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Resumen

Muchos autores han señalado en la estructura productiva del Uruguay una de las causas del magro desempeño de largo plazo de su economía. El presente trabajo intentará ahondar en esa relación, aprovechando los recientes desarrollos metodológicos sugeridos por Hausmann e Hidalgo (2009). El *Método de los Reflejos* que presentan, permite acercarse al nivel de complejidad de una estructura productiva a partir de los bienes que esa economía exporta, por lo que habilitan una aproximación a su crecimiento futuro. Como resultados se encuentra que el país no ha logrado desarrollar ninguno de los bienes que se pueden considerar dentro de los más sofisticados, e incluso se ha alejado de los bienes más complejos que alcanzó en el período. En consecuencia, la estructura productiva uruguaya mantuvo una tendencia al deterioro de su complejidad global, especialmente en los años posteriores a 1994, lo que llama la atención sobre la necesidad de políticas focalizadas en sectores clave si se pretende mantener un proceso de crecimiento económico a largo plazo que aproxime al país respecto a los países desarrollados.

Palabras clave: Convergencia, Cambio Estructural, Capacidades Tecnológicas, Método de los Reflejos.

Abstract

Many Works have pointed at Uruguayan productive structure, as one of the main causes of the country's low long term growth rate. This paper presents a different empirical view of the relationship using recent developments proposed by Hausmann and Hidalgo (2009). Their *Method of Reflections* allows an approximation to the level of complexity that a productive structure has, and therefore their indicators yield hints to that economy's future growth. Results show that Uruguay has never reached the production of sophisticated products, and it has even moved away from the most sophisticated products it has ever reached in the period 1962-2008. As a consequence, Uruguayan level of productive structure complexity exhibit a lowering trend, especially after 1994, which calls attention for industrial policy if the recent path of high growth is to be maintained.

Keywords: Convergence, Structural Change, Technological Capabilities, Method of Reflections.

JEL: F19, O14, O33, O54.

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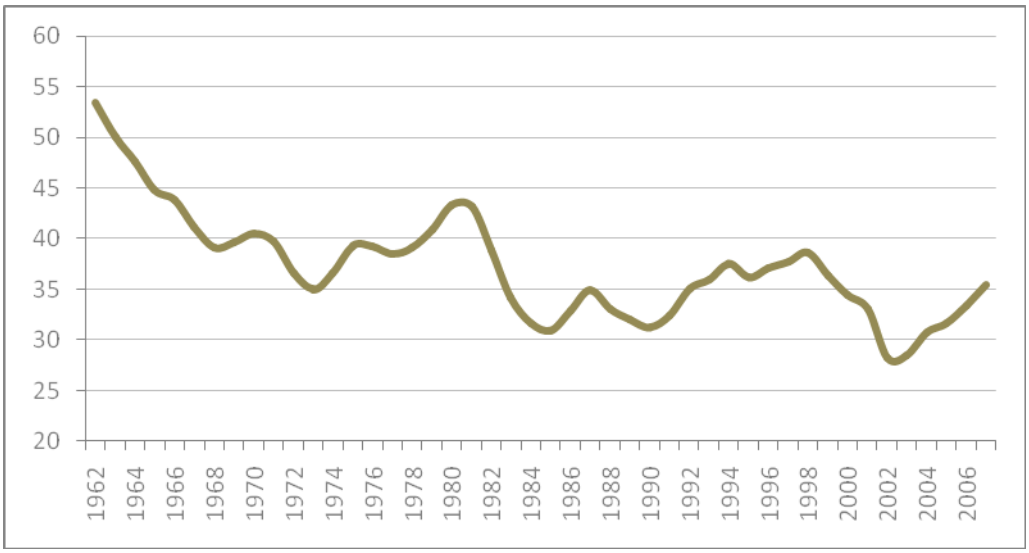
Introduction

During the twentieth century Uruguayan economy has been through periods of rapid expansion followed by years of severe contraction or long stagnation. This caused an overall trend of divergence from developed countries average living standards (see Graph 1 for a depiction of this trend over the last 5 decades). There is a long literature trying to explain this fact by using different approaches: many of them focus in short term issues (e.g. lack of a consistent macroeconomic policy), while many others search for a more structural explanation.

Graph 1. Ratio of per capita GDP: Uruguay to six developed countries (France, Germany, Japan, Netherlands, UK and USA.).



Source: Heston et al. (2009).

On the other hand, the new and sustained process of convergence that Uruguay has started in 2003 has recently motivated many optimistic comments from authorities and the press. In this context it seems inevitable to wonder which the real scope for this new process is. If it is true that an important part of Uruguayan poor long term performance has its roots in structural factors, then a good question to ask is how these factors have changed over the last years. This will help determine whether the country is starting a new chapter of

convergence in its economic history, or whether it is only surfing another big but not-lasting wave.

This paper intends to strengthen the literature that identifies the Uruguayan productive structure as an important part of the country's growth determinants. For this task we use the Method of Reflections introduced by Hausmann and Hidalgo (2009). Through their indicators we try to evaluate the long term performance of the country's productive structure complexity, over the period 1962-2008.

Background literature

The idea that a country's productive structure strongly determines its long term growth performance is not new. The endogenous growth models of Romer (1986), Grossman and Helpman (1991) and Aghion and Howitt (1992), among others introduced this idea into mainstream economics. These models, based in Schumpeter's ideas, place innovation processes and structural change in the center of the economic growth determinants. They establish that innovation processes are important to growth because of their potentiality to overcome diminishing returns restrictions. Structural change affects growth through technological externalities, indivisibilities and complementarities in the productive process. These models explain that the importance of the technologically advanced sector is a relevant factor for economic growth: there is a big difference between a country that produces mainly fruits and one where the main production is related with computers.

Evolutionary literature, also fed by Schumpeter's ideas, made its contribution as well. For example Lundvall (1992), considers that applied-to-production technology is non transferable in some degree. He also states that the introduction of technology to the productive process happens in a slow and cumulative way. This implies that all innovation process has certain path dependence and therefore it is possible for different countries to transit different technological rows. This means that, different countries, having diverse innovation process histories, will acquire different technological capabilities, which of course will influence their ability to produce different products. In a simple way, a country that has spent some time producing mainly fruits will have it hard to change its

specialization since it does not have the technological accumulations required to do something different.

Given that what a country produces determines its future growth, different technological capabilities will yield different growth patterns across countries. If this is true, then productive structures have lots of information on countries' potential growth, since it is inside them that technological capabilities are inserted.

The attempt to approach technological capabilities through an evaluation of a country's production seems then logical. There are plenty of papers on Latin-American poor long term performance using this theoretical framework. In most of them it is possible to find the idea that a country's technological capabilities determine its specialization. But none of these works makes an attempt to measure those capabilities.

There are plenty of papers on Uruguayan poor long term performance using this theoretical framework. Some of the latest are works from PNUD (2008) or Bittencourt (2003). We can find in them the idea that a country's technological capabilities determines its specialization, but none of these works makes an attempt to measure those capabilities.

Hausmann et al. (2007) presented the Product Space (PS) and its associated indicators, and by doing this they suggested a way for getting closer to a measure of countries' technological capabilities. They present an inductive measure of distance between technological requirements of two products, based on information on the countries that have managed to export both of them. This is used to build up a product map, called Product Space, where products are placed close or far from each other according to their technological similarity. This helps to see how easy it is for a country to diversify its production.

There has been some work, applying their suggestion to the Uruguayan case. First, Ferreira-Coimbra and Vaillant (2009) use the proximity matrix to compare the position occupied by different Uruguayan exports between 1985 and 2007. The article however, doesn't have the objective of arriving at a synthetic measure of technological capabilities. Their conclusion is that Uruguayan productive structure is "disconnected", which means

that even when the country developed complex productive processes, this never yield to the production of new complex products. Thus, the country focused its production in natural-resources-intensive products, which configure the natural comparative advantage for Uruguay.

Using the same instrumental, Brunini et al. (2010) tried to come up with a measure of Uruguay's potentialities for changing its productive structure in a way that allows the country to enter a convergence path. Then they compare their results for Uruguay with those obtained for other natural-resources-based economies. They find that an important pre-requisite for structural transformation is export diversification, for the countries analyzed in their paper. This is a strong but intuitive finding since a diversified production implies broader technological accumulations, and this allows a country to face a wider range of products to export, which increases the probability of exporting complex products.

More recently, Hausmann and Hidalgo (2009) presented the Method of Reflections (MR) as a way to measure a country's technological capabilities and also as a way of measuring technological requirements of products. The authors support the idea that there are important factors for productive processes that are non-transferable between countries, which imply that different countries may have accumulated different technological capabilities, and therefore their potentiality to produce diverse products will differ. They suggest that is due to these differences that some countries achieve the production of complex products while others do not.

Data

Hausmann and Hidalgo (2009) establish that economic complexity can be captured by looking at the place that a country occupies in international trade. Therefore, they use export data to build the MR indicators.

Following their suggestion, this paper uses export data from Feenstra et al. (2005), for 75 countries. This dataset contains 4-digit product export data in the SITC classification. These authors matched information from exporting countries with records from importing countries since import data tends to be more accurate than export data. They gathered

information from the COMTRADE dataset for the period 1962-2000. In order to expand the time frame of this analysis, this paper also uses COMTRADE export data for the period 2001-2008, taking the year 2000 as the matching year.

There are some limitations in using this data to analyze a country's productive structure. First, for this kind of analysis it would be desirable to use more disaggregated export data, since information is not presented strictly at a product level at 4-digit level. This paper uses Feenstra et al. (2005) database anyway because of the extended period it covers, and the reliability of its construction. Long term analysis is required when taking a look at productive structures which change over long periods of time.

Another limitation stems from working only with product export data, since the analysis made here will completely ignore production for the domestic market and service exports. This is a strong impediment when trying to get closer to an economy's technological capabilities, since both kinds of production may provide a great deal of technological learning to the productive structure of a country.

Still, we think that the analysis proposed here will bring very useful information about the analyzed economy. As stated by Hausmann and Hidalgo (2009), what matter to explain specialization and growth is the ability that countries have to diversify their productions. This means that if we find the Uruguayan position to be weak when looking at its product exports, then we will know there is something to improve there even when we are ignoring an important part of its productive structure.

Other auxiliary data, like countries GDP or population, where taken from Penn World Tables version 6.3, published by Heston et al. (2009).

Analytical Framework

The export data gathered for this paper may be used for two different goals. On one hand, following Hausmann and Hidalgo (2009) and their Method of Reflections, trade data may be used to build synthetic indicators of productive structure complexity and product sophistication. On the other, following Hausmann and Klinger (2006), trade data may

facilitate the measure of technological similarity between products or between some products and a country's technological capabilities.

The Method of Reflections

Hausmann and Hidalgo (2009) propose to measure a country's technological complexity by looking at its current export basket. They consider a country's export basket to be a good proxy of a country's strongest production, since exports are international-market-tested products.

In order to perform this approximation, they first use Balassa's revealed comparative advantage index (Balassa, 1986):

$$(1) \qquad RCA_{c,p} = \frac{\frac{e(c,p)}{\sum_{p} e(c,p)}}{\frac{\sum_{c} e(c,p)}{\sum_{c,p} e(c,p)}}$$

where *e(c,p)* is the export value of product *p* by country *c*. The $RCA_{c,p}$ gives a ratio of the importance of product *p*'s exports in country *c*'s export basket to the importance that the same product have in worldwide trade.

Then they establish a threshold that separates those products that are exported with comparative advantages by a country from those whicht are not. We built a matrix of countries (rows) and products (columns) in which every component follows the next rule:

$$(2) \qquad M_{c,p} = \begin{cases} 1 & if \ RCA_{c,p} \geq R^{*} \\ 0 & otherwise \end{cases}$$

This paper follows Hausmann and Hidalgo (2009) taking the threshold $R^{*}=1$. Therefore our analysis will consider as exported by a country only those products that have a higher or equal weight in country's export basket than in global trade.

Using this matrix, we can build a database with the MR's simpler indicators:

$$k_{p,0} = \sum_{c=1}^{N_c} M_{c,p} \quad (3)$$

$$k_{c,0} = \sum_{p=1}^{N_p} M_{c,p} \quad (4)$$

being N_p the total number of products considered (here N_p =775) and N_c the total number of countries used in the dataset (here N_c =75).

