2001 – n° 13
Décembre

CEPII
CENTRE D'ÉTUDES PROSPECTIVES ET D'INFORMATIONS INTERNATIONALES

THE NATURE OF SPECIALIZATION MATTERS FOR GROWTH : AN EMPIRICAL INVESTIGATION

Isabelle Bensidoun, Guillaume Gaulier
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SUMMARY

Modern international trade theories show that the nature of the specialization of a country is non-neutral on its growth performances. However, most empirical studies in the growth literature concentrate on the relation between growth and trade openness at the macroeconomic level, i.e. without taking into account potential (sectoral) specialization effects. But a rough examination of the data suggests that the growth performance of economies is not independent of their pattern of international specialization.

After having illustrated this point, we test whether the link between the nature of specialization and growth suggested by the data remains when other factors influencing growth are taken into account. This is done by introducing indicators reflecting the nature of specialization into a standard equation of conditional convergence. Two indicators are tested. The first one is a country's specialization lag indicator that is a weighted average of per capita growth rates of "neighboring" countries, with the weights equal to the distance in terms of specialization between countries. It allows to test if any specialization effects matters for growth. Although this variable emphasizes the influence of the nature of specialization on growth, it does not specify the features of a specialization auspicious for growth. To this end, we introduce a second specialization indicator which sizes up whether the specialization pattern of a country rests on dynamic products.

The study covers 53 countries or zones for six periods of 5 years (1967-1997). Equations are estimated using the generalized method of moments as we are dealing with a dynamic panel-data model. In addition, this estimation method allows the issue of endogeneity of right-hand side variables to be simultaneously handled.

The intuition, suggested by examination of the data, that the nature of specialization, and more particularly the adaptation of specialization patterns to the dynamic of international demand, matters for growth is corroborated by estimations results: specialization variables have the expected sign and are highly significant. Our results do provide strong evidence that the growth effects of international integration depend on the type of products countries are specialized in. One feature of the trade specialization that matters is its adaptation to the dynamism of international demand. To be specialized in products facing a dynamic international demand is auspicious for growth because it gives incentives to improve efficiency in the case of costly and slow factor reallocations, because it gives incentives to invest or fosters new firms to enter the sector which results in competition improvements. But other features also matter as was evidenced by the country's specialization lag variable we introduced in the growth regression. At this stage, as a classification of trade data according to the characteristics of products that could be interesting in this case do not yet exist, we cannot discriminate between different candidates: learning potential of goods, or quality or technological contents of products. This is a scope for further work.

The main implication of our study is that benefits from openness, in its wide sense, are not so obvious. In these circumstances one can ask whether industrial policies should be as disregarded as they are. Furthermore, our result speaks for a real implementation of special and differential treatment for developing countries in the WTO. Temporary protectionist measures that induce an economy to specialize in a growth-engine sector where it currently lacks comparative advantage should be preferred to openness, if long-term growth is at stake

ABSTRACT

Modern international trade theories show that the nature of the specialization of a country is non-neutral on its growth performances. However, most empirical studies concentrate on the relation between growth and trade openness at the macroeconomic level, i.e. without taking into account potential specialization effects. A rough examination of the data suggests that the growth performance of economies is not independent of their pattern of international specialization. After having illustrated this point, we show that the link between the nature of specialization and growth suggested by the data remains when other factors influencing growth are taken into account. Our results do provide strong evidence that the growth effects of international integration depend on the type of products countries are specialized in. In these circumstances, temporary protectionist measures that induce an economy to specialize in a growth-engine sector where it currently lacks comparative advantage should be preferred to openness, if long-term growth is at stake.

Keywords: Growth, openness, trade specialization, generalized method of moments

JEL Classification : C33, F1, O41.

RÉSUMÉ

La théorie moderne du commerce international souligne que les effets à long terme de l'ouverture sur la croissance dépendent de la spécialisation sectorielle des économies. Ainsi, avec l'ouverture, un pays peut être amené à abandonner un secteur moteur de la croissance pour se spécialiser, selon ses avantages comparatifs, sur des secteurs moins porteurs. Dans ce cas il peut perdre à l'ouverture. Cependant la plupart des études empiriques sur la croissance se sont concentrées sur le lien entre ouverture et croissance au niveau macroéconomique, c'est-à-dire sans tenir compte des effets éventuels de spécialisation. Or, un simple examen des données suggère que les performances de croissance des économies ne sont pas indépendantes des caractéristiques de leur spécialisation internationale.

Après avoir illustré ce point, nous testons, en introduisant des indicateurs de spécialisation dans une équation de convergence conditionnelle standard, si ce lien apparent entre nature de la spécialisation et croissance résiste à la prise en compte des autres facteurs influençant la croissance. Deux indicateurs sont testés. Le premier permet d'établir si, de manière générale, certaines spécialisations sont effectivement plus favorables à la croissance que d'autres. Le second permet de déterminer si une spécialisation qui porte sur des produits qui connaissent une demande internationale dynamique influe sur les performances de croissance.

L'étude couvre 53 pays ou zones sur six périodes de cinq ans (1967-1997). Les équations sont estimées par la méthode des moments généralisés du fait du caractère dynamique du modèle. Cette méthode permet en outre de traiter le problème de l'endogénéité des variables explicatives.

L'intuition, suggérée par l'examen des données, que la nature de la spécialisation compte pour la croissance est confirmée par l'analyse économétrique : les variables de spécialisation sont très significatives et ont le signe attendu. Nos résultats montrent que toutes les spécialisations ne se valent pas à long terme. Ainsi, les pays qui se sont spécialisés sur des produits dont la demande internationale a été dynamique ont, toutes choses égales par ailleurs, connu une croissance plus élevée. Les effets sur la croissance de l'insertion internationale dépendent aussi du type de biens dans lesquels les pays sont spécialisés. A ce stade, il n'est cependant pas possible de discriminer entre les différents candidats (les biens ayant un potentiel en termes d'effet d'apprentissage, la qualité ou le contenu technologique des produits), faute de données de commerce disponibles dans ces nomenclatures. Ceci reste un domaine pour des recherches ultérieures.

Nos résultats conduisent à remettre en cause l'existence d'un lien simple et systématique entre ouverture et croissance. Dès lors que certaines spécialisations sont plus porteuses de croissance que d'autres, il conviendrait de s'interroger sur les conditions dans lesquelles les politiques industrielles peuvent jouer un rôle pour favoriser la croissance. Ces résultats plaident aussi pour l'application à l'OMC d'un traitement spécial et différencié en faveur des pays en développement qui les encourage à recourir à des politiques commerciales sélectives.

