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European Economic Integration in Econometric Modelling – Concepts, Measures and Illustration

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# European Economic Integration in Econometric Modelling – Concepts, Measures and Illustration*

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Abstract:
Processes of regional economic integration have been shaping the economic relations between countries significantly during the last decades. In addition, an increasing integration of the national economies into the global economy has affected these economic relations, too. In an effort to operationalize these integration processes for the purpose of empirical analyses, this paper reviews and analyses concepts and actual measures of European integration and globalization. In particular, it discusses how to separate the effects of European integration from those of globalization. The paper searches for regional integration and globalization indices that reduce the endogeneity problem, and it discusses collinearity between them, and their workability in an illustrative gravity model.

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# Content:

# 1 Introduction

Processes of regional economic integration have been shaping the economic relations between countries significantly during the last decades, prominent examples being the European Union (EU), the North American Free Trade Agreement (NAFTA), and the Asia Pacific Economic Cooperation (APEC).[1] In addition, an increasing integration of the national economies into the global economy has affected these economic relations, too. Both kinds of economic integration reduced transactions costs, though perhaps in different ways and to different degrees, capturing a regional subset of countries in the one case and nearly all countries worldwide in the other. Conventional wisdom has it, and economic theories of trade and growth show it, that both kinds of integration processes are likely to have had a tremendous impact on the intensity of trade and the division of labour between the countries involved, as well as on wages and incomes within them.

Empirical studies trying to quantify the impact of these integration processes face major problems: In general, it is not trivial to operationalize integration processes such that indicators can be derived that may serve as explanatory variables in various econometric models (cf. Bosker, Garretsen 2007). In particular, it is demanding to distinguish separate indicators for the two kinds of integration processes, regional integration and globalization. In the empirical literature on economic integration, various studies have used a time trend (e.g., Traistaru, Nijkamp, Longhi 2002), changes of physical transportation costs (e.g., McCallum 1995, Limão, Venables 2001, Glaeser, Kohlhase 2005; Schürmann, Talaat 2000), or on-off or before-after dummy variables (e.g., Bun and Klaassen 2007; Baier and Bergstrand 2007; Glick and Rose 2002, Frankel 1997). However, most approaches neglect important characteristics of the integration processes, e.g., the numerous facets by which these processes manifest, or the gradual non-monotonous nature of these processes over a longer period of time and as a result of several subsequent small integration steps, or the observational equivalence between regional integration processes and globalization. The present paper suggests utilizing available statistical indices that try to quantify processes of economic integration, and it investigates whether these indices are apt to capture the processes of regional integration and globalization in panel regressions that aim at assessing the economic effects of these integration processes.

Besides being adequately specified and being able to distinguish between regional integration and globalization, operational indicators of regional integration and globalization should be exogenous to the response variable in empirical investigations. The present paper searches for regional integration and globalization indices that might reduce problems of endogeneity, particularly those of reverse causality. Also, the paper will discuss the collinearity between potential indicators.

The paper is organized as follows: Section 2 considers concepts of regional integration processes and globalization in order to distil operational indicators for econometric models. It discusses to what extent regional integration processes can be distinguished *conceptually* from global integration processes. Section 3 surveys the literature for empirical approaches of measuring regional integration and globalization, and investigates, by means of a correlation analysis, to what extent indices of regional integration can be distinguished *empirically* from those of globalization. To illustrate the workability of the chosen indicators for econometric analysis, Section 4 presents an estimation of a simple panel gravity model that uses these indicators to isolate the effects of the EU integration on intra-European trade intensities, controlling for those of globalization. Finally, Section 5 concludes.

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[1] For a comprehensive overview on regional trading blocks see Frankel (1997).

# 2 Understanding regional integration and globalization

Regional integration, globalization and the overarching term of economic integration are usually defined rather vaguely in the literature, and understood quite differently, from a narrow, purely economic to a broad, comprehensive perception, and from a static trigger- or outcome-oriented to a dynamic process-oriented perception of integration. This section looks for definitions yielding indicators of regional integration and of globalization that are operational for econometric models. In a first part, the heterogeneity of processes of economic integration is discussed. For meaningful econometric analysis, it would be highly desirable to have this heterogeneity reflected in respective integration indicators. In a second part, the conceptual differences between regional and global integration processes are discussed.

## 2.1 Concepts of economic integration

The most concise concept of economic integration can be found in the pure models of trade theory (particularly NEG models, e.g. Fujita et al 1999, Baldwin et al. 2003) that define economic integration to be the inverse of transportation costs. In these models, integration is assumed to reach from autarky (no integration at all) to unrestricted freedom of trade (complete integration). Usually, no distinction is made here between regional integration and globalization. Moreover, integration usually refers to the freedom of exchanging goods and services only.