Equation (3) establishes that $k_{p,0}$ gives a measure of the number of countries that export product p, so it is a measure of that products ubiquity. Indicator $k_{p,0}$ can also be seen as a simple measure of product p's sophistication, since when a product is exported by few countries it means that technological capabilities required to do so are rare.

Similarly, equation (4) shows that $k_{c,0}$ gives a measure of the number of products exported by country c, and so it is a measure of that country's diversification. This indicator can also be seen as a very simple measure of country c's productive complexity, since a diversified economy must have acquired many technological capabilities to be successful in so many productive processes.

The rest of the MR is constructed following:

$$k_{p,n} = \frac{1}{k_{p,o}} \sum_{c=1}^{N_c} M_{c,p} \times k_{c,n-1} \quad (5)$$

$$k_{c,n} = \frac{1}{k_{c,o}} \sum_{p=1}^{N_p} M_{c,p} \times k_{p,n-1} \quad (6)$$

where n is the number of iterations used to define indicators $k_{p,n}$ and $k_{c,n}$.

We have two vectors as the result of these operations. On one hand we have vector

$$k_p = \left\{ k_{p,0}, k_{p,1}, \ldots, k_{p,n} \right\}$$

defined for each product p, and on the other hand we have vector

$$k_c = \left\{ k_{c,0}, k_{c,1}, \ldots, k_n \right\}$$

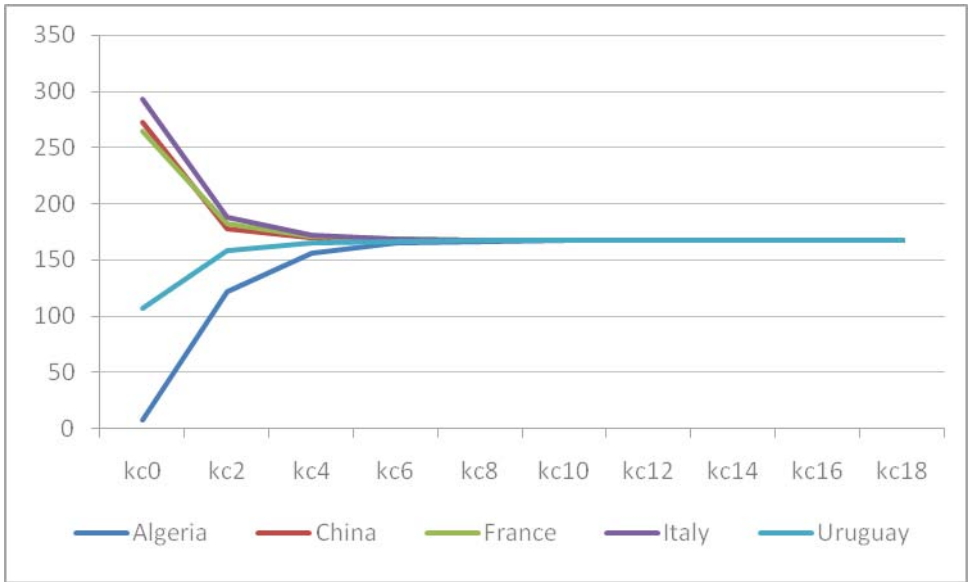
defined for every country c.

To facilitate interpretation let us consider the simplest cases. Following equation (4), $k_{c,1}$ would be the average ubiquity of products exported by country c, while following equation (3) $k_{p,1}$ would be the average diversification of countries exporting product p. Repeating this one more time we see that $k_{c,2}$ is the average diversification of countries exporting products that country c exports as well. Similarly, $k_{p,2}$ is the average ubiquity of products exported by countries that also export product p.

Interpretation of the MR indicators gets harder as we increase de number of iterations, since every vector component gathers information from preceding components, but this also means that elements coming from a higher iteration numbers will have more information about economic complexity of a country or sophistication of a product. Therefore, every component of vector k_c can be considered as a measure of an economy's complexity since it gathers information of the country's diversity, and with successive iterations it will also include information about its production ubiquity. On the other hand, components of vector k_p can be considered as measures of product sophistication since they collect information about product's ubiquity and with successive iterations they manage to capture complexity of the exporters of those products as well.

As shown in Graph 2 for some selected countries, as the number n of iterations grows, the MR indicators converge to their mean, which is not surprising given that they all are averages of other averages. This effect causes a loss of significance of the level of indicators resulting from higher iteration numbers.

Graph 2. $k_{c,i}$ iteration results when i is an even number for some selected countries (2008).



Source: Feenstra et al. (2005) and COMTRADE.

It should also be pointed that odd components inside a vector will converge to a mean, while even components will converge to another, as showed by Graphs A.1 in the Annex. This is not surprising given the way indicators are constructed: in building $k_{c,i}$ information from $k_{p,i-1}$ is used, but information from $k_{c,i-1}$ is not, and the same happens in construction of $k_{p,i}$, so odd components do not contribute in even components construction and vice versa.

Even though the convergence-to-the-mean effect weakens interpretation of the level of the indicators resulting from high iterations, these indicators yield a more robust relative ranking of countries and products than is obtained with less iterated indicators. Graph A.2 in the Annex shows how the sorting of the 75 countries tends to stabilize when the iteration increases. The same happens with products. As explained in Hausmann and Hidalgo (2009) this is because more iterated indicators gather more information and therefore they depurate important distortive effects (as country size). Hence, the sorting stemming from higher iterations can be considered as the one that better reflects economies complexity and products sophistication.

Graph A.3 in the Annex shows the sorting differences between $k_{c,18}$ and $k_{c,17}$ rankings. It is remarkable that both rankings may differ in a country's spot by one place, but a difference

of two or three spots is rare. As we increase the number of iterations, the resulting ranking of even and odd indicators of the same vector gets more alike.

Summing up, indicators that come from higher iterations achieve to sort countries and products in a more accurate way according to their complexity or sophistication. Nevertheless these indicators miss the real intensity in differences between countries, task that less iterated indicators may do.

Therefore, there are two possibilities to use MR indicators, and each will be more adequate for pursuing different kinds of objectives. Following Hausmann and Hidalgo (2009) this paper will take $k_{c,18}$ and $k_{p,19}$ as high iteration indicators when a accurate sorting is needed. We will use lower iterated indicators when the intensity of differences is to be considered. As Graph A.2 shows, after certain threshold for n, it is possible to find some indicators that sorts elements in a pretty accurate fashion while maintaining some intensity of differences among positions, so a middle ground is possible.

Hausmann and Hidalgo (2009) make some empirical tests in order to establish the potentiality of these indicators. They conclude that vector k_c components manage to capture economies technological capabilities. They also find that these indicators are strongly correlated with country's per capita GDP, and can be used to predict future growth (see Appendix of Hausmann and Hidalgo, 2009:22).

The Product Space

Hausmann and Klinger (2006) present a measure of the proximity between different productive processes. They calculate a proximity matrix between every pair of products i and j for the period 1998-2000, as the minimum between the probability that a country exports product i given that the same country exports product j, and the probability that a country exports product j, given that it exports product i.

$$\phi_{ij} = \min\{P(M_i / M_j), P(M_j / M_i)\} \tag{7}$$

This indicator can be interpreted as an inductive measure of technological similarity between two products, since ϕ_{ij} will take higher values when many countries are exporters of both products, which means that both products have similar technological requirements.

Once we have a proximity matrix, we can build the Product Space (PS) proposed by Hausmann et al. (2007). The PS can be visualized by graphing the maximum spanning tree of proximities (ϕ_{ij}) between every pair of products ($i \neq j$).

Finally, following Hausmann and Klinger (2006), we can get a measure of technological proximity between a country's productive structure and a product *i* following:

$$(8) \qquad density_{i,c,t} = \left[\frac{\sum_i \phi_{j,i,t} \cdot M_{i,c,t}}{\sum_i \phi_{j,i,t}} \right]$$

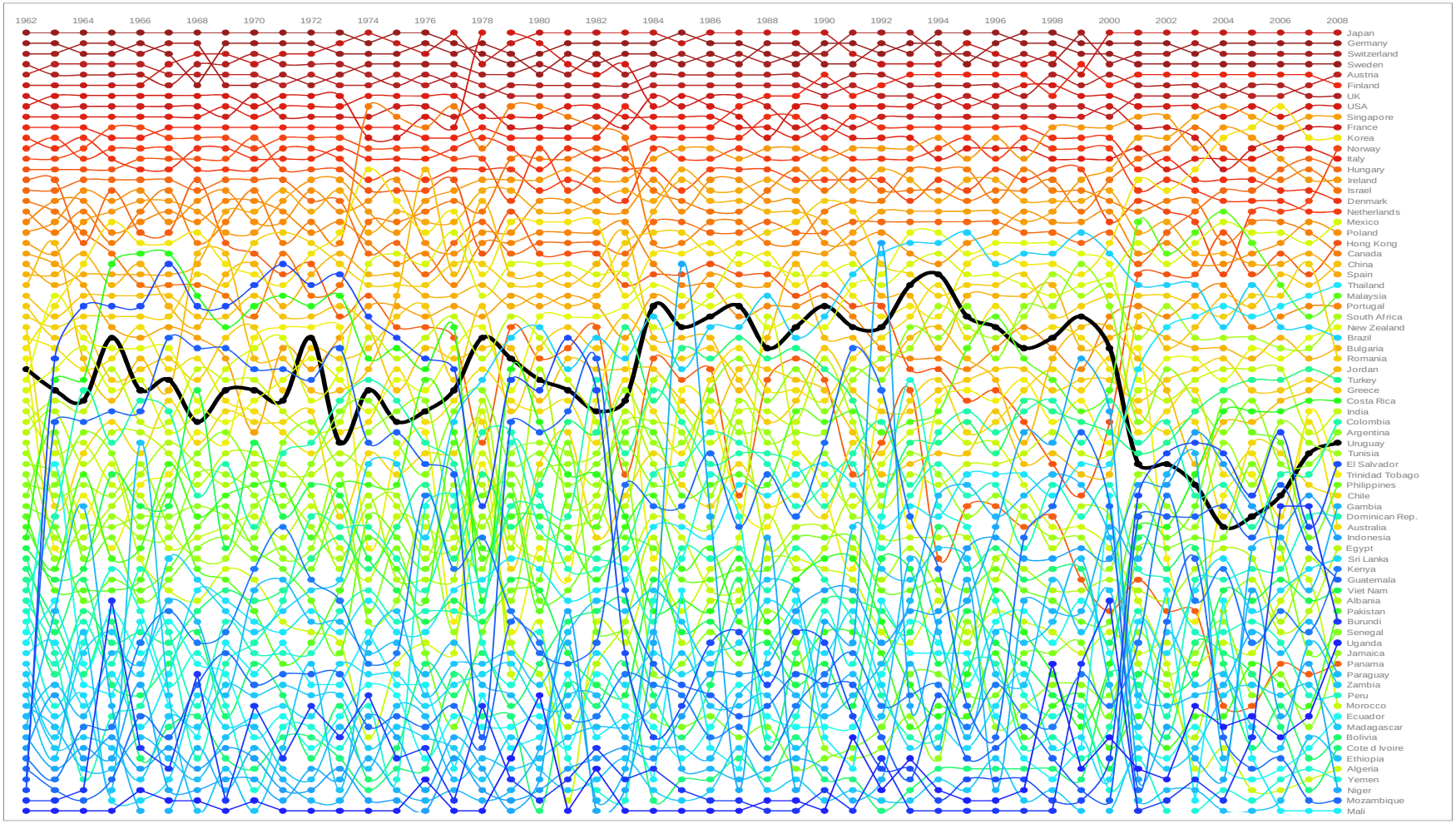
where *t* indexes the time period considered, and *c* represents the country. This indicator can take every value between 0 and 1. A value of 1 means that country *c* has developed revealed comparative advantages in many products close to product *i*, which means that country *c* has many of the capabilities needed to produce product *i*. This is why this indicator reflects how alike are country *c*'s technological capabilities and product *i*'s technological requirements in a moment *t*. Empirical findings in Hausmann and Klinger (2007) support this interpretation, since they conclude that $density_{i,c,t}$ is a good predictor of future exports of country *c*.

Results

Global evolution of Uruguayan productive structure

In order to get a broad perspective of how the Uruguayan complexity has evolved, it is useful to take a look at the evolution of its $k_{c,18}$ over the time period considered here. This is presented in Graph 3 which shows that picture for all 75 countries considered here. In this ranking, higher positions are occupied by more complex economies.

