.005)	(0.007)	(0.006)	(0.011)	(0.007)
Log of EXPY, beg. period	0.034***	0.079***	0.026*	0.037***	0.033**	0.047***	0.053***	0.041**
	(0.006)	(0.020)	(0.014)	(0.012)	(0.016)	(0.014)	(0.015)	(0.017)
Log of % secund. school att., beg. period	0.006***	0.002	0.001	0.016***	0.009	0.008*	0.018**	0.016
	(0.002)	(0.003)	(0.004)	(0.004)	(0.006)	(0.005)	(0.009)	(0.012)
Constant	-0.168***	-0.442***	0.144	-0.108	-0.161	-0.219*	-0.238	-0.220
	(0.043)	(0.135)	(0.105)	(0.096)	(0.103)	(0.129)	(0.142)	(0.172)
Observations	420	412	420	412	412	412	412	412
Number of group(ecode)			53	53	53	53	53	53
Instruments				91	70	52	31	28
R-squared	0.43	0.35	0.49					
First stage F-statistic of excluded instrument p-value (H0: underidentified/weakly identified)		0.000						
Hansen J statistic p-value (H0:overidentified)		0.086		1.000	0.988	0.814	0.131	0.299
Stock-Wright S-statistic p-value (H0: all endogenous regressors==0 and overid. rest. valid, weak-instrument-robust inference)		0.000						
AB test for AR(2) in first diff. (p-value)				0.112	0.159	0.358	0.091	0.155

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All equations include period dummies. IV regressions use log population and log land area as instruments. FE regressions include dummies for countries. GMM is Blundell-Bond System GMM estimator using lagged growth rates and levels as instruments as well as log population and log land area.

Table 12
8-year and 10-year Panel Growth Regressions

	8-year panel				10-year panel			
	(1) **OLS**	(2) **IV**	(3) **FE**	(4) **GMM**	(1) **OLS**	(2) **IV**	(3) **FE**	(4) **GMM**
Log of GDP pc, beg. period	-0.015***	-0.028***	-0.037***	-0.017***	-0.017***	-0.028***	-0.043***	-0.016***
	(0.003)	(0.006)	(0.006)	(0.006)	(0.003)	(0.006)	(0.006)	(0.005)
Log of EXPY, beg. period	0.033***	0.068***	0.017	0.048***	0.036***	0.068***	0.015	0.044***
	(0.005)	(0.014)	(0.011)	(0.012)	(0.006)	(0.016)	(0.010)	(0.016)
Log of % secund. school years attained., beg. period	0.006***	0.003	-0.002	0.007	0.005***	0.002	-0.004	0.003
	(0.002)	(0.002)	(0.003)	(0.005)	(0.002)	(0.003)	(0.004)	(0.008)
Constant	-0.142***	-0.338***	0.204**	-0.269***	-0.156***	-0.334***	0.288***	-0.229*
	(0.030)	(0.083)	(0.085)	(0.082)	(0.034)	(0.096)	(0.092)	(0.115)
Observations	387	377	387	377	308	300	308	301
Number of group(ecode)			79	77			78	77
Instruments				34				26
R-squared	0.50	0.42	0.62		0.56	0.50	0.70	
First stage F-statistic of excluded instrument p-value (H0: underidentified/weakly identified)		0.000				0.000		
Hansen J statistic p-value (H0:overidentified)		0.004		0.192		0.005		0.269
Stock-Wright S-statistic p-value (H0: all endogenous regressors==0 and overid. rest. valid, weak-instrument-robust inference)		0.000				0.000		
AB test for AR(2) in first diff. (p-value)				0.829				0.454

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All equations include period dummies. IV regressions use log population and log land area as instruments. FE regressions include dummies for countries. GMM is Blundell-Bond System GMM estimator using lagged growth rates and levels as instruments as well as log population and log land area.