RÉSUMÉ COURT

La théorie moderne du commerce international souligne que les effets à long terme de l'ouverture sur la croissance dépendent de la spécialisation sectorielle des économies. Cependant la plupart des études empiriques se sont concentrées sur le lien entre ouverture et croissance au niveau macroéconomique, c'est-à-dire sans tenir compte des effets éventuels de spécialisation sectorielle. Or, un simple examen des données suggère que les performances de croissance des économies ne sont pas indépendantes des caractéristiques de leur spécialisation internationale. Après avoir illustré ce point, nous montrons, en introduisant des indicateurs de spécialisation dans une équation de convergence conditionnelle standard, que ce lien apparent entre nature de la spécialisation et croissance résiste à la prise en compte des autres facteurs influençant la croissance. Les effets sur la croissance de l'insertion internationale dépendent du type de biens dans lesquels les pays sont spécialisés. Dans ces conditions, une politique commerciale sélective qui permet à un pays de se spécialiser dans un secteur moteur de la croissance dans lequel il ne dispose pas d'avantage comparatif doit être préférée à l'ouverture, si l'enjeu est la croissance de long terme.

Mots clés : Croissance, ouverture, spécialisation commerciale, méthode des moments généralisés

JEL Classification : C33, F1, O41.

THE NATURE OF SPECIALIZATION MATTERS FOR GROWTH : AN EMPIRICAL INVESTIGATION[1]

Isabelle Bensidoun, Guillaume Gaulier and Deniz Ünal-Kesenci[2]

1. BACKGROUND AND MOTIVATIONS

The absence of systematic catch-up of poor countries with rich ones gives rise to many studies in order to identify factors that impede the catching-up process. Most of the empirical work rests on the Solow model. In this framework, the lack of catching-up between countries stems from differences in their structural characteristics (investment rate, population growth rate and initial level of technology). In order to refine explanations of divergence and shed light on catching-up conditions, studies take particular care over testing the influence on growth of variables beyond the structural characteristics of the Solow model. It concerns economic variables (human capital, public expenditures, rate of openness…) and political variables (revolutions, coup). Nevertheless, few studies in this type of literature have taken into account the influence of the international specialization on growth and beyond the specialization itself, its nature. Well, "new" international trade theories show that the nature of the specialization of a country is non-neutral on its growth performances. For instance, a country weakly specialized in a growth-engine sector, i.e. a sector that has plenty of potential for technological progress or in goods with great potential for learning, can with openness be excluded from this sector and therefore be subject to low growth (Grossman & Helpman, 1991, Young, 1991; Redding, 1999). Aside from supply effects, changing in the composition of demand due to openness also affects growth through sectoral composition effects. Spilimbergo (2000) shows that moving away from standard homothetic utility fonctions greatly modify conclusions on the impact of trade on growth. Introducing nonhomothetic preferences in the framework of a Ricardian model of trade allows the demand side of the composition of trade effects on growth to be taken into account.

Despite these theoretical developments, in the field of trade and growth, most empirical studies concentrate on the relation between growth and trade openness or outward orientation at the macroeconomic level, i.e. without taking into account potential (sectoral) specialization effects. This is probably one of the reason why in most empirical studies openness seems growth-promoting. In fact, when different indicators of openness are used in order to test for robustness, they are either statistically significant in the expected direction or no statistically significant (Dollar, 1992; Edwards, 1993; Sachs & Warner, 1995). The fact that whenever an association is found it is positive leads authors to conclude that openness is a factor of growth. However, these studies have been strongly criticized by Rodriguez and Rodrik (1999). They argue that the available evidence does not demonstrate a negative relationship between growth and restrictive trade policy. Indicators that are

[1] The authors thank cheerfully for their useful comments A. Chevallier, L. Fontagné, M. Fouquin, J.L. Guérin, the participants to the CEPII's seminar on November 2000 and to the conference « Economie et Finance Internationales Quantitatives » held on June 2000 in Tunis, notably G. Lafay. They also thank P. Biscourp for helpful discussions on GMM strategy. Usual disclaimers apply.

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statistically significant are more influenced by basic macroeconomic policies than trade policies or representative of economic instability at large whereas direct measures like tariff levels or the coverage of non-tariff barriers do not yield significant results. As Rodrik (1999) mentioned and as we know from modern growth theory, this is not a surprising result insofar as protection can promote or delay growth depending upon the economic environment. Otherwise stated, trade liberalization has little chance of yielding a considerable impact unless it is accompanied by macroeconomic and institutional improvements. In other respects, the nature of the international integration of economies, i.e. the composition of their trade specialization, also matters for growth.

Yet, as mentioned above, the role of international specialization in growth has been little investigated in the empirical literature. The study by Weinhold and Rauch (1997) fills partly the void. They attempt to obtain evidence "that openness allows economies to take full advantage of dynamic economies of scale associated with learning by doing". To this end, they estimate the impact of the intensity of specialization on productivity growth. They found that the concentration of productive resources in sectors with relatively high productivity (proxy for learning by doing)[3] is auspicious for productivity growth of developing countries.

Busson and Villa (1997) also consider the impact of the characteristics of specialization on growth. They take into account three features of specialization: its intra versus inter-industry nature, its dissimilarity with international demand (taking into account uncertainty) and the foreign demand growth index which measures the interaction between inter-sectoral specialization and the growth in world trade. Using cross-section growth equations, they evaluate a negative impact for inter-industry trade, and positive impacts for the similarity of country trade specialization with international demand, whether the level or the change in international demand is considered. In contrast with Weinhold and Rauch, the intensity of specialization is supposed to reflect the degree of inter-industry trade rather than the potential of dynamic scale returns. In Busson and Villa, intra-industry trade raises the diversity of intermediate capital goods in the economy and promotes the technological diffusion. The two studies thus find an opposite impact for this variable, both being consistent with the different underlying theoretical hypotheses. Aside from the differences in the indices under review, the opposite estimated effects may be due to the use of manufacturing production data in Weinhold and Rauch instead of trade data for all sectors in Busson and Villa. An intense inter-industry specialization may be favorable within the manufacturing sector but unfavorable to growth when primary goods are taken into account. Busson and Villa point out the need for a panel data analysis. Panel data allow to focus on the effect of changes in the specialization pattern on subsequent growth rates *within* countries, thus to control for omitted country variables that bias estimated coefficient in cross-country regressions.

Feenstra and Rose (1997) developed a procedure to order countries according to their ability to export "sophisticated" commodities early on the US market. Sophisticated goods are those exported later, consistently with product cycle theory. They show that, taking into account GDP per capita and other control variables, advanced countries (in the sense that they export first) tend to have higher growth rates of GDP per capita. But they do not give causal interpretation of their finding and apply simple cross-section OLS techniques with all shortcomings attached to this method.

[3] This is measured by an indicator of production concentration.

Aside from the formalized empirical literature on growth, the idea that the features of specialization matter for growth has a long tradition. Detailed country studies (GEPI (1976), Lafay (1980)) do suggest that the growth performance of economies is not independent of their pattern of international specialization. In average, countries which succeed to adapt their international specialization to dynamic products, i.e. whose share in world trade increase, registered better catching-up performances that countries which did not (Bensidoun & Ünal-Kesenci (1998)).