Graph 3. $k_{c,18}$ ranking evolution for the 75 countries in the period 1962-2008.



Source: Feenstra et al. (2005) and COMTRADE.

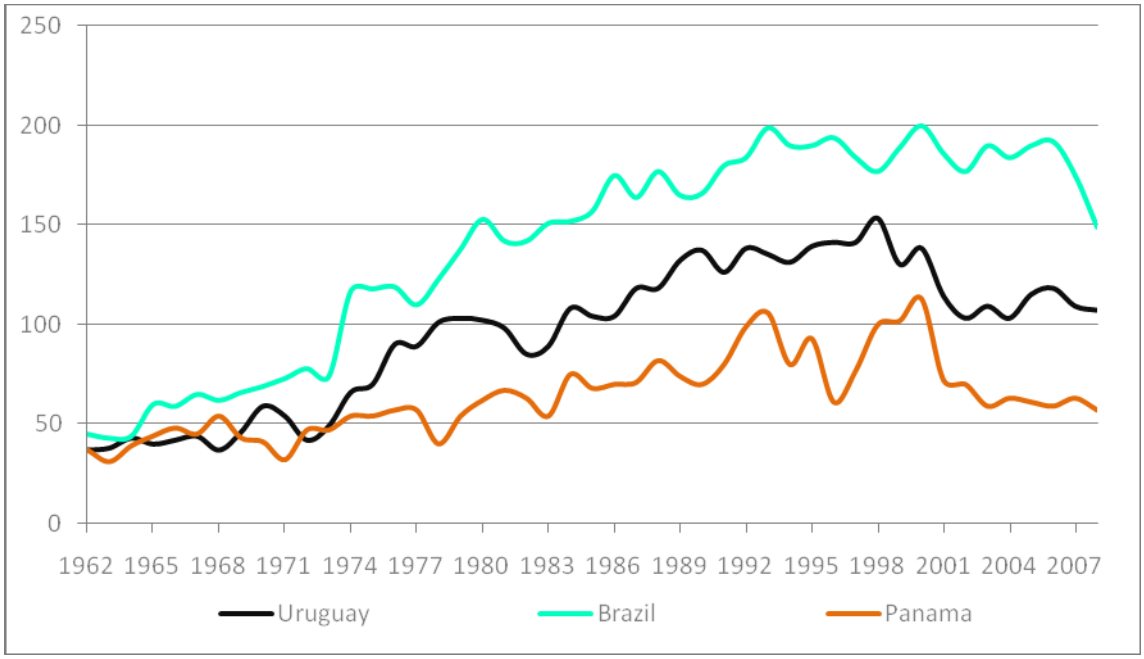
Colors in the graph are sorted according to the position occupied by each country in the first year considered, except for the case of Uruguay which has been marked in black for visualization purposes. It can be seen that some color straps remain more or less unmixed all across the period, which means that processes of structural transformation are not the most common thing to see. This is true especially for countries from the upper part of the graph. In the lower part variation is stronger, and cases with extreme volatility can be found. This is due to the small size of some of these economies and also to a lower quality of their data.

However, it is possible to find some cases of continuous growth in structural complexity, as those of Korea, Mexico, Thailand, Malaysia or Brazil, which have been largely mentioned as notorious examples of structural change. Some other countries show an important decrease in structural complexity, as is the case of Panama or Algeria.

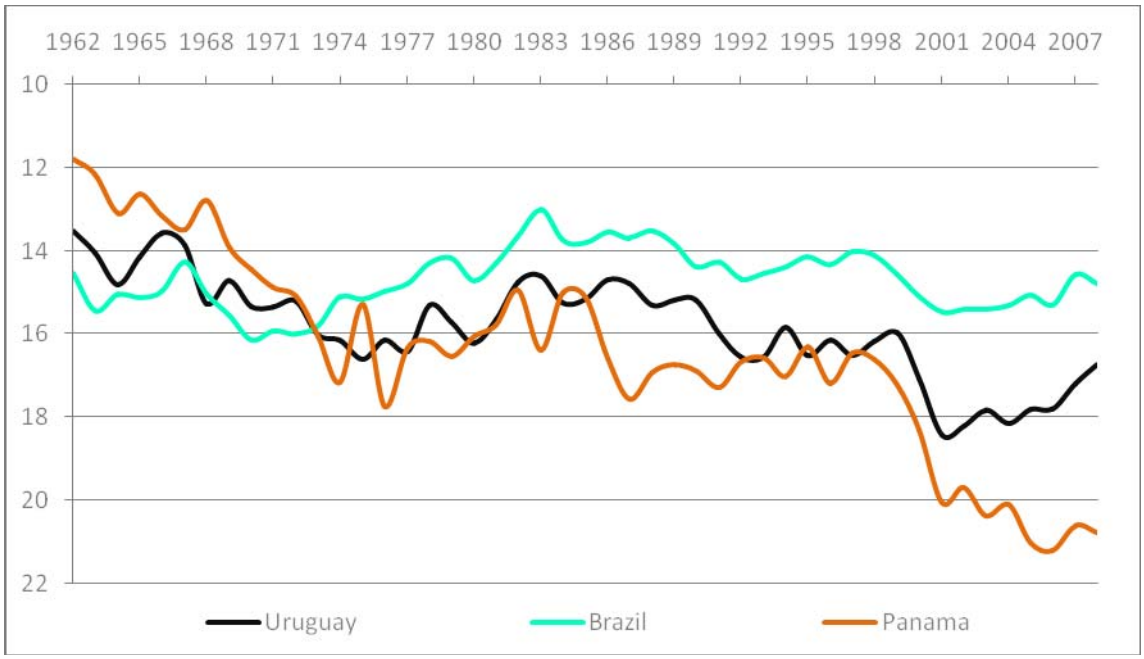
Uruguay seems to exhibit four different tendencies over the period. In 1962-1973 there is a soft decrease in $k_{c,18}$'s level, which means that country's relative capacity of producing sophisticated products got lower that period. This tendency changes and gets positive in the period 1973-1994, starting this year a marked decline until 2004. From 2005 onwards it begins a markedly increasing period but it does not reach back to its historic levels by the year 2008.

For a better explanation of the causes behind the evolution depicted, it is useful to analyze some of the other MR's indicators. Analyzing less iterated indicators like $k_{c,0}$ and $k_{c,1}$ can give us an idea of the intensity of changes over time in the two basic dimensions that the MR considers: countries diversification (the first one) and exports sophistication (the second). This is shown in Graphs 4.a) and 4.b), where we present figures for Uruguay but also for other two countries presented as benchmarks of positive and negative structural transformation: Brazil and Panama. Whenever we see a growing $k_{c,0}$ this will mean that the country's diversification in increasing, while higher values of $k_{c,1}$ means that the country's exports are less sophisticated (so we choose to revert the y-axis in graph 4.b).

Graph 4. a) $k_{c,0}$ evolution for Uruguay, Brazil y Panama (1962-2008).



Graph 4.b) $k_{c,1}$ evolution for Uruguay, Brazil y Panama (1962-2008).



Source: Feenstra et al. (2005) and COMTRADE.

Both graphs show different tendencies between Brazil and Panama: while Brazil's diversification has increased enormously maintaining its export's average ubiquity, Panama's diversification has not increased significantly and its export's average ubiquity has strongly declined over the period. Both phenomenon are clearly correlated with the divergence in productive structure complexity between these two countries.

Focusing on Uruguay, Graph 4.a) shows that the country's diversification increased steadily over the period 1962-1998, but during years 1999 to 2002 there is an important decrease that never recovers again in the period. Graph 4.b) shows an important worsening of Uruguayan export's ubiquity during periods 1962-1975 and 1986-2001, and some years of recovery in between.

It can be inferred that overall loss of complexity in Uruguayan productive structure is strongly influenced by its lowering capacity of export sophisticated products. This conclusion contrasts with the one presented in Brunini et al. (2010), where the authors state that Uruguay does not have an export-sophistication problem. On the contrary, they conclude that Uruguay's technological problem stems from its poor diversification since they find that an important part of Uruguay's exports can be considered as sophisticated.

The difference between their conclusion and ours is based on the construction of the indicators used. Brunini et al. (2010) use *PRODY* as a measure of product's sophistication, following Hausmann et al. (2005). *PRODY* assigns to every product, the per capita GDP of its exporters, weighted by the country's *RCA* in that product, therefore it considers that a product is sophisticated if exporters of that product have high per capita GDP levels.

Then, in order to establish a country's global complexity, Brunini et al. (2010) build the *EXPY*, which sums the *PRODY* of every exported product in a country, weighted by its participation in the export basket.

Even though these indicators are very useful for international comparison, when studying the case of a small, land-based economy like Uruguay, they may not be the best option. The existence of important distortions in land-based products international trade, cause that many rich countries report exports in this kind of products, which means many of these products usually have a relative high *PRODY*. This effect makes *PRODY* an unsuitable indicator of sophistication for countries like Uruguay that appears to have a sophisticated export basket, when in fact it is concentrated in products that are not considered the biggest technological knowledge generators or diffusers, like cattle-based products.

Hidalgo (2009) makes a comparison between *PRODY*-based indicators and MR's indicators. He concludes that the latter set of indicators overcome most limitations of the former set by dropping the use of per capita GDP, and therefore, by treating each country as equal to the rest in their construction. Even when international trade distortions may still affect the outcomes obtained, these distortions will not be overestimated for countries exporting some of the products rich countries export, as is the case of Uruguay.

Product-level analysis

In this section we present a detailed product-level analysis on the evolution of the Uruguayan productive structure, made by looking at the sophistication level of the products exported over the period. Table A.1 in the Annex presents a list of all products for which the country has accomplished *RCA>1* for each of the nine 5-year periods considered between 1964 and 2008. Only to simplify the table presentation, we exclude products that only suffice this condition in one of the sub-periods, with the exceptions of those products that suffice the condition in the last sub-period.[2]

Table A.1 shows the product's four digit code, its name, its classification according to Leamer (1984), its average *RCA* for the sub-period and its relative ranking position according to the 2008's de $k_{p,19.}$ This last column is the one that sorts products in the table, and must be read as the position of a product in a decreasing 1 to 775 ranking, according to its sophistication.

By presenting this table we aim to show the sophistication level of traditionally exported products, but also of those products that the country has abandoned, and those recently-developed products that may show where the country is heading to.

A simple overview of the table allows us to conclude that Uruguay has no historic tradition in exporting sophisticated products: the country reached only 7 products of

[2] This exception is made because of the importance of the last sub-period for the analysis proposed in the next section.

those ranked among the top 100 over the whole period. Only one of them is still a part of the country's exports today: product 5411 (marked red and related with provitamins). This product has a long tradition in the country since it also appears along the 1946-1978 period.

In the last period considered only two products of the Uruguayan export basket ranked among the top 200 according to $k_{p,19}$. This allows us to conclude that Uruguay has recently abandoned the production of the most sophisticated products ever reached.

Table A.1 also helps to see how some land-based products have increased their participation in the country's export basket since 1990. Products 4113, 6130, 482, 2224, 111, 115, 12, 616, 6114, 421 or 422 (all marked orange), have an outstanding grow in their average *RCA* over the period 1990-2008. These are products related to animal oil, greases, fur skins, malt, cow or horse meat or leather, live sheep, natural honey and rice. Ferreira-Coimbra and Vaillant (2009: 28) link this phenomenon with the tariff-reducing policy applied in Uruguay during this period, which enhances specialization in the country's natural comparative advantages.

Product 2460 (pulpwood, marked green) also has enormously increased its *RCA*, but this happened only over the last five year sub-period and, as has been largely studied, this is not only due to the general openness policy, but it is also due to focalized-incentives policy.

It is also possible to identify another relevant product group: those for which Uruguay have always had high *RCA*. These products can be considered as traditional comparative-advantage-based products since their share of total exports does not seem to depend on the country's adopted commercial policy. Belonging to this group we find products 6542, 6512, 8483, 2686, 2682 and 2681 (highlighted in yellow), which are animal hair, wool or fur skin based products.

All products named above (excluding product 5411) have a high or rapidly growing *RCA*, but their $k_{p,19}$ ranking positions are not good, so they cannot be considered sophisticated products.