When analysing the effects of economic integration empirically, however, this definition turns out to be too narrow to capture the complexity of the actual phenomenon of economic integration, and in fact there are several much broader concepts of economic integration, some referring to forces driving integration, some referring to the outcome from integration (cf. Edwards 2007). In this paper, economic integration is understood as a *process* (following, e.g., Balassa 1961, Oman 1996, OECD 2005), consisting of three constitutive elements: the driving forces of economic integration, the transmission channels through which economic integration affects the economies of the integrating countries and the consequences of economic integration. Following various authors (e.g., Oman 1996, van Liemt 1998, Rodrik 2000), a broad definition of integration is adopted including technology, politics, institutions and culture. Main *driving forces* are technological progress in information, communication and transportation (IC&T) technologies on the one hand – which is interpreted to take place autonomously – and institutional progress by deliberate national or supranational policy measures on the other. In addition, there may be further driving forces such as innovations in industrial organization that allow for the emergence of multinational enterprises (MNEs) and for outsourcing and off-shoring, or innovations on financial markets that increase the volume and volatility of financial flows. The impetus from these driving forces is then *transmitted* via reductions of transaction costs, or put in other words, via a decline of economic distance between the countries involved (Cairncross 1997). As *consequences*, these reductions of transaction costs are expected to yield increased trade intensity of goods and services, adjustments in the international division of labor through increased flows of capital, information and knowledge and through migration of workers, and, finally, changes of income, employment and growth (Bhagwati 2004, Schulze and Ursprung 1999).

*Transaction costs* are at the core of the process of economic integration, and closest to the concept of economic integration in pure models of trade theory. However, transaction costs are difficult to determine given their high degree of heterogeneity. Transaction costs vary considerably according to the various dimensions they include (cf. Limão, Venables 2001): A transaction may concern different *objects to be moved,* e.g., goods, people, capital or information, and different *transportation modes* employed, e.g., sea, air, railway, road, pipeline, cable, wireless or internet transport. Any transaction may

cause both *direct and indirect costs* in different proportions, e.g., the direct, usually distance-dependent costs of physically moving objects and the accompanying indirect, usually one-off costs of overcoming all sorts of tariff and non-tariff border barriers.[2] And these direct and indirect costs may vary substantially according to the *locations* between which the transaction takes place, e.g., within or between particular countries, within a regional integration zone like the EU, or at world level. Finally, transaction costs may vary according to the *point in time* at which the transaction takes place.

As each of these dimensions may occur in combination with almost every other, they span a whole range of different possible transaction costs. For instance, direct costs for land transport of goods or people often depend on location, on the specific rules within a country or within a regional integration zone that decide, say, on the degree of competition in the respective transport industry. By contrast, direct marine or air transport costs or communication costs largely depend on the rules of global markets, but even these may be modified within countries that want to isolate their people from these global markets. Even stronger, indirect one-off costs depend decisively on locations, as each country has, in principle, the sovereignty to decide what border barriers it wants to maintain or abolish, be it tariffs, technical standards, market and product regulations, consumer preferences, differences in law, culture and language, or other institutional settings: It may unilaterally reduce such barriers; it may participate in bilateral or multilateral agreements on mutually reducing them; but it may also decide to exempt itself from any reductions of such barriers.[3] The dependence of transaction costs on the point in time is obvious, as transaction costs, particularly direct, distance-dependent costs, are assumed to have declined more or less continuously and gradually over at least the last fifty years, though not without some drawbacks or sudden leaps such as the fall of the iron curtain. [4]

In a strict sense, transaction costs thus could be determined only for a specific transaction concerning a specific object and a specific transportation mode between a specific pair of locations at a specific point in time. Also, any reductions of transaction costs could be determined only for specific transactions between a specific pair of locations and for a specific time interval. However, as will be discussed below in the section on integration measurement, up to date, there is no comprehensive dataset on all these transaction costs.

Attention is therefore drawn to the *driving forces* of economic integration that could also be thought of representing the process of integration. The driving forces underlie the transaction cost reductions and can therefore be considered to serve as proxies for transaction costs. The driving forces intervene differently into different types of transaction costs. The *progress in IC&T technologies* fosters integration primarily by bridging distances within and between countries, and it may thus be attached to the reduction of direct distance-dependent transaction costs. Major improvements of this sort are, e.g., the invention of automobiles and expressways, of container traffic, or of the telecommunication technology from the telegraph to the internet. To a minor extent, IC&T technologies may also contribute to reducing some indirect, one-off transaction costs by facilitating the handling of legislative regulations and administrative and cultural border barriers. By contrast, *institutional progress* by deliberate government

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[2] These costs may include getting permissions and allowances, paying charges, taxes and tariffs, closing contracts in foreign language under foreign law, insuring freight, processing payments, or opening up foreign markets for the objects in question.