After having illustrated, in section 2, the marked differences in terms of international specialization between countries that have caught-up with rich countries and those that have not, we show, in section 3, that the link between the nature of specialization and growth suggested by simple observation remains when other factors influencing growth are taken into account. This is done by introducing indicators reflecting the nature of specialization into a standard equation of conditional convergence. Two indicators are tested. The first one allows to check whether countries with similar specialization recorded related growth performances. Although this variable emphasizes the influence of the nature of specialization on growth, it does not specify the features of a specialization auspicious for growth. To this end, we test whether a specialization in accordance with the dynamism of the international demand is growth-promoting. Our results suggest that the nature of specialization and in particular the adaptation of the specialization to the dynamism of the international demand is growth-promoting. Comments on these results and on the channels whereby the specialization is linked to growth are provided also in section 3. Section 4 concludes.

2. INTERNATIONAL SPECIALIZATION AND GROWTH : A FIRST EVIDENCE

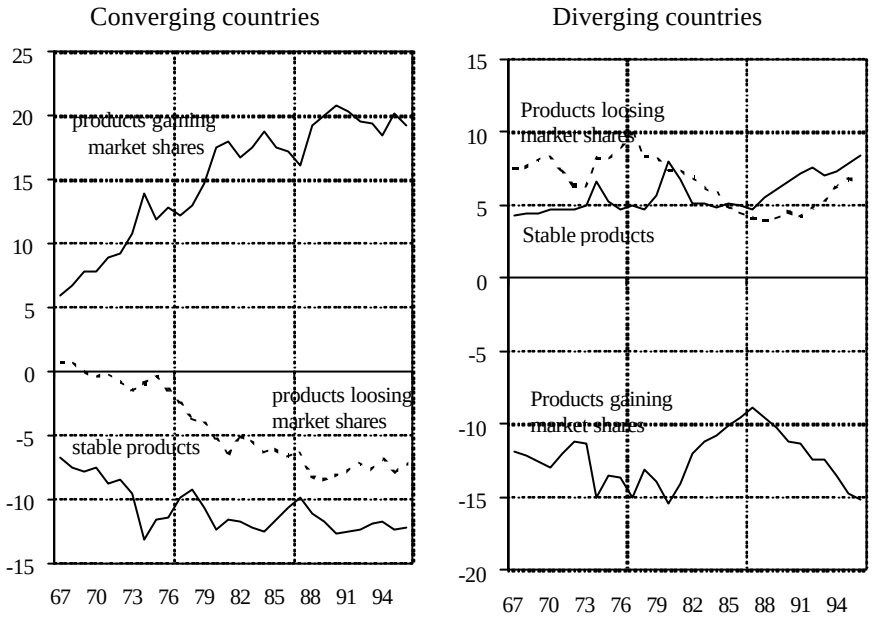
Simple observation of the data does suggest that the nature of the trade specialization matters for growth. Figure 1 shows marked differences, as far as the specialization features is concerned, between countries that have managed to reduce the relative gap in living standards with the rich countries[4] (converging countries[5]) and those that have not (diverging countries). The former have "betted" on dynamic products, i.e. goods whose share in international trade has increased (eg: electronics, textiles) whereas the latter have international specialization which are characterized by inertia. By maintaining comparative advantages in goods whose share in world trade has been stable at best, or falling at worst, (eg: food & agriculture, energy), this latter group of countries have suffered from the cumulative effects of an unsuited international trade specialization.

[4] Rich countries are the 17 countries among the richest in 1960 which remain so in 1995 : United-States, Switzerland, New-Zealand, Sweden, Australia, United Kingdom, Germany, Denmark, Canada, Netherlands, France, Norway, Island, Belgium, Austria, Finland and Italy.

[5] Countries which registered faster GDP growth per capita than rich countries in average for the period 1960-1995. Diverging countries are those which registered weaker GDP growth per capita than rich countries for the same period.

Figure 1 : Specialization* according to the dynamism of products in world trade

(*in thousandths of GDP at PPP)*



* The specialization is measured by an indicator of the contribution to the trade balance (see Annex 5.1 for a definition).

Source : CEPII, *Compétitivité des nations*, 1998.

The adaptation of specialization patterns to international demand is one way whereby specialization seems to spur growth. But other features of specialization may also be growth-promoting: for example, specialization in goods with great potential for learning, as formalized in the Young model (1991) or specialization in high-quality or high-technology products, as considered in the Grossman & Helpman model (1991). Moreover, specialization in primary products, which suffer from unfavorable price trends and from great price variability, can be suspected to lead to poor growth performances. As part of these features cannot be directly measured, because of data unavailability, we turn to a global indicator which may in part reflects these characteristics of the international specialization and gives an indirect evidence of the role of international specialization on growth.

In order to evaluate if generally speaking the growth performances are affected by the nature of specialization, an index of growth weighted by the similarity of specialization ($Gsim_i$) is calculated for each country (see Box).

Box:

For each country i, we calculate the average per capita GDP growth rate of countries similar in terms of specialization to country i. It is equal to the per capita GDP growth rate of countries j weighted by an index measuring the degree of similarity in terms of specialization between i and j. This index of specialization's similarity is all the more high that countries i and j have comparative advantages and disadvantages in the same products (see Annex 5.3 for a definition).

The average per capita GDP growth rate of countries similar in terms of specialization to country i is $Gsim_i$:

$$Gsim_i = \frac{\sum_j (g_{y_j}^{t-t_0} \cdot Sim_{ij}^{t_0})}{\sum_j Sim_{ij}^{t_0}}$$

with $g_{y_j}^{t-t0}$ the real per capita GDP growth rate of country j between t and t_0 and $Sim_{ij}^{t_0}$ the specialization's similarity between i and j in t_0.

In this indicator, per capita GDP growth rates of countries j are the same for each country i. What differs is the weighting of per capita GDP growth rates. The indicator is all the more high that countries with high growth rates were similar in terms of specialization to country i.

This indicator measures the average growth of countries whose specialization was similar to the one of the countries shown in table 1. For example, between 1992 and 1997, the average growth of countries, with a specialization pattern similar to the specialization pattern of Taiwan at the beginning of the period, was 2.6% whereas the average growth of countries with a specialization pattern similar to the specialization pattern of Norway was only 1.7%. As from 1977-82, average growth performances differ notably it can be concluded that some specialization profiles are more carrier of growth than others are. In this respect, the specialization profile of Taiwan, Hong Kong or South Korea has generated growth rates among the highest for all periods. The specialization profile of Brazil or Argentina is, since the end of the seventies, associated with relatively high growth rates.

The international specialization of a country reflects structural phenomena like relative gap of factor productivity, factor endowment, economies of scale or specific advantages of firms. The ordering of countries in table 1 suggests that, roughly, specialization in electronic products and/or textiles has been growth-promoting contrary to specialization in primary products, as expected.

The dynamic of specialization appears also in the results. The case of Taiwan is particularly illustrative. This country succeeds to remain the country with the most favorable specialization pattern for almost all periods, since countries with specialization profiles similar to his own recorded the better growth performances.

Table 1 : Average real per capita GDP growth rates of other countries weighted by the similarity of specialization ($Gsim_i$)[1].