There are however some intermediate-sophisticated products that has been recently developed by the country, as is the case of products 5162, 6210, 6553, 8921, 7832 and 2482 (marked blue). Nevertheless, these products do not have high *RCA*'s (except for products 6210 and 6563) and therefore they cannot be considered as solid comparative advantage products. Also, because of their diverse nature, it is hard to find among them a common set of technological requirements.

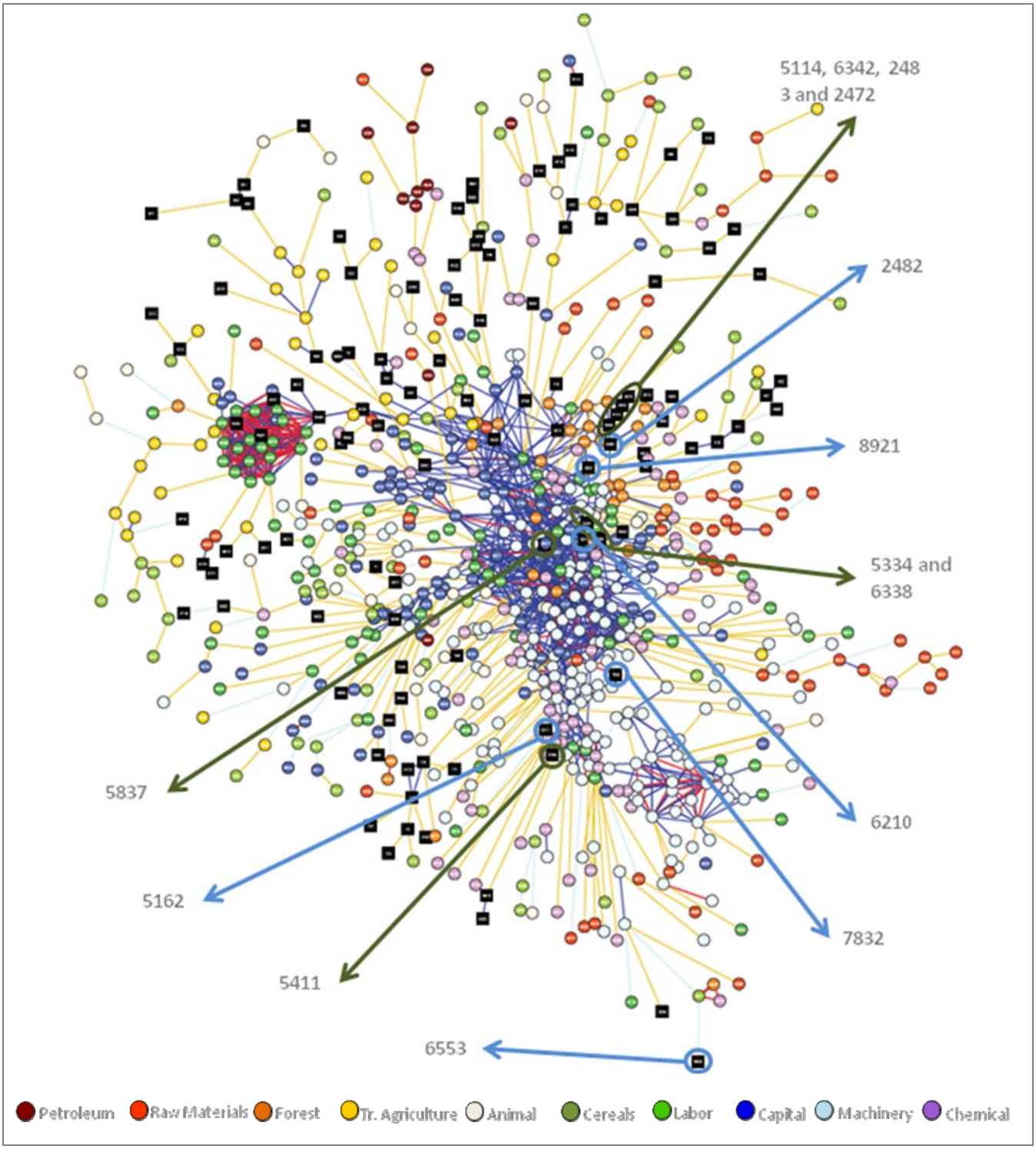
Therefore these new products do not configure alone a solid base for new sophisticated products. Notwithstanding this, we will move forward in their analysis in the next section.

Where to?

Having presented an overview of the way how Uruguayan productive structure has evolved over the last decades, it seems interesting to wonder where it can go. If a country succeed to export products that have the technological requirements that this country posses, and if we can extract valuable information of those accumulated assets by looking at the country's current exports, then we should be able to use this information to get an approximation to where is this country heading.

To achieve such an evaluation, Graph 5 offers a visual of the Uruguay's PS for the period 2004-2008, following the methodology proposed by Hausmann et al. (2007). In the graph, every node represents one of the 775 products considered here and node colors are assigned following Leamer's classification (Leamer, 1984). Lines linking nodes show the level of proximity between two products according to the color they have: darker colors stand for higher proximities. Black squares identify Uruguay's exports with *RCA*>1 over the period.

Graph 5. Uruguay's exports for the period 2004-2008 in the Product Space.



Source: Feenstra et al. (2005) and COMTRADE.

The PS has a dense core within which proximities between products are relatively high, and it also has a periphery where products occupy disperse positions. The authors[3] show that it is in the core of the PS where more sophisticated product are located. Leamer classification helps to see that the PS's core is mostly occupied by Chemical and Machinery based products. They state that the PS's core implies a certain stairway to heaven, since a country that manages to accumulate core products technological requirements will have it easier to reach lots of highly sophisticated products.

Most Uruguayan exports for the period considered, belong to periphery of the PS, which means that products reached by the country have few other products around. This fact says a lot about the country's technological possibilities to transform its productive structure in the future. Ferreira-Coimbra and Vaillant (2009) and Brunini et al. (2010) have presented PS visualizations and similar conclusions have been taken.

The blue arrows placed in Graph 5 identify positions occupied by recently-developed intermediate-sophisticated products discussed in the previous section. As stated above, these products have diverse nature, which explains why they are so apart from each other in the PS. Relative positioning in the PS of these products helps to point another of their features: all these products are close to the core (been product 6553 the only exception). This means that even though these products cannot be considered as very important for their sophistication level (which is only intermediate), there is a strategic value to them since they may provide the capabilities required to reach more sophisticated products.

In most cases, referenced products are located nearby other products that Uruguay already exported (green arrowed nodes). This may mean that these previous productions helped accumulate the required technological capabilities needed for the new products, and therefore they are an important cause behind these new productions. In particular, product 6210 (plastic materials) is very close to other products already produced like products 5334 (varnishes and lacquers) and 6638 (manufacturers of asbestos), while product 5162 (aldehyde-ketone-quinone function compounds) appears very close to product 5411 (vitamins and provitamins). It is possible to find some classic-structural-

[3] See Figure 4 in: http://www.chidalgo.com/productspace/chnages.htm

transformation-linear trends in products appearing in the PS as well, since achieving production of products 2483 (wood of non-coniferous species) or 2472 (sawlogs and veneer logs) seem to have caused the production some more sophisticated products like 8921 (printed books).

If the causal relationship suggested previously could be solidly established and if accumulating the technological requirements needed for the production of a new sophisticated product would directly lead to that product's export, then we would have reasons to believe that Uruguay could reach more sophisticated products in the medium-term by going more into the core trough blue-arrowed-products.

Unfortunately real structural transformations are not that linear. There are many counterexamples of these dynamics. For example product 7832 (road tractors and semi-trailers) does not seem to have a direct technological antecedent in Uruguayan productive structure, it just emerged in the PS. This kind of examples shows that the implicit dynamics in the PS method (a product emerge when all the technological requirements of the products are available) is not so direct. That a country exports a product with many other products around does not assures that some of this other products is going to be incorporated in the export basket, even if it is a very sophisticated product. This is because investment and production decisions are not taken by considering product sophistication. This explains why product 5837, which has presented *RCA>1* for a long time in Uruguay, does not seem to promote the development of nearby products.

Given the difficulty in extracting conclusions about Uruguay's structural change directionality using the PS, this paper tries to complement that analysis using another tool that focuses on the relationship between a country's technological accumulations and each non-exported product, instead of considering *vis-à-vis* product proximities.

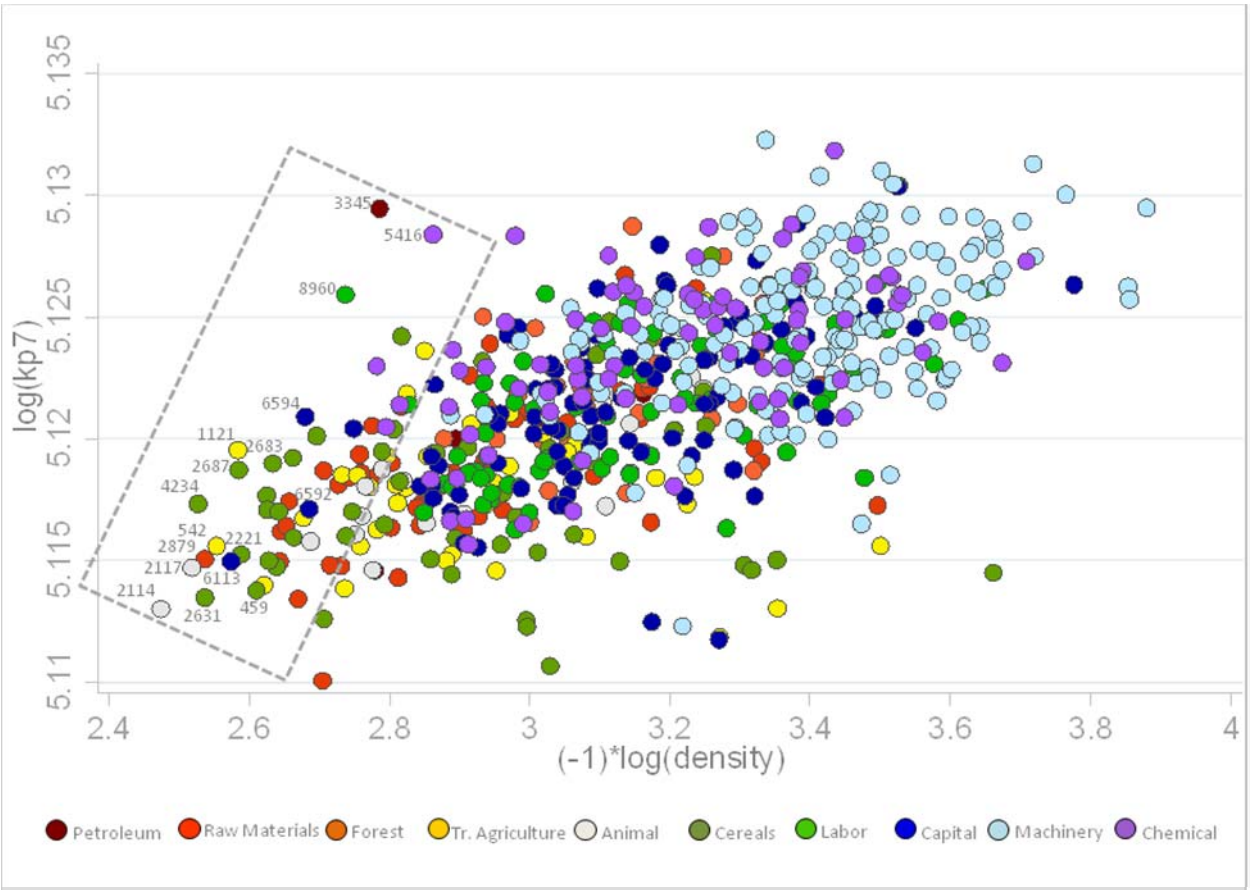
For this task we present an Efficient Frontier (EF), in a very similar way as done by Hausmann and Klinger (2006) for South Africa. An EF consists on a graph of every product not exported by a country according to two dimensions: the product's sophistication level, and a measure of distance between a product technological requirement and a country's accumulated capabilities. The analysis of an EF allows

determining how sophisticated those products that are closer to the country's capabilities are.

Hausmann and Klinger (2006) used *PRODY* as a measure of product sophistication. As pointed before, *PRODY* is not the most suitable measure for countries like Uruguay, so here we use $k_{p,7}$ instead. This indicator delivers a robust product sophistication ranking but maintaining some intensity in the difference among positions. Following Hausmann and Klinger (2006) we use density as a measure of the second dimension of the EF (see equation (8)).