[3] The examples of countries like the UK, which has chosen to not fully participate in the EU, or North Korea, which has isolated itself almost completely from the global economy, indicate that national governments do, in fact, have a choice.

[4] Some authors already claimed the "death of distance" (Cairncross 1997). However, markets remain far from being universally integrated (e.g., Anderson, van Wincoop 2004; Brakman, Garretsen and Schramm 2006).

action fosters integration primarily by either removing actual barriers to trade and to mobility between countries or by improving more generally governance and thus providing a reliable basis essential to any economic activity. Institutional progress may thus be attached primarily to the reduction of indirect one-off transaction costs. In particular, bilateral or multilateral agreements on trade and cooperation abolish tariffs, quotas, and non-tariff barriers, and attenuate impediments resulting from differing currencies, from differences in technical standards, trade and migration barriers, from political, legislative, cultural and social differences. To a minor extent, government action may also contribute to reducing direct, distance-dependent transaction costs, e.g., by enforcing competition in the transport industry, and by investing in transport infrastructure. Other driving forces such as *innovations in industrial organization* or *innovations on financial markets* cannot be attributed to specific transaction costs. Obviously, all such driving forces are likely to vary according to location and point in time.

Hence, the driving forces seem closely related to the heterogeneity of transaction costs and their changes, as they also vary according to type of transactions concerned, to location and to point in time. If they could be operationalized in a meaningful way they might do as proxies for the process of economic integration in absence of the transaction costs proper. They might even do better than transaction costs in reducing problems of endogeneity, particularly of reverse or mutual causation, in relation to the response variables of respective empirical investigations, as they are more upstream with respect to the chain of causation. Yet, in an interdependent world, mutual interdependencies and various interrelations between all variables involved can never be excluded. For instance, the driving forces are likely to be *interrelated horizontally* in complex ways: Thus, innovations in IC&T technologies that reduce the international transaction costs may foster policies of liberalizing goods and factor markets because they raise the opportunity costs of protection. They may also trigger business strategies of developing new products or processes, or of relocating the production and other corporate functions to places that offer higher comparative advantages for these functions. And they may generate financial innovations providing the necessary accompanying financial flows. Liberalizations of goods and factor markets, in turn, may call for improved IC&T technologies or new corporate strategies. And financial innovations may call for new international institutions and regulations in order to stabilize markets. Also, there might be *vertical feedbacks* between the driving forces, transaction cost changes and consequences of economic integration. For instance, the decrease of wages or incomes (on the level of consequences) may motivate policies of liberalizing goods or factor markets (on the level of driving forces). Or increasing turmoil on various markets in response to supranational shocks may call for policies to secure the success of economic integration in terms of welfare and growth.

Still, to make economic integration operational, it is necessary to abstract to some extent from such horizontal interdependencies and vertical feedbacks, and to treat the relations between the driving forces, transaction cost changes and consequences of economic integration as unidirectional and causal. The driving forces are therefore suggested to be appropriate specifications of the whole process of integration for the purpose of econometric analyses. The analysis of these driving forces may also enable distinguishing European integration (as an example of regional integration) from globalization.

## 2.2 Distinguishing EU integration from globalization

European integration and globalization differ with respect to location, point in time and type of driving forces, of transaction costs and of consequences concerned. These different characteristics can be exploited for distinguishing between European integration and globalization.

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Most obviously, the processes of European integration and globalization differ according to location (Table 1) as the former reduces transaction costs between European countries only,[5] whereas the latter reduces transaction costs between most countries worldwide. Also, European integration can be defined precisely in terms of the time period concerned, whereas the respective time period for globalization is indeterminate. Both location and time have already been utilized frequently in the literature as distinguishing characteristic.

There might be a further distinguishing characteristic concerning the type of driving forces and transaction costs: In this view, the European integration process can be said to primarily concern the removal of political, social and economic barriers between European countries – from the creation of a Free Trade Area to the completion of the Single Market to the introduction of the European Monetary Union, and the instalment of the Acquis Communautaire as a common legal framework for all EU member states. It can thus be said to reduce primarily indirect one-off transaction costs. Besides, there are just a few reductions of direct, distance-dependent transaction costs due to improved transport infrastructure (e.g., by the TEN program).