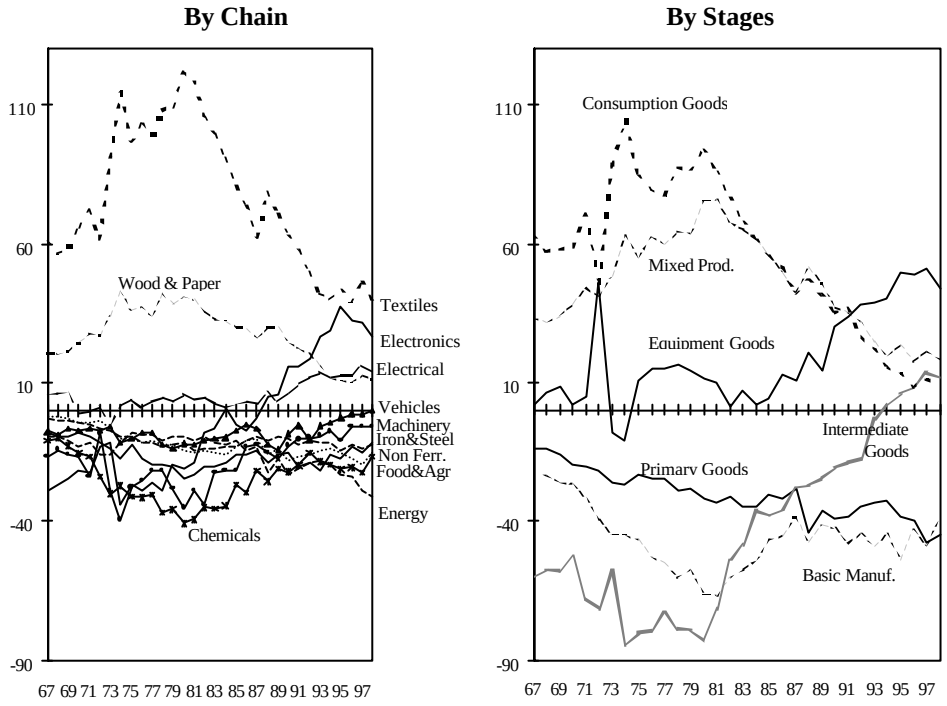
67-72	72-77	77-82	82-87	87-92	92-97
4.8 Taiwan	3.3 Algeria	2.1 Taiwan	2.4 Taiwan	1.9 Taiwan	2.6 Taiwan
4.7 Italy	3.3 NOMEC*	1.9 CEEC	2.3 CEEC	1.8 Hong Kong	2.6 Thailand
4.7 CEEC	3.3 Venezuela	1.9 Italy	2.3 Japan	1.8 Pakistan	2.6 Philippines
4.6 Hong Kong	3.3 Hong Kong	1.9 India	2.3 Italy	1.8 Turkey	2.6 India
4.6 Spain	3.3 Gulf	1.9 Portugal	2.2 Former Yug	1.8 Former Yug	2.5 Pakistan
4.6 China	3.3 South Korea	1.9 China	2.2 Spain	1.8 South Korea	2.5 Hong Kong
4.6 France	3.3 Nigeria	1.9 South Korea	2.2 Germany	1.8 India	2.5 South Korea
4.6 U. Kingdom	3.3 Colombia	1.8 Spain	2.2 France	1.8 China	2.5 Chine
4.6 Portugal	3.3 Portugal	1.8 Former Yug	2.1 South Korea	1.7 Portugal	2.5 Turkey
4.6 South Korea	3.3 Taiwan	1.8 Hong Kong	2.1 Austria	1.7 Philippines	2.4 Morocco
4.6 Former Yug.	3.3 Pakistan	1.8 Japan	2.0 India	1.7 CEEC	2.4 Former Yug
4.6 Japan	3.3 Indonesia	1.8 Turkey	2.0 Hong Kong	1.7 Greece	2.4 Brazil
4.5 Austria	3.3 Brunei	1.7 Greece	2.0 Portugal	1.7 Argentine	2.4 Ireland
4.5 India	3.3 Turkey	1.7 U. Kingdom	2.0 Belg.-Lux.	1.7 Ireland	2.4 Portugal
4.5 Belg.-Lux.	3.3 China	1.7 Israel	1.9 Sweden	1.7 Brazil	2.4 Italy
4.5 Israel	3.2 CEEC	1.7 Brazil	1.9 United States	1.7 Italy	2.3 Malaysia
4.5 Philippines	3.2 Egypt	1.7 Argentine	1.9 Denmark	1.7 Thailand	2.3 CEEC
4.5 Mexico	3.2 Mexico	1.7 Philippines	1.9 Switzerland	1.7 Morocco	2.3 Israel
4.5 Morocco	3.2 Tunisia	1.7 Pakistan	1.9 Brazil	1.7 Israel	2.3 Argentine
4.4 Switzerland	3.1 New Zealand	1.5 Switzerland	1.5 Colombia	1.5 Finland	2.1 Australia
4.4 Tunisia	3.1 South Africa	1.5 Netherlands	1.4 Peru	1.5 France	2.1 United States
4.3 Brazil	3.1 Chili	1.5 Other Afr.	1.4 Australia	1.5 Indonesia	2.1 Switzerland
4.3 Indonesia	3.1 Ireland	1.5 Singapore	1.4 South Africa	1.5 Egypt	2.1 Austria
4.3 Germany	3.1 Peru	1.5 Australia	1.4 Chile	1.5 Australia	2.1 Finland
4.3 South Africa	3.1 Thailand	1.4 South Africa	1.4 Malaysia	1.5 Gulf	2.0 Other Afr.
4.3 Thailand	3.1 Austria	1.4 Canada	1.3 Norway	1.4 Algeria	2.0 Sweden
4.3 Norway	3.1 Belg.-Lux.	1.4 Chile	1.3 Other Afr.	1.4 Former USSR	2.0 Canada
4.3 Algeria	3.1 Australia	1.4 Norway	1.3 Ecuador	1.4 Sweden	2.0 Germany
4.3 New Zealand	3.1 Netherlands	1.4 Egypt	1.2 Mexico	1.4 Nigeria	2.0 Nigeria
4.3 Other Afr.	3.1 Japan	1.2 Former USSR	1.2 Former USSR	1.4 Canada	2.0 U. kingdom
4.3 Malaysia	3.0 France	1.2 Ecuador	1.2 NOMEC*	1.4 Netherlands	2.0 Former USSR
4.3 Australia	3.0 Denmark	1.2 Venezuela	1.1 Brunei	1.4 NOMEC*	2.0 Egypt
4.3 Former USSR	3.0 Canada	1.2 Gabon	1.0 Gabon	1.4 Venezuela	1.9 Venezuela
4.3 Peru	3.0 Sweden	1.1 NOMEC*	1.0 Indonesia	1.4 Austria	1.9 Algeria
4.3 Chile	3.0 Switzerland	1.1 Indonesia	1.0 Venezuela	1.4 Brunei	1.8 Gulf
4.3 Gabon	2.9 U. Kingdom	1.1 Brunei	1.0 Gulf	1.4 Gabon	1.8 Brunei
4.2 Gulf	2.9 Norway	1.1 Gulf	1.0 Egypt	1.4 U. kingdom	1.8 Gabon
4.2 Canada	2.9 United States	1.0 Nigeria	0.9 Algeria	1.3 Chile	1.8 NOMEC*
4.2 Nigeria	2.9 Germany	0.8 Algeria	0.9 Nigeria	1.2 Norway	1.7 Norway

Note : Countries are sorted in descending order according to the indicator's result. For each period, only the first and last twenty countries are listed in the table.
1 see box, for a definition.
* NOMEC= Non oil Middle East countries.
Source : Authors calculation from CEPII, CHELEM database.