When building Uruguay's current EF it seemed reasonable to take a five-year period, since one year data could reflect irrelevant short-term effects. This is why Graph 6 shows all products for which Uruguay had on average $RCA<1$ over the period 2004-2008. We have colored products according to Leamer's classification (Leamer, 1984) in order to see whether products factor intensity plays a role on how close they are to Uruguay's capabilities or not.

Graph 6. Efficient Frontier for Uruguay in the period 2004-2008.



Source: Feenstra et al. (2005) and COMTRADE.

Graph 6 shows that Uruguay's EF has a positive trend, which implies that more sophisticated products are further away from the country's current capabilities. Among the closest products, those based on Cereals, Tropical Agriculture, Raw Materials and Animals are the most frequent, so these are the more accessible type of products for Uruguay. Capital or Chemical intensive products are widely dispersed along the point cloud: some are quite close while some are very far. At last, Machinery and Labor intensive products are definitely too far for the country's current reach (with the exception of product 8960, referred to art pieces).

Taking a better look at the closer products (inside the dashed box), we see that this group is made up by products like 2114, 2117, 4234, 2631, 2879, 542, 6113 and 2221. All these products imply little transformation of their basic raw material (animal skins, cereals and groundnuts) and none of them show high sophistication levels, so it cannot be said that Uruguay would jump to a high complexity level by reaching them.

There are however some high sophistication products located not so far away from Uruguay's current capabilities, like products 3345 (lubricating oils) and 5416 (glycosides, glands or other organs and their extracts). These are also natural-resource-based products, but they require more complex production processes.

Graph A.4 in the Annex, locates Uruguay's closest products in the PS. It is notable there how product 5416 is the only one that is close to the PS's core. All other products are located far away in the periphery which seems to be the place where Uruguay's diversification comes easier.

Here we see again that desirable products are not only sophisticated products. Some products like 3345 and 8960 have high sophistication levels, but they do not seem to contribute much in terms of economic complexity. By producing them Uruguayan productive structure does not learn how to do new things, but it saturates its production possibilities given it's already acquired capabilities.

Therefore, both the EF and the PS analysis for the 2004-2008 period, seem to reaffirm the idea that Uruguay's productive structure cannot be considered complex, and its perspectives for the future are not very auspicious.

The PS shows that the path for positive structural change is not closed since there are some products occupying strategic close-to-the-core positions that would allow expanding Uruguay's diversification and including sophisticated products. However, looking at the EF it can be pointed that is not around those strategic products where the country has its greatest capabilities accumulation.

It cannot be said that Uruguay will never reach sophisticated products, but our analysis seems to indicate that for that to happen, some technological improvements are needed, so active policy is required.

Final Remarks

This paper performed a description of Uruguayan productive structure, considering the technological aspect as the main focus of the work, since this is one of the most important features to look when studying long term growth tendencies.

For this task, we followed Hausmann and Hidalgo (2009) using the Method of Reflections indicators, which have never been applied to the Uruguayan case. MR indicators gather information on countries diversification and products ubiquity in order to evaluate economies complexity and products sophistication. They are able to rank countries according to the richness of their technological accumulations and products according to the rareness of their technological requirements. They are therefore suitable for the task we propose in this paper.

We find that Uruguayan economic complexity seems to go along with the process of income divergence from developed countries that the country has followed over the last 50 years. Global complexity indicator ($k_{c,18}$) exhibit a markedly decreasing trend over the period 1962-2008, although it has some relative highs and lows. This trend is especially strong over the decade 1994-2003.

Looking for a decomposition of this evolution, we see that Uruguay does not have a diversification problem as stated in Brunini et al. (2010), since the diversification grows over the period considered. The main cause of the complexity deterioration can be found in the exports sophistication decline along the period.

Considering this conclusion, we decided to take a closer product-level look at the Uruguayan productive structure. We find that the country does not have a historic tradition in exporting sophisticated products, and it has even moved further away from the more sophisticated products ever reached.

We also find an important grow in the relative weight of traditional land-based products in the country exports, which may be caused by the openness process followed by the country in the 90´s. There is also a group of products with high *RCA* levels along the

whole period, which can be considered as highly competitive exports with strong comparative advantages that are not highly influenced by trade policy. These latter products are based in primary raw materials as wool or animal-hair based textiles.

All these products share the feature of having low sophistication levels according to $k_{p,19}$. The increasing concentration in these products reinforces the idea that Uruguayan productive structure has lost technological capabilities over the period.

There is however a group of intermediate level sophistication products recently developed by the country. One might consider the emergence of these products as a sign of possible complexity recovering. Unfortunately, these products have diverse nature and therefore they cannot be considered as a new cluster seed. Also, their *RCA* levels are not high so they cannot be considered as products with solid comparative advantage yet.

A further analysis of future structural change possibilities confirmed that is not around these products that the country has accumulated its strongest technological capabilities. On the contrary, products that have similar technological requirements to Uruguay's current capabilities, presents low sophistication levels. This means that even if the country reaches their production, this would not improve Uruguay's overall complexity.

We therefore conclude that Uruguay's current low level of technological capabilities is the outcome of a long process of complexity decay. This implies that the country will have it difficult to reach sophisticated products. Therefore there seems to be a room for active public policy which should be directed to enhance the country's technological capabilities.

These conclusions are valid within the analytical framework used in this paper, which has some important limitations that should be remembered. The most important one is that we are using product exports data only so services and domestic market productions are not considered in the analysis. Given that Uruguay's service sector has been growing over the period considered here, this may imply that our evaluation of Uruguay's economic complexity could be under-estimated.

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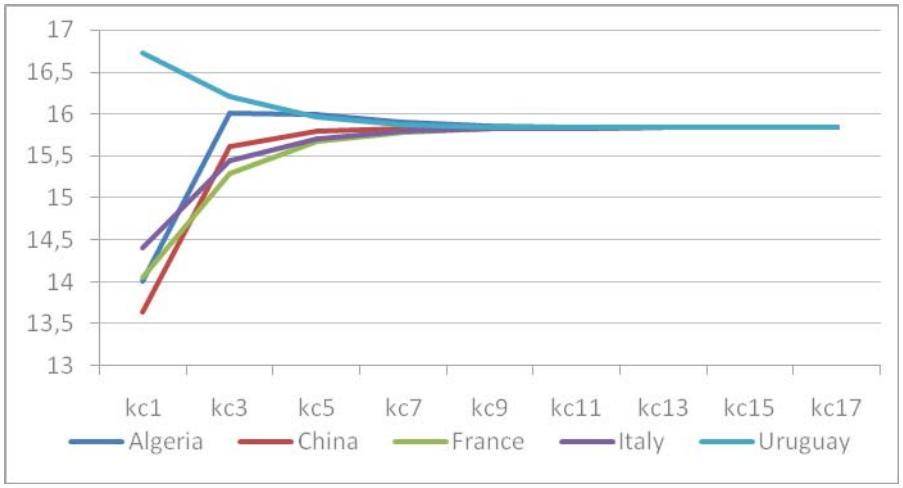
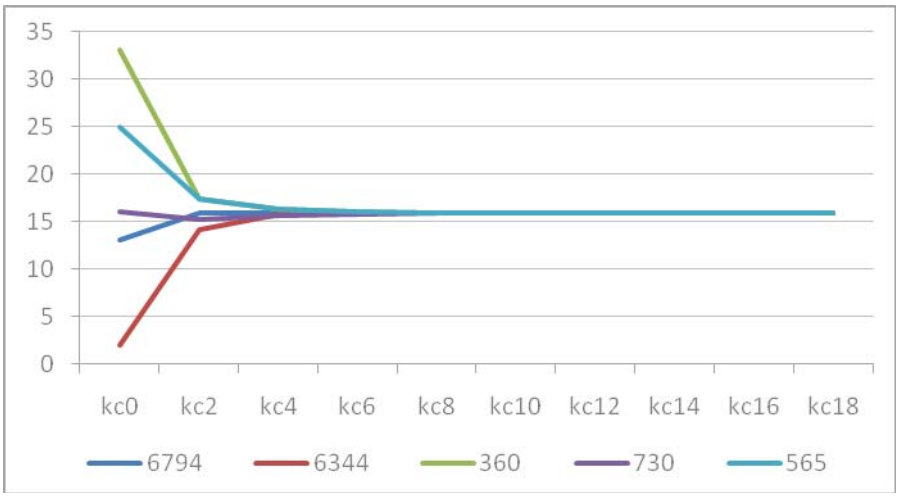
Annex

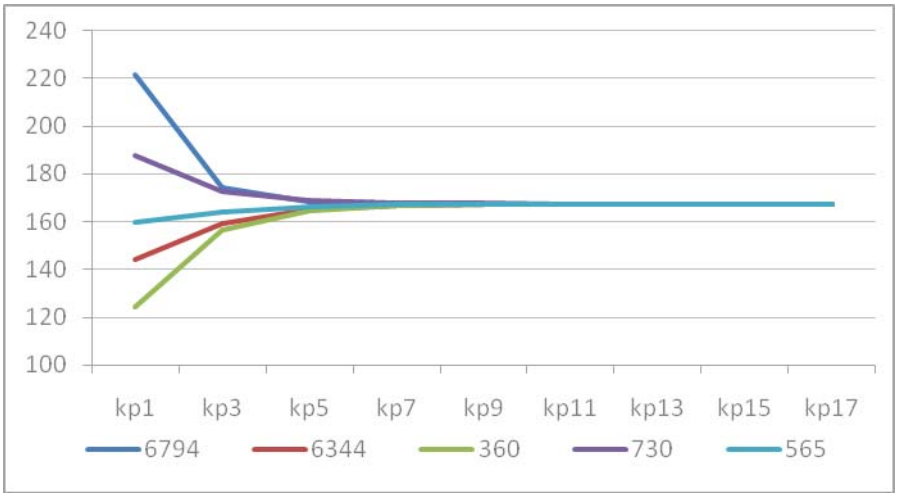
Graphs A.1. a) $k_{c,i}$ iteration results when i is an odd number (2008).



b) $k_{p,i}$ iteration results when i is an even number (2008).

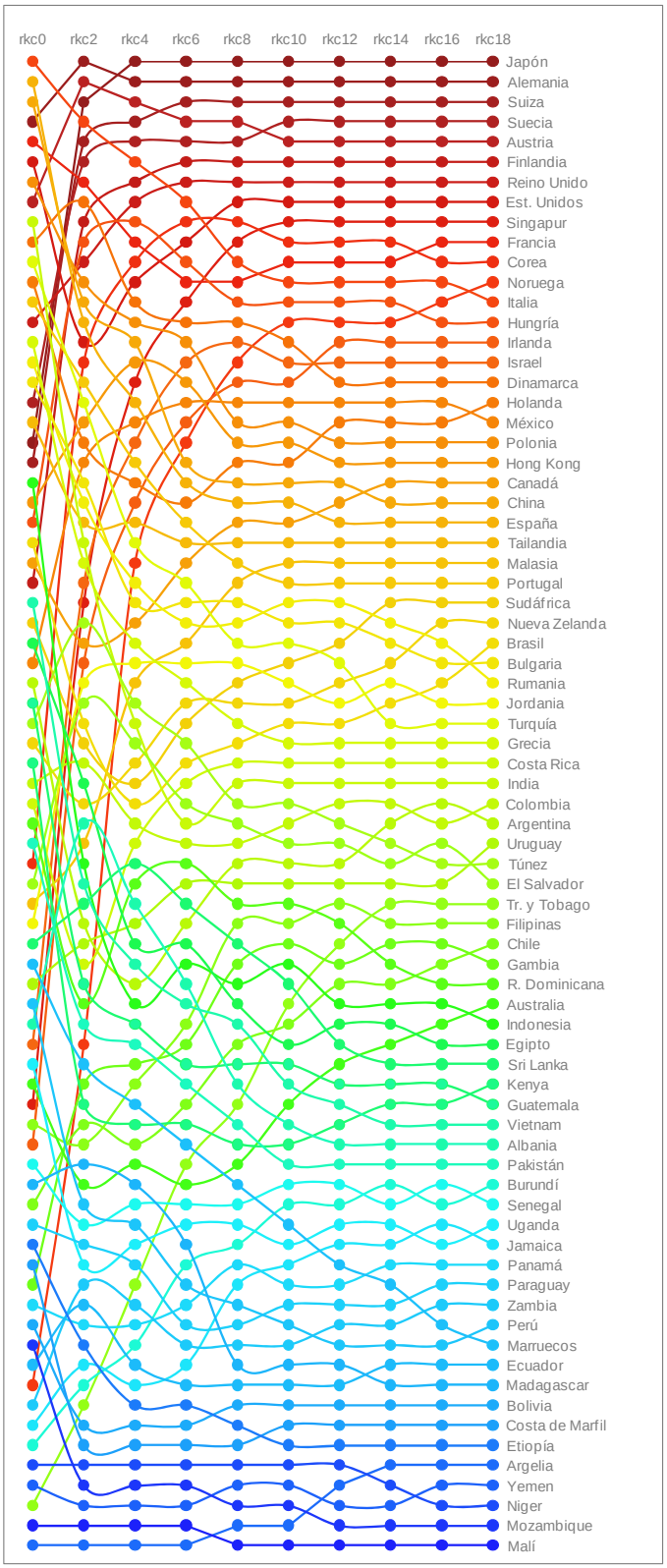


c) $k_{p,i}$ iteration results when i is an odd number (2008).