*Table 1* — Distinctive characteristics of EU integration and globalization

|  | EU integration | Globalization |
|---|---|---|
| Location | EU member states | Most countries worldwide |
| Time | EU6: since 1957; countries acceding later: since start of negotiations | indeterminate |
| Type of driving forces in effect | Institutional progress (primarily) | All |
| Type of transaction costs concerned | Indirect, one-stop (primarily) | All |

*Source*: Own compilation.

More definitely, the process of globalization can be viewed as including all kinds of driving forces described above. The progress of IC&T technology (e.g., container traffic, internet) is assumed to evolve autonomously and as a worldwide phenomenon and hence to be part of globalization. IC&T technologies are considered to be available ubiquitously in principle, even though a national government may restrict the access of its firms and citizens to these technologies. Similarly, other driving forces like the changes in industrial organisation or the changes on financial markets are understood to evolve autonomously as a worldwide phenomenon, and hence to be part of worldwide globalization. Institutional progress by government action as part of the globalization process includes both multilateral actions like WTO or UN agreements that are guided by a common understanding among (almost) all countries in the world to reap the benefits of enlarged markets, and numerous bilateral actions that taken together form a net of mutual agreements. Globalization via these driving forces can thus be said to reduce both direct, distance-dependent costs and indirect, one-off costs.

Hence, these differences between European integration and globalization could provide indicators that are conceptually distinct from one another.

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[5] It thereby increases (relative) transaction costs versus all non-EU countries and thus discriminates against them, which may lead to trade diversion.

# 3   Measuring regional integration and globalization

The analysis now turns to reviewing and assessing actual approaches to measure economic integration for detecting appropriate distinct indicators for regional integration and globalization, respectively. In the literature, there exist several approaches for measuring the changes of transaction costs. Many of them are not designed to distinguish between regional integration and globalization processes (Table 2, upper part). The simplest measure is a time trend (e.g., Traistaru, Nijkamp, Longhi 2002). The time trend is exogenous to any response variable but insensitive to fluctuations over time in the progresses of regional integration or globalization. Another measure is trade volume. Trade volume is a catch-all variable that is sensitive to fluctuations over time in the progresses of regional integration or globalization but endogenous to many response variables. In addition, the measure of trade volumes does not allow discriminating between the effects of any forms of economic integration and trade-enhancing factors that are unrelated to economic integration.

Still another group of measures aims at quantifying direct transaction costs, for instance, by interacting geographic distance or travelling time and freight charges (Limão, Venables 2001, Wolf 2000, Hilberry, Hummels 2003, Anderson, Wincoop 2004, Combes, Lafourcade 2005). Unfortunately, such measures usually cover only a small section of the whole variability and heterogeneity of transaction costs, focusing on specific objects to be moved by specific transport modes and between a limited number of locations, and they are thus not representative for the whole process of economic integration, not even for the part accruing to the decrease of distance-dependent direct transaction costs. More generally, data in this field are sporadic and disparate. There do exist some World Bank or IMF data on shipping a container between various countries, or data on travelling times by car or by truck across European or US streets, or data on air traffic charges, and the more, yet not in a combined, comprehensive and comparable form. It would be a very appreciable and demanding research agenda to collect a detailed panel dataset of comparable transaction costs, reflecting their immense heterogeneity, and allowing for also constructing aggregate indicators from it. However, up to date, no such dataset exists. Other studies therefore try to proxy direct transaction costs by the share of the transport industry in a country's total value added or employment, or by the ratio of a country's freight bill over GDP (Glaeser, Kohlhase 2005), or by the sizes of trade flows or trade intensities (McCallum 1997, Head, Ries 2001, Bosker, Garretsen 2007, Edwards 2007).

In another approach, the costs of trade are derived as distance decay functions where the parameters are estimated in the context of computable NEG models (Anderson, Wincoop 2000, Redding, Venables 2004, Hanson 2005, Brakman, Garretsen and Schramm 2006). These measures generally focus on the distance-dependent direct trade costs thereby largely neglecting all other kinds of transaction costs. In addition, like the measure of trade volumes, they do not allow discriminating between the effects from economic integration and from factors unrelated to economic integration, and they do not allow distinguishing between the effects from European integration and from globalization processes.