Graph 2 shows the evolution of the Taiwanese specialization in terms of chains and stages. Textiles has always been the main strong point of Taiwan. Its comparative advantage in this chain followed an ascending trend up to the beginning of the eighties. Since then, the progressive disengagement of Taiwan from textile products goes hand in hand with an involvement in electronic products, which are the second strong point of the country in 1998. In textiles, Taiwan maintained a comparative advantage in upstream activities (yarn and fabrics), and abandoned consumer goods. In electronic products, it gets out from consumer electronics products with a weak value added to focus on equipment goods like computers. If Taiwan has still a comparative disadvantage in electronic intermediary products (electronic components), this has been cut by half since the beginning of the nineties. The shift in the Taiwanese specialization is also visible in terms of stages. Mainly specialized in consumer goods and mixed products in the seventies and eighties, the first comparative advantage of Taiwan is from now onwards in equipment goods and its strong

disadvantage in intermediate products turns into a comparative advantage. Whether shifts in the Taiwanese specialization are ascribable to an increase in the GDP per capita of Taiwan that gives rise to an increase in wages that drives the change in specialization (i.e. a process *à la Leamer*) or whether these changes allow productivity gains because electronic products or equipment goods are more an engine of growth than textiles or consumer goods can not be settled at this stage. But we can assume that both directions work. The econometric analysis of section 3 will allow to check if the second direction is valid.

Graph 2 : International specialization of Taiwan*



* The specialization is measured by an indicator of the contribution to the trade balance (see Annex 5.1 for a definition).

Source : CEPII, CHELEM database.

Although this section suggests that the nature of specialization matters for growth, it can not be excluded that we are faced with a spurious outcome. Countries with relatively close standard of living could share similar specialization patterns and the link between the nature of specialization and growth could be actually due to a convergence effect. The difference of growth rates between countries would not be due to their differences in specialization patterns but to their differences in development levels. Similarly, it is possible that the relationship between the adaptation of the specialization pattern to international demand and growth does not stand up to the consideration of investment if both factors are correlated. In order to check if the nature of specialization actually matters for growth, it is necessary to control for other variables influencing growth. A standard equation of conditional convergence, in which indicators reflecting the nature of specialization are introduced, is estimated to this end.

3. INTERNATIONAL SPECIALIZATION AND GROWTH : A CONFIRMATION

The model

The study covers 53 countries or zones for six periods of 5 years (1967-1997). All the data are from the CEPII CHELEM database, except the investment rates which are from the World Bank database, *World Development Indicators*.

The general form of the equation to be estimated is as follow:

$$(1)\quad \ln y_{it} - \ln y_{it-t} = a_i + b \ln y_{it-t} + d_1 \ln inv_{it} + d_2 \ln disc_{it} + l \ln spec_{it} + g_t + e_{it}$$

with y_{it} the PPP GDP per capita of country i at time t ($t = 5$),
inv_{it}, the investment rate on average for the period from $t-t$ to $t-1$,
$disc_{it}$, the openness indicator on average for the period from $t-t$ to $t-1$,
a_i individual fixed effects, g_t, time fixed effects[6],
and $spec_{it}$ specialization indicators that are successively introduced (see below).

The openness indicator is from Gaulier (2001). Obstacles to trade are evaluated by a measure of observed discriminations in terms of suppliers on a market. The presence of obstacles to trade (tariffs or NTB) on a market should lead to distortions in the geographical distribution of supplying. The idea is that faced with protected market, only some suppliers will accept to bear the access costs resulting from barriers, even if these costs are the same for all suppliers. The higher the trade barriers, the more concentrated on a few trade partners imports will be, and market shares far from those derived from a distribution based on suppliers weights in world trade. In this case, the discrimination will be high and the openness weak (see Annex 5.4 for a presentation of the indicator).

The first way of dealing with the nature of specialization is to introduce the average per capita growth rates of countries similar in terms of specialization, formerly noted $Gsim_i$, into the growth equation.

$$(2)\quad \ln y_{it} - \ln y_{it-t} = \alpha_i + \beta \ln y_{it-t} + \delta_1 \ln inv_{it} + \delta_2 \ln disc_{it} + \lambda \left(\sum_j w_{ijt-t} (\ln y_{jt} - \ln y_{jt-t})\right) + \gamma_t + \varepsilon_{it}$$

with $w_{ijt-\tau} = \dfrac{Sim_{ijt-\tau}}{\sum_j Sim_{ijt-\tau}}$

and $Sim_{ijt-\tau}$ the specialization's similarity between i and j.

To understand the meaning of this variable let's make a turn in spatial economy literature. In this field, to investigate whether geographic effects matter for growth, country's spatial lag is introduced into convergence equation (Rey & Montouri (1999)). This allows to confirm if any spatial structure remains in the unexplained variation of the growth rates after

[6] Time fixed effects have been differentiated for oil and non-oil countries.

conditioning on initial levels of income. The country's spatial lag is the weighted average of the growth rates of neighboring countries, with the weights being obtained from contiguity matrix. The variable used in our study to test for the influence of specialization effects is of the same type. But instead of being in the geographic space, we stand in the space of specialization as we weight growth rates by the distance in terms of specialization between countries. As spatial lag allows to test for any influence of geography on growth, our variable allows to check whether the nature of specialization matters for growth.

Although this variable emphasizes the influence of the nature of specialization on growth, it does not specify the features of a specialization auspicious for growth. To this end, we introduce the second specialization indicator ($adapt$) which sizes up whether the specialization pattern of a country rests on dynamic products.

(3) $\ln y_{it} - \ln y_{it-t} = a_i + b \ln y_{it-t} + d_1 \ln inv_{it} + d_2 \ln disc_{it} + q \ln adapt_{it} + g_t + e_{it}$

with $adapt$ the index that confront the initial specialization by products of each country to the evolution of products in world trade as follows :

$$ADAPT_{i,t} = 100 - \frac{1}{4}\sum_k \left| \tilde{CTB}_{i,k,t-\boldsymbol{t}} - \Delta \frac{X_{k.}}{X_{..}} \right|$$

With, $\tilde{CTB}_{i,k,t-\boldsymbol{t}}$ the contribution to the trade balance indicator[7] of country i for product k adjusted so as to rule out differences in the degree of specialization between countries[8]. The changes in world market shares of products, $\Delta \frac{X_{k.}}{X_{..}}$, are adjusted in the same way. The more the indicator is close to 100 the more the specialization of a country is on dynamic products.