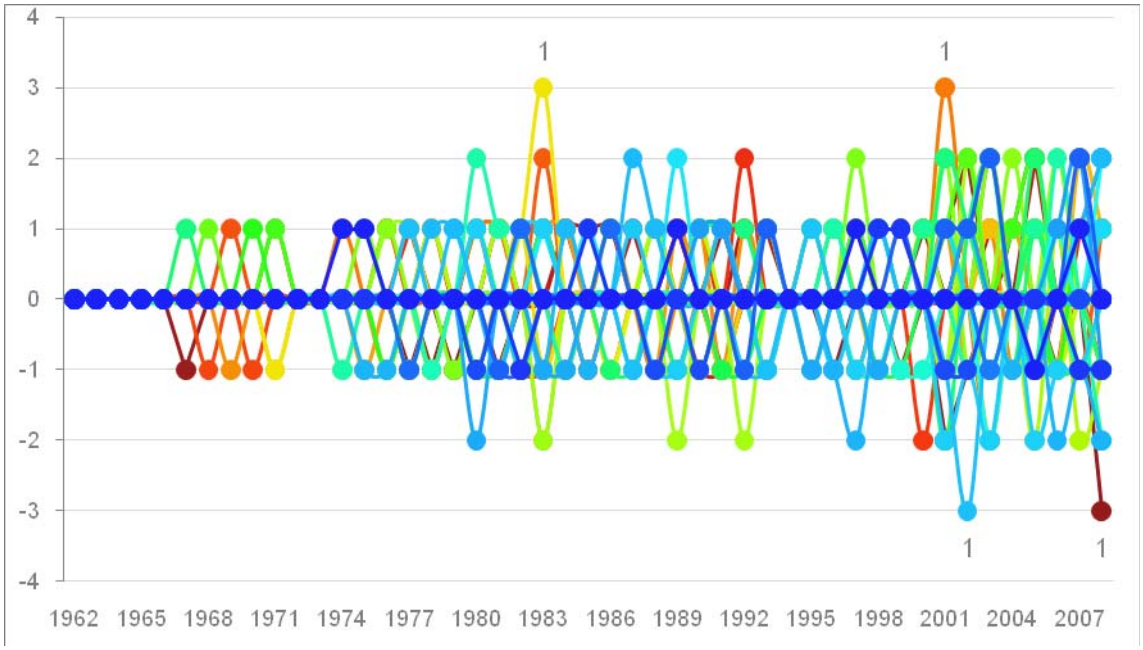
Source: Feenstra et al. (2005) and COMTRADE.

Graph A.2. $k_{c,i}$ ranking results when i is an even number (2008).



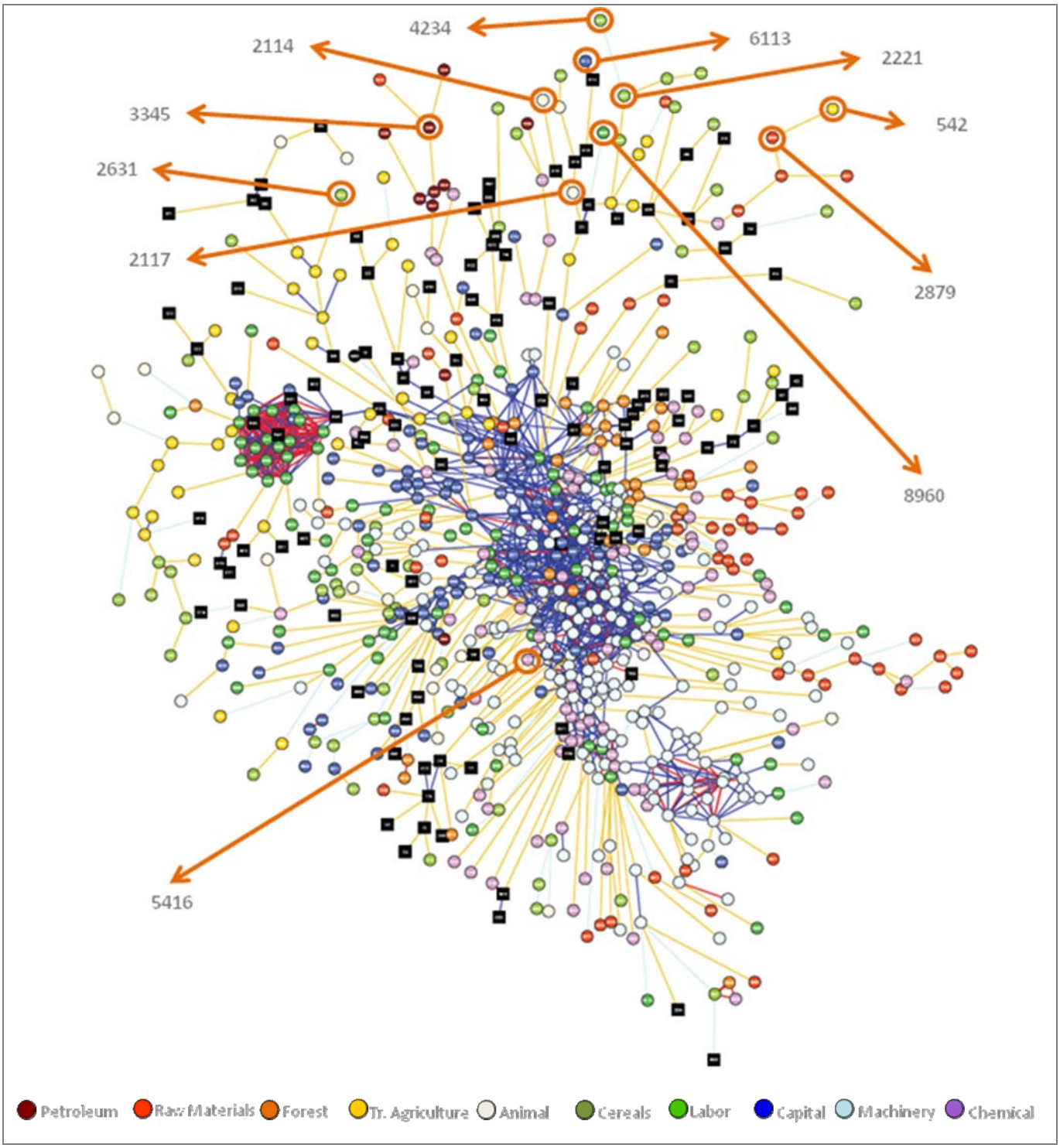
Source: Feenstra et al. (2005) and COMTRADE.

Graph A.3. Ranking differences between $k_{c,18}$ y $k_{c,17}$ for the 75 countries (1962-2008).



Source: Feenstra et al. (2005) and COMTRADE.

Graph A.4. Uruguay's exports of the 2004-2008 period and its closest neighbors in the Product Space.



Source: Feenstra et al. (2005) and COMTRADE.

Table A.1. Uruguayan exports with an five yearly average RCA>1. (products exported in only one five-year period are excluded except that period is 2004-2008).

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
5416	GLYCOSIDES;GLANDS OR OTHER ORGANS & THEIR EXTRACTS	Chemical	5,70	2,72	4,60	1,26		2,06	1,80	1,33		21
5841	REGENERATED CELLULOSE	Chemical					4,03	5,14				29
5822	AMINOPLASTS	Chemical					1,62	2,44				40
6412	PRINTING PAPER & WRITING PAPER,IN ROLLS OR SHEETS	Forest Products				1,59	1,30		1,32	2,09		54
5415	HORMONES,NATURAL OR REPRODUCED BY SYNTHESIS	Chemical		1,14				2,15				65
8960	ART,COLLECTORS PIECES & ANTIQUES	Labor Intensive		1,03	1,64	1,71	3,85	1,55	3,88			87
5411	PROVITAMINS & VITAMINS,NARURAUREPROD.BY SYNTHESIS	Chemical	2,32	6,05	1,96					1,52	2,07	88
6643	DRAWN OR BLOWN GLASS,UNWORKED,IN RECTANGLES	Labor Intensive	2,38	4,34	10,81	8,21	1,59	6,25	1,61			119
5162	ALDEHYDE-,KETONE-,& QUINONE-FUNCTION COMPOUNDS	Chemical					1,03			1,31	1,58	123
5331	OTHER COLOURING MATTER	Chemical					1,14	1,16				136
5332	PRINTING INK	Chemical				1,13	2,04					144
5514	MIXTURES OF TWO OR MORE ODORIFEROUS SUBSTANCES	Chemical							1,97	1,28		174

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
2120	FURSKINS, RAW (INCLUD.ASTRAKHAN,CARACUL, ETC.)	Animal Products			2,02	1,30						186
5821	PHENOPLASTS	Chemical					4,14	3,31	1,40			194
6647	SAFETY GLASS CONSISTING OF TOUGHENED/LAMINAT.GLASS	Labor Intensive			3,28	2,68						198
6210	MATERIALS OF RUBBER(E.G.,PASTES.PLATES,SHEETS,ETC)	Capital Intensive						4,12	7,47	10,35	8,27	215
5922	ALBUMINOIDAL SUBSTANCES;GLUES	Chemical	1,74	2,90	2,16	3,78	6,37	3,42	1,35			244
6553	KNITTED/CROCHETED FABRICS ELASTIC OR RUBBERIZED	Capital Intensive									20,65	247
8921	BOOKS,PAMPHLETS,MAPS AND GLOBES,PRINTED	Labor Intensive									1,08	263
7832	ROAD TRACTORS AND SEMI-TRAILERS	Machinery									1,39	265
5852	OTHER ARTIFICIAL PLASTIC MATERIALS,N.E.S.	Chemical			2,03	1,02	2,48		1,76			270
5913	WEED KILLERS (HERBICIDES)PACKED FOR SALE ETC.	Chemical					2,02	4,49				281
6573	COATED/IMPREGNATED TEXTILE FABRICS & PRODUCTS NES.	Capital Intensive			1,14	1,23						282
2482	WOOD OF CONIFEROUS SPECIES,SAWN,PLANED,TONGUED ET	Forest Products									1,01	284
1122	OTHER FERMENTED BEVERAGES N.E.S (CIDER,PERRY MEAD)	Tropical Agriculture		3,24	3,48							288
2734	PEBBLES AND CRUSHED OR BROKEN STONE.GRAVEL,MACADA	Raw Materials	8,09	4,35								290