Other analyses explicitly address regional integration or globalization, respectively, and control for other determinants (Table 2, lower part). Some studies try to infer the changes of transaction costs from creating counterfactuals. One possibility is employing before-after dummy variables. In a panel gravity regression framework, Bun and Klaassen (2007), for example, use a dummy variable to assess the effects of the Euro on trade intensities. The dummy variable is set to one if both trading countries have the Euro in the respective year, and zero else. A similar dummy variable is used frequently

*Table 2* — Overview of approaches to measure economic integration

|  | Approaches |
|---|---|
| *Measures not distinguishing between EU integration and globalization* | |
| Broad measures | Time trend (e.g., *Traistaru, Nijkamp, Longhi 2002*) <br> World trade volume |
| Specific measures | Direct transaction costs: <br> - distance (in kms or in traveling time) × freight charges *(Limão, Venables 2001, Wolf 2000, Hilberry, Hummels 2003, Anderson, Wincoop 2004, Combes, Lafourcade 2005)* <br> - transport industry share in total economy *(Glaeser, Kohlhase 2005)* <br> - freight bills over GDP *(Glaeser, Kohlhase 2005)* <br> - inference from trade flows / trade intensities *(e.g., McCallum 1997, Head, Ries 2001, Bosker, Garretsen 2007, Edwards 2007)* <br> - accessibility indicator derived from gravity approach on basis of traveling times *(Schürmann, Talaat 2000)* <br> Trade cost functions with distance decay (e.g., *Anderson, Wincoop 200; Redding, Venables 2004; Hanson2005; Brakman, Garretsen and Schramm 2006*) |
| *Measures addressing specifically regional integration or globalization* | |
| Counterfactuals | Before-after dummy (e.g., *Bun and Klaassen 2007; Rose 2000; Glick and Rose 2002; Egger, Pfaffermayr 2002*) <br> Difference-in-differences analysis (e.g., *Hanson, Xiang 2002; Slaughter 2001*) |
| Measures of EU integration | ECB index (*Dorrucci et al. 2002; Dorucci 2005*) <br> Modified ECB index *(this paper)* |
| Measures of globalization | EFW Fraser Institute index *(Gwartney and Lawson 2006)* <br> KOF index (*Dreher 2006*) <br> A.T.Kearney index (*A.T. Kearney, Inc. 2006*) <br> CSRG Warwick globalization index (*Lockwood and Redoano 2005*) <br> OECD globalization indices *(OECD 2005)* <br> UNCTAD-TRAINS Database |

*Source*: Own compilation.

to assess the effects of free-trade-areas on trade intensities (e.g., Frankel 1997, Glick and Rose 2002). These studies yield rather mixed, usually small results as to the significance of FTAs on trade flows. As Baier and Bergstrand (2007) argue, however, such dummy variables are not exogenous to trade flows; in particular, unobserved heterogeneity is suspected of biasing estimates downward. And indeed, the actual effects of economic integration might be underestimated in these studies, due to the fact that a variable on globalization is usually omitted and the considerable heterogeneity of FTA integration processes is misspecified by a before-after dummy variable. For, regional integration in FTAs usually does not take place in a single step at a given point in time, but rather as a continuous process, characterized by gradual reductions of spatial transaction costs and

border impediments over longer periods of time.[6] Also, regional integration in FTAs does not always imply a same level of integration for all countries concerned, but may allow for variation where some countries partially exempt themselves from some integration issues as, e.g., in the EU cases of Great Britain, Sweden or Denmark.

Another possibility is analysing the difference-in-differences of the effects of integration events ("before" vs. "after" and "included" vs. "non-included"; Hanson, Xiang 2002; Slaughter 2001). The evolution over time of the response variable in question is compared econometrically to the evolution over time of the same response variable in a "control group" of comparable countries outside Europe (e.g., South-East Asia), which is, like the European countries, affected by the globalization but is unaffected by the European integration.[7] Other studies estimate transaction costs from the difference between actual trade volumes versus trade volumes predicted on the base of gravity models, or from the mark-up of actual prices from prices predicted on the base of price models. Creating counterfactuals is, however, not always possible, particularly not in the case of measuring globalization; it is also very demanding with respect to the database. Another major problem with these approaches is controlling for any systematic differences between the EU and the control group that is not associated but may interfere with the European integration.

This leaves some measures explicitly designed to approximate the process of European integration (ECB index) and the process of globalization, respectively (EFW index, KOF index, A.T.Kearney index, CSRG index, and others), as most promising approaches for the purpose of the present paper. However, these indices also bear some disadvantages: First, some of them include a mix of sub-indices that are partly related to the driving forces, partly to the consequences of the integration process. Second, they focus on institutional progress as the only driving force and neglect other driving forces like the progress of IC&T technology, which is disadvantageous particularly in the case of the globalization indices. Nevertheless, these measures are regarded worth considering them as distinct indicators for European integration and globalization, and worth analysing them in some more detail.