Beyond this two indicators of specialization, we introduce in both equations the intensity of specialization, Is_{it}, measured by the standard deviation of CTB indicator to check for the impact evidenced by Weinhold and Rauch (1997) and Busson and Villa (1997) (see Annex 5.2 for a definition of this variable).

In order to control for potential heterogeneity in behaviors in developed and developing countries, coefficients are allowed to differ between these two groups if it is statistically relevant[9].

[7] See Annex 5.1 for a presentation of this indicator.

[8] The range of comparative advantages and disadvantages obtained from the contribution to the trade balance indicator gives information about the degree of specialization of countries. To get ride of this size effect in the calculation of the ADAPT indicator, we compute adjusted CTB ($\tilde{CTB}$) : CTB are multiplied by a coefficient so that the sum of adjusted values equals 100 for positive contributions and –100 for negative contributions.

[9] Countries with a GDP per capita that represents 50% of the US GDP per capita are considered as developed.

Estimation method

The generalized method of moments (GMM) is used to estimate both equations as the within estimator is inconsistent in the case of a dynamic panel-data model. In addition, the GMM allows the issue of endogeneity of right-hand side variables to be simultaneously handled.

To wipe out the time fixed effects all variables are taken as deviations from period means. A first-difference transformation eliminates the individual effects. With this two transformations, the terms α_i and γ_t drop from equations *(2)* and *(3)* which become:

$$(4)\quad \ln \bar{y}_{it} - \ln \bar{y}_{it-t} = \tilde{\beta}(\ln \bar{y}_{it-t} - \ln \bar{y}_{it-2t}) + \delta_1(\ln \overline{inv}_{it} - \ln \overline{inv}_{it-t}) + \delta_2(\ln \overline{disc}_{it} - \ln \overline{disc}_{it-t}) + \delta_3(\ln \bar{is}_{it} - \ln \bar{is}_{it-t}) + \lambda\left[\overline{\sum_j w_{ijt-t}(\ln y_{jt} - \ln y_{jt-t})} - \overline{\sum_j w_{ijt-2t}(\ln y_{jt-t} - \ln y_{jt-2t})}\right] + (\varepsilon_{it} - \varepsilon_{it-t})$$

$$(5)\quad \ln \bar{y}_{it} - \ln \bar{y}_{it-t} = \tilde{\beta}(\ln \bar{y}_{it-t} - \ln \bar{y}_{it-2t}) + \delta_1(\ln \overline{inv}_{it} - \ln \overline{inv}_{it-t}) + \delta_2(\ln \overline{disc}_{it} - \ln \overline{disc}_{it-t}) + \delta_3(\ln \bar{is}_{it} - \ln \bar{is}_{it-t}) + \rho(\ln \overline{adapt}_{it} - \ln \overline{adapt}_{it-t}) + (\varepsilon_{it} - \varepsilon_{it-t})$$

with $\bar{y}_{it} = y_{it} - y_{\bullet t}$, $y_{\bullet t} = \frac{1}{N}\sum_i y_{it}$ and $\tilde{\beta} = 1 + \beta$

Following Arellano and Bond (1991) and Caselli, Esquivel and Lefort (1996), we estimate the equations in first differences using the endogenous and the explanatory variables in levels lagged twice or more as instruments. As we are dealing with a small sample, the set of instruments has been restricted : only lagged values from *t-2* down to *t-3* were used[10]. A Sargan test of overidentifying restrictions is performed to check the consistency of the set of orthogonality conditions. Results are reported in table 2.

To check the robustness of our results, we also estimate, following Audenis *et alii* (2001) the equations in level and used the endogenous and explanatory variables in first differences lagged once or more as instruments. Such alternative estimation strategy does not affect conclusions regarding the country's specialization lag ($Gsim_i$) and the *Adapt* variables (see Annex 6 for a presentation of the results and further comments).

[10] A larger set of instruments implies a bigger variance matrix of orthogonality conditions, which is more difficult to invert.

Results

Table 2 : Growth regressions

Dependent variable : $\ln y_{it}$	Equation 4	Equation 5
y_{t-t}	0.44*	0.44*
	[.000]	[.000]
Gsim	0.07*	
	[.000]	
$Adapt^{PED}$		0.04*
		[.004]
$Adapt^{PD}$		0.03*
		[.000]
Is^{PED}	-0.02**	-0.03**
	[.028]	[.022]
Is^{PD}	0.08*	0.05*
	[.000]	[.000]
$Disc^{PED}$	-0.34*	-0.43*
	[.000]	[.001]
$Disc^{PD}$	-0.20*	-0.24*
	[.000]	[.000]
Inv^{PED}	0.09*	0.05
	[.000]	[.292]
Inv^{PD}	0.01	-0.02
	[.647]	[.287]
Implied speed of convergence[11]	16.5%	16.6%
Sargan Test	27.15	27.13
	[.984]	[.979]
Countries = 53 ; Observations = 318		

*, ** indicate that the coefficient is significantly different from 0 at the 1 and 5 percent significance level.
P-values are in brackets.

The findings, provided in the previous section, that the nature of specialization, and more particularly the adaptation of specialization patterns to international demand, matters for growth is corroborated by estimations results: specialization variables have the expected sign and are highly significant. This implies that worries about potential artifact of the convergence relationship included in our first results are not relevant since there remains strong evidence of specialization effects after controlling for other factors influencing growth.

[11] The implied speed of convergence to the steady state path of output per capita can seem high with respect to the 2% usually obtained in growth regressions. But as mentionned by Caselli et alii (1996) when the treatment of correlated individual effect and endogeneity are correctly addressed by GMM estimates, the convergence rate dramatically increases. Then our 16,5% speed of convergence is of the same magnitude as the Caselli et alii speed of convergence (13%) . The remaining difference can be attributable to the difference in samples.

What do these results revealed? First that the effect of international integration depends on the nature of specialization. The country's specialization lag variable (*Gsim*) captures the non neutrality of specialization on growth: some specialization are better for growth than others. This can be due, for one thing, to the characteristics of products (for example, the learning characteristics of goods or their technological contents).

Second, that to be specialized in products facing a dynamic international demand is auspicious for growth. Different channels whereby the adaptation of specialization patterns to international demand affect growth can be proposed[12]. If one assumes that factor reallocations are costly and slow, sectors faced with a dynamic demand are given incentives to improve their efficiency, as they can not rely on resources from other industries to meet this growing demand. Sectors faced with a dynamic demand are also incited to invest. In the framework of a vintage capital model, as new capital units are more efficient than previous, productivity gains show up. Another way is to suppose that the dynamism of demand gives incentives to new firms to enter the sector. With the increase of the number of firms, competition improves which can be growth promoting. The fact that the effect of the adaptation of specialization on growth may pass through the investment may explain why investment is not significant in this equation[13].