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
6571	FELT & ARTICL.OF FELT,NES,WHETHER/NOT IMPREGNATED	Capital Intensive							1,99	1,21		291
6542	FABRICS,WOVEN,CONTAIN.85% OF WOOL/FINE ANIMAL HAIR	Capital Intensive			20,82	25,12	25,47	34,43	26,08	32,95	26,87	294
5334	VARNISHES AND LACOUERS;DISTEMPERS,WATER PIGMENTS	Chemical					7,71	6,06	2,49	2,50	1,30	298
2234	LINSEED	Cereals, etc.				7,71	1,65	3,30	1,18		2,21	302
3510	ELECTRIC CURRENT	Raw Materials							1,47	1,87	1,59	304
6541	FABRICS,WOVEN,OF SILK,OF NOIL OR OTHER WASTE SILK	Capital Intensive							1,43	6,22	5,75	306
4113	ANIMAL OILS,FATS AND GREASES,N.E.S	Cereals, etc.	1,59	2,72	1,66	3,26	7,89	11,04	15,90	29,26	39,19	308
5837	POLYVINYL ACETATE	Chemical					4,56	5,56	13,26	5,58	3,97	322
7933	SHIPS,BOATS AND OTHER VESSELS FOR BREAKING UP	Machinery		1,38	3,34							329
574	APPLES,FRESH	Tropical Agriculture							1,02	2,73	2,45	335
6130	FURSKINS,TANNED/DRESSED,PIECES/CUTTINGS OF FURSKIN	Capital Intensive	6,29	17,31	10,40	5,67	5,93	8,16	25,27	22,39	23,86	338
6417	PAPER& PAPERBOARD,CORRUGATED,CREPEDCRINKLED ETC	Forest Products						2,66	2,98	2,07		339
223	MILK & CREAM,FRESH,NOT CONCENTRATED OR SWEETENED	Animal Products		1,16			1,32	7,24	14,01	13,11	9,01	346
8928	PRINTED MATTER,N.E.S.	Labor Intensive							1,04	1,28		347

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
6122	SADDLERY AND HARNESS,OR ANY MATERIAL FOR ANIMALS	Capital Intensive								1,42	1,81	348
5834	POLYVINYL CHLORIDE	Chemical					1,06	1,42	1,55	2,12	1,73	357
114	POULTRY,DEAD & EDIBLE OFFALS EX.LIVER,FRESH/FROZEN	Animal Products				3,65	1,22					359
482	MALT,ROASTED OR NOT (INCLUDING MALT FLOUR)	Cereals, etc.	2,75	9,65	14,40	25,13	27,71	35,06	58,02	86,35	97,06	361
6664	TABLEWARE & OTHER ARTICLES OF PORCELAIN OR CHINA	Labor Intensive						1,02	1,20			364
6783	OTHER TUBES AND PIPES,OF IRON OR STEEL	Capital Intensive						1,04	2,33	2,71	2,46	380
240	CHEESE AND CURD	Animal Products				2,31	3,93	5,50	7,63	10,54	12,94	386
5914	DISINFECT.,ANTI-SPROUTING PROD.ETC.PACKED FOR SALE	Chemical						6,17	6,52	6,02	1,29	387
6544	FABRICS,WOVEN,OF FLAX OR OF RAMIE	Capital Intensive							9,21		1,22	389
15	HORSES, ASSES, MULES AND HINNIES, LIVE	Animal Products	3,14	1,86	2,78	2,52	2,72	2,69	1,48		3,04	392
7248	MACH.FOR PREPARING,TANNING OR WORKING HIDES	Machinery									1,34	394
5311	SYNTHETIC ORGANIC DYESTUFFS	Chemical									1,62	397
129	MEAT& EDIB.OFFALS,N.E.S.SALT.IN BRINE DRIED/SMOK.	Animal Products					4,36	183,05	70,57	36,47	23,15	399
2460	PULPWOOD (INCLUDING CHIPS AND WOOD WASTE)	Forest Products						1,23		3,71	56,25	400
481	CEREAL GRAINS,WORKED/PREPARED,(BREAKFAST FOODS)	Cereals, etc.			1,98	5,64	4,96	1,06	24,07			402

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
5323	SYNTH.ORG.TANNING SUBSTANCES,& INORG.TANNING SUBST	Chemical					5,10	11,12	15,85	28,29	18,91	403
6351	WOODEN PACKING CASES,BOXES,CRATES,DRUMS ETC.	Forest Products				2,62	1,10					411
5542	ORGANIC SURFACE-ACTIVE AGENTS,N.E.S.	Chemical				3,87	2,22	2,43		1,46	5,15	414
116	EDIBLE OFFALS OF ANIMALS IN HEADINGS 001.1 - 001.5	Animal Products	7,30	14,21	31,79	13,18	8,82	16,49	16,94	17,47	11,89	416
4311	OILS,ANIMAL & VEGETABLE,BOILED,OXIDIZED, ETC.	Animal Products			2,03	1,11						421
6538	FABRICS,WOVEN OF DISCONTINUOUS REGENERATED FIBRES	Capital Intensive						2,22	2,95	1,48		423
8310	TRAVEL GOODS,HANDBAGS,BRIEF-CASES,PURSES,SHEATHS	Labor Intensive			7,62	5,57	2,07	1,05				424
7852	CYLES,NOT MOTORIZED	Machinery							2,01	5,11		425
141	MEAT EXTRACTS AND MEAT JUICES; FISH EXTRACTS	Animal Products	32,88	9,58	8,40	11,18	14,69	47,17	20,53	22,84	11,97	427
6638	MANUFACTURES OF ASBESTOS: FRICTION MATERIALS	Labor Intensive						1,67	2,47	17,32	11,16	431
4241	LINSEED OIL	Cereals, etc.	25,92	28,94	48,04	29,68	8,99	9,58				438
430	BARLEY,UNMILLED	Cereals, etc.				2,18	4,73	6,65	5,61	1,38	4,42	439
6560	TULLE,LACE,EMBROIDERY,RIBBONS,& OTHER SMALL WARES	Capital Intensive				1,25	2,16		1,57	1,53	1,07	441
6770	IRON/STEEL WIRE/WHETH/NOT COATED,BUT NOT INSULATED	Capital Intensive			1,06	1,86	1,04					444

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
5912	FUNGICIDES PACKED FOR SALE ETC.	Chemical						2,15	1,25		5,83	445
484	BAKERY PRODUCTS (E.G.,BREAD,BISCUITS,CAKES) ETC.	Cereals, etc.							3,07	1,92		448
230	BUTTER	Animal Products		1,20	1,31	4,20	3,41	3,20	9,55	13,50	15,79	449
6252	TYRES,PNEUMAT.,NEW,OF A KIND USED ON BUSES,LORRIES	Capital Intensive					1,55	2,93	2,39			452
6428	ART.OF PAPER PULP,PAPER,PAPERBOARD,CELLU.WADDING	Forest Products							1,93	2,30	1,16	454
488	MALT EXTRACT;PREP.OF FLOUR ETC,FOR INFANT FOOD	Cereals, etc.							2,29	3,60	4,63	456
980	EDIBLE PRODUCTS AND PREPARATIONS N.E.S.	Cereals, etc.			1,12	1,67		1,50	4,64			457
118	OTHER FRESH,CHILLED,FROZEN MEAT OR EDIBLE OFFALS	Animal Products				1,89	4,14	4,42	3,95	5,74	4,86	458
2665	SYNTH.FIBR.NOT CARDED,COMBED OR OTHERWISE PREPARE	Cereals, etc.					2,02	2,69	2,53	1,15		462
412	OTHER WHEAT (INCLUDING SPELT) AND MESLIN,UNMILLED	Cereals, etc.							1,26		2,58	466
6651	CONTAINERS,OF GLASS,USED FOR CONVEYANCE OR PACKING	Labor Intensive			6,65	5,19		2,56	4,57			472
8211	CHAIRS AND OTHER SEATS AND PARTS	Labor Intensive							1,25	1,71	1,89	477
5114	SULPHON.NITRATJNITROSAT.DERIVATIV.OF HYDROCARBONS	Chemical						6,13	8,60	31,17	2,40	479

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
1123	BEER MADE FROM MALT (INCLUDALE,STOUT AND PORTER)	Tropical Agriculture			1,81	1,03	1,30	1,05	1,81			480
2111	BOVINE & EQUINE HIDES (OTHER THAN CALF),RAW	Animal Products	7,37	1,99		1,23	2,03	2,39	1,56		1,37	481
452	OATS,UNMILLED	Cereals, etc.	1,46		2,30	1,25	1,77					483
6673	OTH.PRECIOUS & SEMI-PRECIOUS STONES,UNWORK.CUT ETC	Labor Intensive								1,48	5,13	485
8931	ART.FOR THE CONVEYANCE OR PACKING OF GOODS	Labor Intensive			1,35				3,97	4,76	7,77	486
2685	HORSEHAIR & OTHER COARSE ANIMAL HAIR (EXCL.WOOL)	Cereals, etc.	17,23	18,59	45,61	43,85	26,89	31,50	17,95	8,70	13,63	487
6512	YARN OF WOOL OR ANIMAL HAIR (INCLUDING WOOL TOPS)	Capital Intensive	32,31	41,63	53,04	53,81	50,49	92,87	70,56	94,23	72,29	488
819	FOOD WASTES AND PREPARED ANIMAL FEEDS,N.E.S	Cereals, etc.			3,40	1,44						489
2224	SUNFLOWER SEEDS	Cereals, etc.					1,40	4,69	20,85	63,28	43,61	490
6543	FABRICS,WOVEN,OF WOOL OR OF FINE ANIMAL HAIR N.E.S	Capital Intensive					1,15	1,45	5,42	3,07	6,36	492
6129	OTHER ARTICLES OF LEATHER OR OF COMPOSIT. LEATHER	Capital Intensive		1,64	4,81	50,57	74,74	82,63	7,55	1,15	1,01	493
149	OTHER PREPARED OR PRESERVED MEAT OR MEAT OFFALS	Animal Products	7,86	1,16	4,02	4,00	8,82	13,01	9,80	10,86	10,37	496
6112	COMPOSITION LEATHER FIBRE,IN SLABS ETC.,SHEETS,ETC	Capital Intensive			2,11			1,39				497

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
6517	YARN OF REGENERATED FIBRES,NOT FOR RETAIL SALE	Capital Intensive			3,20	3,28	3,90	4,00	3,88			501
6421	BOXES,BAGS & OTH.PACKING CONTAINERS,OF PAPER/PAPBD	Forest Products							1,90	1,53		502
111	MEAT OF BOVINE ANIMALS, FRESH, CHILLED OR FROZEN	Animal Products	26,95	33,94	36,69	28,84	22,34	21,66	40,78	56,49	91,42	503
6535	FABRICS WOVEN OF CONTIN.REGENERAT.TEXTIL.MATERIALS	Capital Intensive					1,94	2,26	2,64			505
4313	FATTY ACIDS,ACID OILS,AND RESIDUES	Animal Products		1,57	1,85	1,08			1,78			506
2733	SANDS,NATURAL,OF ALL KINDS,WHETHER OR NOT COLOURED	Raw Materials	14,53	17,25	1,25	1,49	2,50	1,51	4,33	4,20	1,39	509
1223	TOBACCO,MANUFACTURED (INC.SMOKING,CHEWING TOBACC	Cereals, etc.								1,92	2,20	512
115	MEAT OF HORSES,ASSES,ETC.,FRESH,CHILLED,FROZEN	Animal Products	17,04	8,15	8,19	6,78	10,36	43,71	51,17	81,57	74,66	513
8483	FUR CLOTHING,ARTICLES MADE OF FURSKINS	Labor Intensive			4,21	26,72	31,06	43,07	40,87	47,67	22,20	516
2687	SHEEPS/LAMBS WOOL/OTHER AIMAL HAIR,CARDED/COMBED	Cereals, etc.	87,33	129,93	74,85	39,92	61,84	41,65	39,68	21,11		518
8122	SINKS,WASH BASINS,BIDETS,WATER CLOSET PANS,ETC	Capital Intensive		1,33	1,64	2,02	3,54	5,41	5,13	3,13	1,24	521
411	DURUM WHEAT,UNMILLED	Cereals, etc.						1,60	1,98	1,24	1,75	525
11	ANIMALS OF THE BOVINE SPECIES (INCLUDING BUFFALOES) LIVE	Animal Products	1,77	2,59	5,43	5,47		6,31	19,23	4,90	8,94	531
6666	STATUETTES & OTH.ORNAMENTS,& ARTICLES OF	Labor Intensive			1,66	4,17	1,74	1,34		1,74	1,70	533