Table 13
8-year and 10-year Panel Growth Regressions, Restricted Sample: Non-high-income Economies

	8-year panel				10-year panel			
	(1) OLS	(2) IV	(3) FE	(4) GMM	(1) OLS	(2) IV	(3) FE	(4) GMM
Log of GDP pc, beg. period	-0.016***	-0.029***	-0.040***	-0.026***	-0.018***	-0.030***	-0.050***	-0.028***
	(0.003)	(0.006)	(0.008)	(0.009)	(0.004)	(0.006)	(0.009)	(0.010)
Log of EXPY, beg. period	0.032***	0.075***	0.025**	0.050***	0.035***	0.075***	0.024*	0.043***
	(0.006)	(0.018)	(0.012)	(0.012)	(0.006)	(0.020)	(0.013)	(0.013)
Log of % secund. school years attained., beg. period	0.007***	0.004	0.003	0.013***	0.006***	0.003	-0.001	0.013
	(0.002)	(0.003)	(0.004)	(0.005)	(0.002)	(0.003)	(0.004)	(0.009)
Constant	-0.133***	-0.398***	0.135	-0.231**	-0.143***	-0.380***	0.228**	-0.145
	(0.041)	(0.115)	(0.096)	(0.114)	(0.045)	(0.130)	(0.108)	(0.118)
Observations	262	257	262	257	208	204	208	204
Number of group(ecode)			53	53			53	52
Instruments				34				21
R-squared	0.48	0.34	0.59		0.54	0.46	0.69	
First stage F-statistic of excluded instrument p-value (H0: underidentified/weakly identified)		0.000						
Hansen J statistic p-value (H0:overidentified)		0.042		0.584		0.046		0.856
Stock-Wright S-statistic p-value (H0: all endogenous regressors==0 and overid. rest. valid, weak-instrument-robust inference)		0.000						
AB test for AR(2) in first diff. (p-value)				0.640				0.913

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
All equations include period dummies. IV regressions use log population and log land area as instruments. FE regressions include dummies for countries. GMM is Blundell-Bond System GMM estimator using lagged growth rates and levels as instruments as well as log population and log land area.

X. Conclusions

The indicators computed in this paper provide guidance for policies to expand cost efficient exports and foster growth. Three important groups of products are identified which are important in terms of potential government action to improve export performance and future growth. First, there are goods which can be called "high return-low cost products", and which are close to the efficiency frontier, using HHR terminology. This group is composed of goods currently exported by Argentina that show both high product income (and therefore can yield high returns in terms of GDP growth) and low distance (which means that are positioned in a dense region of the product space and are therefore more likely to result in the development of new export products of high product income). In general, goods at the efficiency frontier include chemical products and primary products with some degree of value added, including moderately processed meat, fish and grains. Among this group wheat, fish fillets and unwrought aluminum figure prominently in total exports.

Second, there is a set of exported products that can be called high return-high cost products. This set is composed of goods showing high product income but also high distance. They can potentially foster growth given their intrinsic high income content, but they are located in a low density region of the product space, which makes it relatively less likely that new products with similar characteristics will be brought into the Argentine export basket. In other words, developing new export products with similar characteristics to the goods in this second group might prove more costly in terms of the investment required. The most important exports in this group are a variety of chemical products, several types of machinery and tools (printing machinery, auto parts, drawing machines, specialized tools) and optical goods (lenses, micro-optical).

Third, there is a set of goods than can be called low cost-low return products. This group comprises goods with low product income as well as low distance. Typical exports in this category are primary products and minerals with little or no processing. The advantage of these goods in terms of potentially fostering economic growth lies in their low distance. They belong to a region of the product space that would make it relatively easy to develop new export products with relatively similar input needs (physical and human capital, sector-specific financial requirements, institutional or regulatory requirements, infrastructure, supply chain characteristics, customer characteristics, etc.).

It is important to note that the analysis in this paper does not identify specific policies needed for a successful export performance. The value of the analysis is to identify promising export sectors and to focus on sector policies that might limit further export expansion, or possibly impede the development of new export products.

A second set of conclusions is that public policies to improve export performance as a means to foster higher growth should not be confined to industrial products alone. Industrial goods do indeed show higher product-income values, as would be expected. However, several of the goods that appear to be most efficient at the efficiency frontier are related to agriculture. Within the HHR framework for growth through exports, the key element is to identify goods showing the best tradeoff in terms of having high product income and low distance, regardless of the sector they belong to.

This analysis should be seen as the first step towards a well-focused policy framework for exports and growth. The value of this analysis is to focus efforts on setting up mechanisms to identify shortages in public goods that might constrain the development of higher income exports. A next step could be, for example, to undertake international case studies which illustrate success

stories. Specific policy measures can only be identified by in-depth sector-specific analysis. An initial minimum list of core ingredients would include elements such as (a) setting up channels for private-public sector communication and partnerships, (b) facilitating mechanisms for private sector self-organization if necessary in industries or sectors in which producers are located, (c) developing institutions within the public sector to improve the provision of public goods.

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