In other respects, results in table 2 show that the intensity of specialization (*Is*) has opposed effects on growth in developed and developing countries. For developed countries we find a positive impact which can reflect the positive effect of dynamic economies of scale on growth, whereas for developing countries the negative impact express the harmful consequences of a marked specialization in primary products.

Specialization effects are obtained taking into consideration the positive impact of openness on growth (negative impact of the discrimination variable). The discrimination variable is highly significant and the elasticity is particularly strong for developing countries. This result seems to confirm benefits of openness. Nevertheless, as suggested by Rodriguez and Rodrik (1999), this indicator of openness, as others, can capture effects of economic policies beyond trade policy. However, our specification allows openness *per se* and specialization effects to be distinguished.

4. CONCLUSION

The main aim of this study was to further explore what detailed country studies show: the nature of trade specialization matters for growth. By turning to a regression format, we confirm previous findings. Our results do provide strong evidence that the growth effects of international integration depend on the type of products countries are specialized in. One feature of the trade specialization that matters is its adaptation to the dynamism of international demand. But other features also matter as was evidenced by the country's specialization lag variable we introduced in the growth regression. At this stage, as a classification of trade data according to the characteristics of products that could be interesting in this case do not yet exist, we cannot discriminate between different

[12] We thank Jean-Louis Guérin for his suggesting us some of these channels.

[13] Investment is also not significant for developed countries in equation 4. As Barro & Sala-i- Martin (1995) point out, the use of instrumental variables method that allows the endogeneity of investment to be taken into account leads to this result.

candidates: learning potential of goods, or quality or technological contents of products. This is a scope for further work.

The main implication of our study is that benefits from openness, in its wide sense, are not so obvious. In these circumstances one can ask whether industrial policies should be as disregarded as they are. Empirical works, that aim at improving our understanding of the conditions in which industrial policies are beneficial to growth, would be of a great interest. Furthermore, our result speaks for a real implementation of special and differential treatment for developing countries in the WTO. Temporary protectionist measures that induce an economy to specialize in a growth-engine sector where it currently lacks comparative advantage should be preferred to openness, if long-term growth is at stake.

REFERENCES

Arellano M., Bond S. (1991) "Some Tests of Specification for Panel Data : Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies* 58, 277-297.

Audenis C., Biscourp P., Fourcade N., Loisel O. (2001) "Testing the Augmented Solow Growth Model: An Empirical Reassessment using Panel Data", INSEE, Département des Etudes Economiques d'Ensemble, mimeo.

Barro R.J. (1991) "Economic Growth in a Cross-Section of Countries", *Quaterly Journal of Economics*, May, 407-443.

Barro R.J., Sala-i-Martin X. (1995) *Economic Growth*, McGraw-Hill.

Baumol W. (1986) "Productivity Growth, Convergence and Welfare : What the Long Run Data Show", *American Economic Review*, 76, 1072-1095.

Bensidoun I., Ünal-Kesenci D. (1998), "La concurrence internationale : vingt ans après", *La Lettre du CEPII*, N°171, septembre.

Busson F., Villa P. (1997) "Croissance et spécialisation", *Revue Economique*, 1457-1483.

Caselli F., Esquivel G., Lefort F. (1996) "Reopening the Convergence Debate : A New Look at Cross-Country Growth Empirics", *Journal of Economic Growth*, 1:3, September, 363-389.

CEPII (1998) *Compétitivité des nations*, Rapport du CEPII, Economica.

Dollar D. (1992) "Outward-oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985", *Economic Development and Cultural Change*, 523-544.

Edwards S.(1993) "Openness, Trade Liberalization, and Growth in Developing Countries", *Journal of Economic Literature*, XXXI, 1358-1393.

Feenstra , Rose A. (1997) "Putting Things in Order: Patterns of Trade Dynamics and Growth", *NBER Working paper* n°W5975, March.

Gaulier G. (2001) "Discrimination commerciale : une mesure à partir des flux bilatéraux", *Document de travail CEPII*, 2001-n°04, mars.

GEPI (1976) "Japon 1960-1980 : une économie à la recherche de la spécialisation optimale", *Document du Centre Français du Commerce Extérieur*, novembre.

Grossman G.M., Helpman E. (1991) *Innovation and Growth in the Global Economy*, Cambridge, Mass. : MIT Press.

Islam N. (1995) "Growth Empirics: A Panel Data Approach", *Quaterly Journal of Economics*, November, 1127-1170.

Lafay G. (1980) "La nouvelle spécialisation des cinq grands pays industriels", *Economie prospective internationale*, n°1, janvier, 41-72.

Lafay G., Freudenberg M. , Herzog, C. , Ünal-Kesenci D. (1999), *Nations et mondialisation*, Economica, Paris.

Mankiw N.G., Romer D., Weil D.N. (1992) "A Contribution to the Empirics of Economic Growth", *Quaterly Journal of Economics*, 107 (2), 407-437.

Nickell S. (1981) "Biases in Dynamic Models with Fixed Effects", *Econometrica*, 49(6), 1417-1426.

Pesaran M.H., Smith R. (1995) "Estimating Long-run Relationships from Dynamic Heterogeneous Panels", *Journal of Econometrics*, 68, 79-113.

Rauch J.E., Weinhold D. (1997) "Openness, Specialization, and Productivity Growth in Less Developed Countries", *NBER Working Paper*, 6131.

Redding (1999), "Dynamic Comparative Advantage and the Welfare Effects of Trade", *Oxford Economic Papers*, 51.

Rey S.J., Montouri B.D. (1999) "US Regional Convergence: A Spatial Econometric Perspective", *Regional Studies*, Vol. 33.2, 143-156.

Rodriguez F., Rodrik D. (1999) "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence", *NBER Working Paper*, 7081.

Rodrik D. (1999) "The New Global Economy and Developing Countries : Making Openness Work ", *Economic Development Policy Essay No.24, Overseas Development Council*.

Sachs J.D., Warner A.M. (1995) "Economic Convergence and Economic Policies", NBER Working Paper n°5039.

Spilimbergo (2000) "Growth and Trade: The North Can Lose", *Journal of Economic Growth*, 5: 131-146.

Young A. (1991) "Learning by Doing and the Dynamic Effects of International Trade", *Quaterly Journal of Economics* 106, 369-405.

5. METHODOLOGICAL ANNEXES

5.1 The measure of international specialization

International specialization of countries is measured by the "contribution to the trade balance" (CTB) indicator (Lafay, 1990). Unlike other indicators of specialization, the CTB is a symmetrical indicator in the sense that it focuses not only on exports but also on imports. CTB compares observed trade balance for a product to a theoretical trade balance corresponding to an absence of specialization. The latter is calculated so as to spread the global trade balance on the different products according to their respective weights in the country total trade.

$$CTB_i^k = \left(\frac{1000}{Y_i}\right)\left[\left(X_i^k - M_i^k\right) - \sum_k\left(X_i^k - M_i^k\right)\left(\frac{X_i^k + M_i^k}{\sum_k\left(X_i^k + M_i^k\right)}\right)\right]$$

with *i* the country, *k* the product, *Y* the GDP, *X* are the exports and *M* the imports.