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
	ADORNMENT											
2116	SHEEP & LAMB SKINS WITH WOOL ON,RAW (FRESH,SALTED)	Animal Products	30,03	28,54	8,44	9,67	11,87	30,21	9,31	6,58	10,29	545
8421	OVERCOATS AND OTHER COATS, MEN,S	Labor Intensive			1,74		10,12	8,20	7,31	5,21	4,57	548
343	FISH FILLETS,FRESH OR CHILLED	Animal Products			7,87	46,32	34,01					550
2686	WASTE OF SHEEPS/LAMBS WOOL OR OF OTHER ANIM.HAIR	Cereals, etc.	25,09	35,37	68,93	61,92	78,07	93,92	111,54	145,84	135,65	556
2112	CALF SKINS,RAW (FRESH,SALTED,DRIED,PICKLED/LIMED	Animal Products	3,86	1,88	1,53		2,50	8,49	4,89	2,07	7,95	559
6123	PARTS OF FOOTWEAR	Capital Intensive	11,81	16,44	9,44	7,48	2,27					562
6118	LEATHER,SPECIALLY DRESSED OR FINISED	Capital Intensive					1,43	7,62	4,04	4,56		563
2119	HIDES AND SKINS,N.E.S WASTE AND USED LEATHER	Animal Products		1,50	3,90	3,04	3,04			1,90	1,29	565
2667	SYNTH.FIBRES,CARDED,COMBED OR OTHERWISE PREPARED	Cereals, etc.					2,07	2,18	1,03			566
112	MEAT OF SHEEP AND GOATS, FRESH, CHILLED OR FROZEN	Animal Products	8,53	12,63	19,81	10,49	6,91	17,80	21,56	27,18	28,93	567
586	FRUIT,TEMPORARILY PRESERVED	Tropical Agriculture			4,67				1,04			568
2682	SHEEPS OR LAMBSWOOL,DEGREASED,IN THE MASS	Cereals, etc.	20,24	29,48	27,95	24,52	24,50	36,07	27,44	31,87	42,04	572
8431	COATS AND JACKETS OF TEXTILE FABRICS	Labor Intensive			38,43	28,35	9,51	5,74	5,11	3,82	2,89	573
8471	CLOTHING ACCESSORIES OF TEXTILE FABRICS	Labor Intensive					2,03	1,38	1,35			574
572	OTHER CITRUS FRUIT,FRESH OR DRIED	Tropical Agriculture		1,26	4,56	6,73	8,92	14,09	19,52	12,46	9,02	575

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
8481	ART.OF APPAREL & CLOTHING ACCESSORIES,OF LEATHER	Labor Intensive		1,79	36,79	23,98	15,33	12,59	6,70	2,69		576
4236	SUNFLOWER SEED OIL	Cereals, etc.	2,88		1,39			2,47		1,82	1,05	578
582	FRUIT,FRUIT-PEEL & PARTS OF PLANTS,PRES. BY SUGAR	Tropical Agriculture			1,20	5,99						580
612	REFINED SUGARS AND OTHER PROD. OF REF. BEET/CANE	Tropical Agriculture			1,24		2,30					584
2919	OTHER MATERIALS OF ANIMAL ORIGIN, N.E.S	Animal Products	2,67	4,70	8,52	6,85	8,48	11,20	11,80	16,63	19,15	586
12	SHEEP AND GOATS, LIVE	Animal Products	3,44	4,47	7,29	7,18	9,49	9,14	17,45	24,99	41,86	587
6624	NON-REFRACT.CERAMIC BRICKS,TILES,PIPES & SIM.PROD.	Labor Intensive		1,10	1,73	1,86	2,92	4,72	2,38	1,66		591
585	JUICES;FRUIT & VEGET.(INCL.GRAPE MUST) UNFERMENTED	Tropical Agriculture						1,78	1,19	1,92	1,34	595
6932	WIRE,TWISTED HOOP FOR FENCING OF IRON OR STEEL	Capital Intensive			2,80		3,78					598
5513	ESSENTIAL OILS,CONCRETES & ABSOLUTES:RESINOIDS	Chemical						2,10	2,62	11,79	1,26	599
251	EGGS IN SHELL	Animal Products				1,47		2,15	1,26			601
8424	JACKETS,BLAZERS OF TEXTILE FABRICS	Labor Intensive				1,50	5,56	2,91	5,72	3,46	2,12	604
5231	METALLIC SALTS AND PEROXYSALTS OF INORGANIC ACIDS	Chemical					1,78	2,63	3,62	5,71	8,83	605
914	MARGARINE,IMITAT.LARD & OTHER PREPARED	Cereals, etc.									4,74	606

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
	EDIBLE FATS											
2731	BUILDING AND MONUMENTAL STONE NOT FURTHER WORKED	Raw Materials	2,10	3,61	4,15	2,30	3,68	5,05	3,43	1,87		611
224	MILK & CREAM,PRESERVED,CONCENTRATED OR SWEETENED	Animal Products					1,33	3,46	9,18	17,70	22,13	612
1222	CIGARETTES	Cereals, etc.								5,74	3,74	613
8510	FOOTWEAR	Labor Intensive			4,00	2,07		1,31				615
813	OIL-CAKE & OTHER RESIDUES (EXCEPT DREGS)	Cereals, etc.	3,28	3,29	2,40	1,40		1,43	1,67	3,19		617
2472	SAWLOGS AND VENEER LOGS,OF NON CONIFEROUS SPECIES	Forest Products						1,80	13,74	41,45	62,08	618
2925	SEEDS,FRUIT & SPORES,NES,OF A KIND USED FOR SOWING	Animal Products			1,34	1,26	2,15	1,80	1,97	2,47	2,22	619
8434	SKIRTS,WOMENS,OF TEXTILE FABRICS	Labor Intensive			2,50	9,42	2,98					625
616	NATURAL HONEY	Tropical Agriculture		3,26	11,67	9,64	15,38	28,19	35,83	55,05	62,14	626
6423	REGISTERS,EXERCISE BOOKS,NOTE BOOKS,ETC.	Forest Products				1,95	2,21	1,37				633
8439	OTHER OUTER GARMENTS OF TEXTILE FABRICS	Labor Intensive				1,22		1,82				634
4233	COTTON SEED OIL	Cereals, etc.			1,43				12,95			635
5622	MINERAL OR CHEMICAL FERTILIZERS,PHOSPHATIC	Chemical		2,57	2,83	4,70	5,33	7,69	4,46	15,08	14,23	639
1213	TOBACCO REFUSE	Cereals, etc.									6,81	640
8422	SUITS,MENS,OF TEXTILE FABRICS	Labor Intensive			4,92	1,99	2,74	5,75	3,40	2,85	1,34	645
9410	ANIMALS,LIVE,N.E.S.,INCL. ZOO-ANIMALS	Animal Products				2,67			3,01			646

Product	Product name	Leamer cluster	1964-1968	1969-1973	1974-1978	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	position in $k_{p,19}$ ranking
344	FISH FILLETS,FROZEN	Animal Products			1,48	16,87	24,55	27,01	15,75	17,34	15,49	649
5629	FERTILIZERS,N.E.S.	Chemical							1,54	3,57	3,17	650
6576	HAT SHAPES,HAT-FORMS,HAT BODIES AND HOODS	Capital Intensive			2,10	1,55						655
8429	OTHER OUTER GARMENTS OF TEXTILE FABRICS	Labor Intensive					1,26	1,61				656
8423	TROUSERS,BREECHES ETC.OF TEXTILE FABRICS	Labor Intensive			6,14			1,32				658
4232	SOYA BEAN OIL	Cereals, etc.						1,62		1,06		659
6114	LEATHER OF OTHER BOVINE CATTLE AND EQUINE LEATHER	Capital Intensive	24,72	44,42	38,93	39,16	39,45	41,80	31,64	52,17	45,73	660
6583	TRAVELLING RUGS AND BLANKETS,NOT KNITTED/CROCHETED	Capital Intensive			6,63	10,09	1,96	9,37	1,46	1,07	1,57	663
2222	SOYA BEANS	Cereals, etc.					1,11	3,28	1,98	2,61	20,35	667
8451	JERSEYS,PULL-OVERS,TWINSETS,CARDIGANS,KNITTED	Labor Intensive			3,64	7,28	2,89	2,19	1,34	1,09		670
421	RICE IN THE HUSK OR HUSKED,BUT NOT FURTHER PREPAR.	Cereals, etc.	6,89	38,53	94,93	52,48	75,53	50,54	81,10	150,04	127,02	673
350	FISH,DRIED,SALTED OR IN BRINE; SMOKED FISH	Animal Products			1,10		1,03	1,55	1,65	2,34		674
5541	SOAP;ORGANIC SURFACE-ACTIVE PRODUCTS & PREPARATNS	Chemical				1,68	3,93	3,33	1,69			675
372	CRUSTACEANS AND MOLLUSCS,PREPARED OR PRESERVED	Animal Products							1,33	1,59	1,89	679
342	FISH,FROZEN (EXCLUDIND FILLETS)	Animal Products			6,75	7,89	7,24	7,95	7,19	13,75	13,91	683
6342	PLYWOOD CONSISTING OF SHEETS OF WOOD	Forest Products									4,59	685

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6612	PORTLAND CEMENT,CIMENT FONDU,SLAG CEMENT ETC.	Labor Intensive	5,24	7,18	8,74	1,41			2,99	3,74	2,66	686
2483	WOOD OF NON-CONIFEROUS SPECIES,SAWN,PLANED,TONGUE	Forest Products							1,47	1,47	3,82	687
2911	BONES,HORNS,IVORY,HOOVES,CLAWS,CORAL,SHELLS ETC.	Animal Products	1,47		1,52	1,96				2,83	1,20	688
6522	COTTON FABRICS,WOVEN,BLEACH.MERCERIZ.DYED,PRINTED	Capital Intensive					1,33	1,03				690
571	ORANGES,MANDARINS,CLEMENTINES AND OTHER CITRUS	Tropical Agriculture		1,77	5,63	5,58	12,34	21,36	25,42	28,86	27,75	692
8459	OTHER OUTER GARMENTS & CLOTHING,KNITTED	Labor Intensive			1,25	1,03	1,08	1,30				696
341	FISH,FRESH(LIVE/DEAD)OR CHILLED,EXCL.FILLETS	Animal Products					1,21	1,65	5,23	2,89	1,45	698
8432	SUITS & COSTUMES,WOMENS,OF TEXTILE FABRICS	Labor Intensive			9,16	45,54	3,55	2,99	3,14	2,59		704
1212	TOBACCO,WHOLLY OR PARTLY STRIPPED	Cereals, etc.									1,25	707
2634	COTTON,CARDED OR COMBED	Cereals, etc.		1,04		1,58						708
460	MEAL AND FLOUR OF WHEAT AND FLOUR OF MESLIN	Cereals, etc.							3,92	4,83	5,04	709
371	FISH,PREPARED OR PRESERVED,N.E.S. INCLUDING CAVIAR	Animal Products				3,21			1,81	2,32	1,96	710
2681	SEEPS OR LAMBSWOOL,GREASY OR FLEECE-WASHED	Cereals, etc.	27,55	26,03	33,82	49,80	25,46	29,33	24,18	19,32	29,64	712
9710	GOLD,NON-MONETARY	Raw Materials				59,37	143,74	14,79	6,38	8,21	2,58	714
742	MATE	Tropical Agriculture							9,26	19,70	25,53	715

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6115	SHEEP AND LAMB SKIN LEATHER	Capital Intensive					2,30	3,12	4,82	2,79	2,48	719
814	FLOURS &	Cereals, etc.			1,99	6,06	4,89	5,46	4,58	4,89	10,13	727
812	BRAN,SHARPS & OTHER RESIDUES DERIVED FROM SIFTING	Cereals, etc.			3,78	5,07	5,14	2,47				728
360	CRUSTACEANS AND MOLLUSCS,FRESH,CHILLED,FROZEN ETC	Animal Products								2,37	2,41	729
6116	LEATHER OF OTHER HIDES OR SKINS	Capital Intensive					1,19	6,06	3,28	1,36	1,29	736
2117	SHEEP & LAMB SKINS WITHOUT THE WOOL,RAW(FRESH ETC)	Animal Products	2,06	4,44			1,71	1,25	1,25			740
422	RICE SEMI-MILLED OR WHOLLY MILLED, BROKEN RICE	Cereals, etc.	1,93	3,56	4,18	23,12	15,28	45,61	49,80	55,87	48,41	743
459	BUCKWHEAT,MILLET,CANARY SEED,GRAIN SORGHUM ETC	Cereals, etc.			6,12	2,00				1,74		744
6113	CALFLEATHER	Capital Intensive	2,96	7,11	7,32	5,16	8,14	59,18	30,87	8,64		748
611	SUGARS,BEET AND CANE,RAW,SOLID	Tropical Agriculture						1,51		2,17		750