### 3.1 Measures of European integration

The European integration process is described by an index developed at the European Central Bank (ECB; Dorrucci et al 2002). Dorrucci et al. construct a numerical composite index of institutional integration that accounts for institutional change from 1957 to 2001 (Figure 1). The index is based on scores that are attributed to each single event of European integration. The events are grouped within five sub-indices that refer to the Balassa stages of integration (Balassa 1961): (i) free trade area where internal tariffs and quotas among member countries are abolished, (ii) customs union where common external tariffs and quotas are set up, (iii) common market where restrictions on internal factor movements are abolished, (iv) economic union where a significant degree of policy co-ordination and law harmonization is achieved, and (v) total economic integration where economic policies are conducted at a supra-national level.[8] The scores for each event are chosen such that they allow for a maximum of 20 scores for each sub-index, and the composite index as the unweighted sum of these sub-indices thus ranges from 0 (no integration) to 100 (full integration).

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[6] The Single Market of the EU, for example, was not established or completed at the end of 2002, as was announced in official EU documents. It has rather been established gradually by a large number of single steps since the mid-1980s, and is still not fully completed by today.

[7] These countries might in turn be influenced by the impacts of their own processes of regional integration (e.g., APEC), an effect that ought to be regarded in such approaches.

[8] The ECB index does not include any policy measures designed to accompany and accommodate the EU integration process, such as the EU cohesion policy via the EU Structural Funds. It is debatable whether this should be included.

The ECB index has originally been defined for the EU6 founding members only but has been supplemented in 2005 to include scores for all countries acceding to the EU in 1973-1995 (Dorrucci 2005). In these supplemented indices, all accessions are reflected by a one-step increase from zero to the respective contemporary integration level of the incumbents. However, as accession to the EU usually proceeds gradually from the official start of the accession negotiations up to the agreed end of the transition period, own indices have been constructed that are time-smoothed over the whole accession period (Figure 1).[9] Also, pre-accession EFTA membership and the exemptions of some acceding EU countries like the UK or Denmark from the Schengen process and the European Monetary Union are explicitly taken into account.

*Figure 1 —* ECB indices of institutional integration among the EU15 countries[a]
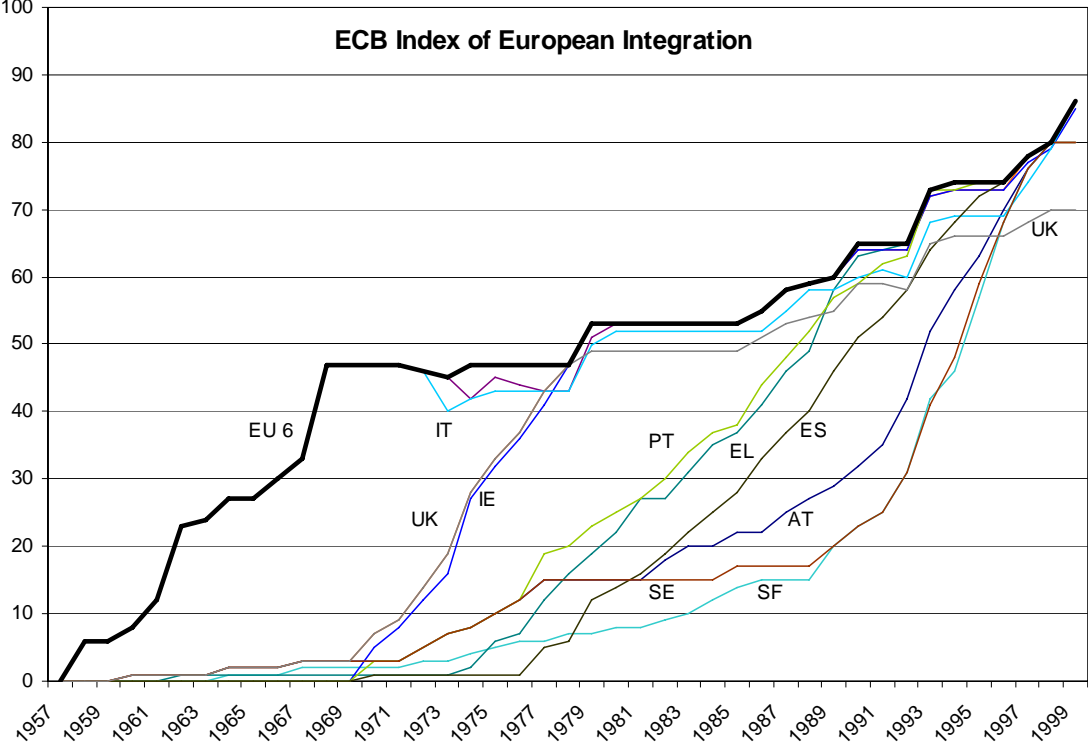


a The index for the EU6 was compiled by the ECB (Dorrucci et al. 2002). The indices for the remaining nine member states are based on own compilations, following the method used by Dorrucci et al. (2002) but time-smoothing the indices during the pre- and post-accession periods.
*Source*: Dorrucci et al. 2002. - Own supplements.