A positive contribution is interpreted as a revealed comparative advantage. By definition, the sum over all products is zero.

Moreover, to remove large annual fluctuations in the composition by products of world trade, a correction (e_k^t) is applied to all trade flows :

$$e_k^t = \left(\frac{W_k^{t0}}{W^{t0}}\right) / \left(\frac{W_k^t}{W^t}\right)$$

with *W* the world trade and *t0* the base year.

5.2 The intensity of specialization

The range of comparative advantages and disadvantages obtained from the CTB indicator gives information about the degree of specialization of countries. The intensity of specialization of a country is measured as follow:

$$IS_i = \sqrt{\frac{1}{K} \cdot \sum_{k=1}^{K}\left(CTB_i^k\right)^2}$$

5.3 Similarity of specialization patterns

The "contribution to the trade balance" (CTB) indicator is used to evaluate similarity of specialization patterns between pair of countries. Two steps are needed to transform the CTB indicator into a similarity index:

- We first compute adjusted CTB, ($\tilde{CTB}$) , in order to get ride of the size effect (degree of specialization) included in the CTB: *CTB* are multiplied by a coefficient so that the sum of adjusted values equals 100 for positive contributions and –100 for negative contributions;

- then, for each pair of countries, we add up absolute differences of adjusted CTB. The similarity will equal 100, if the two countries have the same specialization pattern (possibly with different intensities). If each comparative advantage for country *i* is matched by an equal disadvantage for country *j* then similarity will be 0.

The distance in specialization patterns between country *i* and *j*, Sim_{ij} , is defined as follow:

$$Sim_{ij} = 100 - \frac{1}{4}\sum_k \left| \tilde{CTB}_{ik} - \tilde{CTB}_{jk} \right|$$

5.4 Openness : Revealed Trade Discrimination indicator (*Disc*).

In growth and convergence literature, trade openness is usually measured via the ratio of exports plus imports to GDP. However this measure has severe drawbacks: it is sensible to countries size, development and specialisation pattern. It can not be considered as a trade policy indicator.

CEPII developed an alternative indicator, called Trade Discrimination. Gaulier (2001) introduces the intuition behind this indicator, the methodology, and some results. Here is a summary of the idea and the main stages of the methodology.

The Trade Discrimination indicator makes the assumption that distortion in geographic spread of supply on a given market *reveals* the restrictiveness of trade policy (tariff barriers, formal and informal non-tariff barriers). Faced with markets protected by significant barriers, only some suppliers will be able to bear the resultant costs. Even if the obstacles are the same for everyone, i.e. even if there is no *ex-ante* discrimination, in the end there will be some *ex-post* discrimination. As a result, the greater the barriers, the more imports will be concentrated in a small number of trading partners and/or the more market shares will be distorted compared to a *prorata* distribution based on the importance of suppliers on world markets. The measure of distance between a "natural" distribution of supply and the observed distribution reveals *ex-post* discrimination and thus protection.

The distribution of trade flows is measured by the relative intensity indicator, which is the ratio of the observed trade flows to "natural" flows. The latter are determined by the geographical distribution of world trade according to the relative importance of exporters and importers respectively.

$$\delta_{ij}^k = \frac{\left(\frac{M_{ij}^k}{M_{..}^k} \right)}{\left(\frac{M_{i.}^k M_{.j}^k}{\left(M_{..}^k\right)^2} \right)}$$

with M_{ij}^k the imports of country *i* from country *j* in product *k*. A dot stands for total on the omitted dimension. $M_{i.}^k$ are total imports of country *i* in product *k*.

In order to remove the impact of geography (trade costs), we take the ratio of product level trade intensity, d_{ij}^{k}, to total (textile and other heavily protected products are excluded) manufacturing products trade intensity, d_{ij}^{ref}. As soon as the impact of geography is identical across goods, this transformation removes the distance effect. Thanks to the *Law of Large Numbers*, trade flows in the reference-manufacturing group are supposed to be unaffected by "unnatural" (protection) factors.

$$\Omega_{ij}^{k} = \frac{d_{ij}^{k}}{d_{ij}^{ref}}$$

Deviations from unity in the ratio Ω_{ij}^{k} are supposed to reveal trade distortions.

We sum over all partners for each importing country. We get a measure of distance of relative intensities to a vector of 1. The distance measure is *ad hoc* but get the right properties.

$$Disc_{i}^{k} = \sum_{j} \alpha_{j}^{k} (\ln \Omega_{ij}^{k})^{2}$$

Exporters are weighted according to their size in the world trade of the product.

By means of a regression we purge *Disc* of the impact of countries size: *ceteris paribus* large countries tend to be less discriminatory (they get more opportunities to diversify imports). We take the residual of an OLS regression of *Disc* on population (we allow for a non-linear effect of population).

After normalisation the indicator stands between 0 (no discrimination, that is higher degree of openness) and 100 (higher discrimination in the sample). As we do not use the product dimension in this study we simply sum over products for each country (importer), using the share products in world trade as weights.

Our measure is strongly correlated with alternative measures (FMI, Fraser Institute). Episodes of liberalisation are usually well identified. Overall results are very sensible.

6. TECHNICAL ANNEX

Growth regressions

Dependent variable : $\ln y_{it}$	Equation 4	Equation 5
y_{t-t}	0.90*	0.94*
	[.000]	[.000]
Gsim	0.14*	
	[.000]	
$Adapt^{PED}$		0.10*
		[.000]
$Adapt^{PD}$		0.05*
		[.000]
Is^{PED}	0.02**	0.01
	[.017]	[.605]
Is^{PD}	0.07*	0.07*
	[.000]	[.000]
$Disc^{PED}$	-0.04	0.13
	[.338]	[.006]
$Disc^{PD}$	-0.23*	-0.13*
	[.000]	[.000]
Inv^{PED}	0.19*	0.09*
	[.000]	[.000]
Inv^{PD}	0.10*	0.06*
	[.000]	[.003]
Implied speed of convergence	2.1%	1.3%
Sargan Test	50.24	47.11
	[.274]	[.346]
Countries = 53 ; Observations = 318		

*, ** indicate that the coefficient is significantly different from 0 at the 1 and 5 percent significance level.
P-values are in brackets.

In this case (equations in level and instruments in first differences), it is not possible to introduce individual fixed effects (i.e. to transform the equation by taking all variables as deviations from individual means) because as the assumption of weak exogeneity does not hold any more (with such a transformation, all the shocks would be introduced into the error term) it will not be possible to find instruments uncorrelated with shocks. Thus, only group effects are considered (developed and developing countries). This means that we made the assumption that the correlation between individual effects and the explanatory variables is constant within each group whereas in the case presented in the text we suppose that the correlation is time dependant. This to say that results are not directly comparable with those of table 2.

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