The ECB index has the advantage of keeping close track with the events that are at the roots of the European integration process. In spite of a somewhat subjective and arbitrary scoring, the index offers an original and convincing way of measuring the

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[9] The integration of any new member during this transition period is modelled as linear increases of the indices for simplicity, unless distinct information on accelerations or drawbacks in this process is available. Such accelerations or drawbacks are events such as, on the one hand, advanced unilateral tariff reductions as in Spain 1979, or, on the other hand, the new installation of state-owned enterprises as in Greece 1983 (this installation has, however, been withdrawn in 1990-1992). Information on such events have been drawn in particular from OECD, Economic Surveys, var. countries, var. years.; moreover, from Schrader and Laaser 1994, Laaser 1997, Preston 1997, Vanthoor 2002.

progress of institutional integration.[10] To the econometric modelling of the effects of integration, it offers an explaining variable that can be expected to be causal, related to the driving forces of the process and available for a long time period (1957-2001). Moreover, the index is clearly distinct from the globalization process, as it is defined for institutional progress only, and rests upon events that are purely European.

## 3.2 Measures of globalization

A variety of globalization indices have been proposed in the literature (see Table 2). Of these, the CSRG Warwick index is available (on a yearly base) only from 1982 onwards, the A.T. Kearney index from 1991 onwards. The OECD globalization indicators offer lots of valuable information yet without weighing them into ready-for-use indices. The same is true for the UNCTAD-Trains database (which offers an impressive amount of detailed information on tariffs and NTBs). An index by Cappello, Camagni and others (2009) is under construction; it focuses largely on results of globalization, and does not seem to exist in a time series so far. The indicators by Kaufmann et al. (2008) and those by the World Bank Doing-business Database are focussed extensively on governance issues and much less on barriers to trade and mobility. The present paper therefore concentrates on the "Economic Freedom of the World" (EFW) index by the Fraser Institute (Gwartney and Lawson 2006) as an example of a purely institutional index, and on the KOF index by Dreher (2006) as an example of a mixed index that captures both indicators of the institutional determinants of a country's integration into the world economy as well as those of a country's actual integration into the world economy. For comparison, the world trade volume is also provided.

*Figure 2 —*    World trade and Globalization Indices for the EU 15 countries
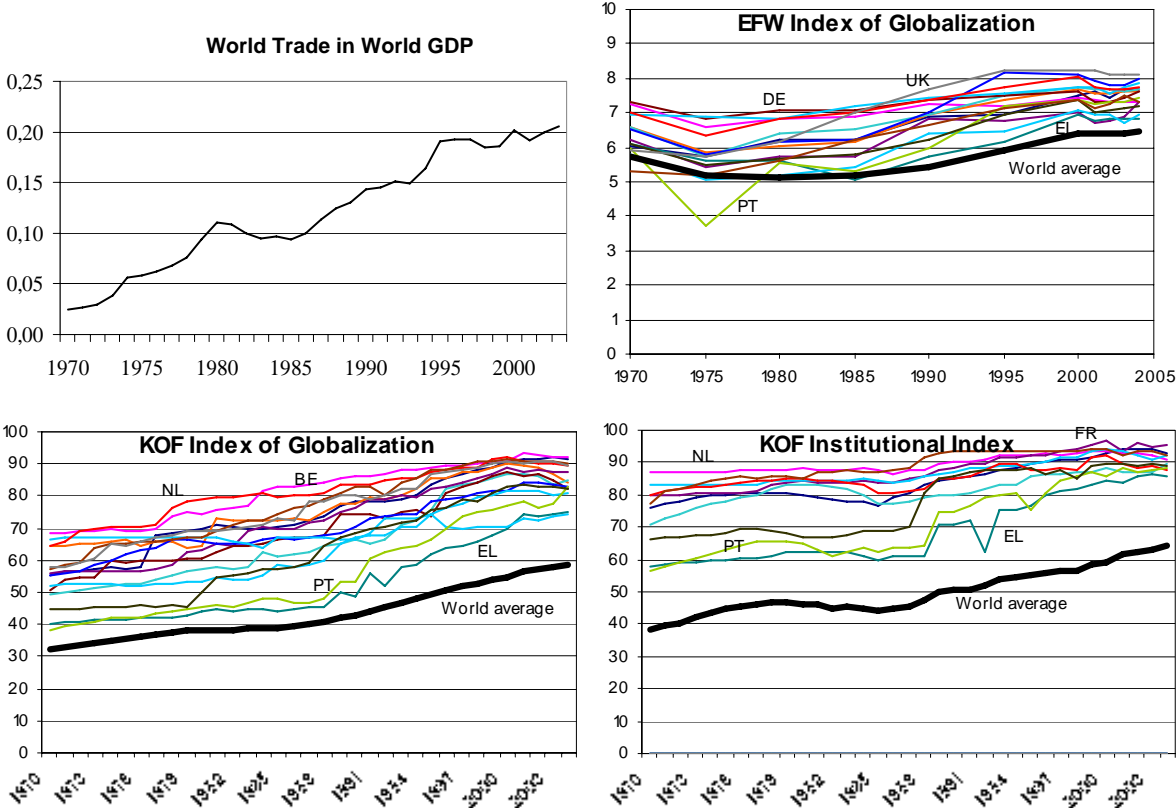


*Source*: World Bank. Gwartney and Lawson (2006). - Dreher (2006).

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[10] In fact, in a very recent paper, Hiller and Kruse (2010) show integration events complying with these stages to be highly influential on trade intensities.

The aggregate *world trade volume* as a share of the aggregate world real GDP is shown here, because it is sometimes used as an easy-to-calculate index of globalisation (see Figure 2). This variable has grown tremendously in recent decennials indicating the dimension of the phenomenon. It is, however, an outcome of integration rather than an indicator of the integration process, it does not account for the heterogeneity of the integration process and it is not an appropriate indicator of the globalization process.

The *Fraser Institute's EFW ("Economic Freedom of the World") index* is a country-specific composite index which is available from 1970 to 2000 on a five year basis and from 2000 on an annual basis. It captures a country's integration into the world economy by various indicators related to globalization that are calculated from raw data and grouped into five sub-indices (Table 3). The composite index is defined as an unweighted average of these sub-indices and ranges from 0 (no globalization) to 10 (complete globalization). In contrast to the raw index, a so-called chain-linked index includes corrections for missing data (which is presented here for EU15 countries, Figure 2; see Gwartney and Lawson, 2006, for details).

*Table 3 —* Variables of EFW and KOF globalization indices

| EFW Index of Globalization 2007[a] | KOF Index of Globalization 2007[b] |
|---|---|
| 1: Size of Government | A. Economic Globalization |
| A. Government consumption spending | *i) Data on Actual Flows* |
| B. Transfers and subsidies | Trade (% of GDP) |
| C. Government enterprises and investment | FDI flows (% of GDP) |
| D. Top marginal tax rate | FDI stocks (% of GDP) |
| 2: Legal Structure and Property Rights | Portfolio Investment (% of GDP) |
| A. Judicial independence | Income to Foreign Nationals (% of GDP) |
| B. Impartial courts | *ii) Data on Restrictions* |
| C. Protection of intellectual property | Hidden Import Barriers |
| D. Military interference in law and politicy | Mean Tariff Rate |
| E. Integrity of the legal system | Taxes on Internat. Trade (% of current revenue) |
| 3: Access to Sound Money | Capital Account Restrictions |
| A. Growth of money supply | B. Social Globalization |
| B. Standard inflation variability | *i) Data on Personal Contact* |
| C. Recent inflation rate | Outgoing Telephone Traffic |
| D. Foreign currency bank accounts | Transfers (% of GDP) |
| 4: Freedom to Trade Internationally | International Tourism |
| A. Taxes on international trade | Telephone Average Cost of Call to US |
| B. Regulatory trade barrier | Foreign Population (% of total population) |
| C. Size of trade sector | *ii) Data on Information Flows* |
| D. Off. exchange rate ./. black market rate | Internet Hosts (per capita) |
| E. International capital market controls | Internet Users (share of population) |
| 5: Regulation of Credit, Labor, Business | Cable Television (per capita) |
| A. Credit Market Regulations | Daily Newspapers (per capita) |
| B. Labor Market Regulations | Radios (per capita) |
| C. Business Regulations | *iii) Data on Cultural Proximity* |
| [a] For detail see Fraser Institute online (http://www.freetheworld.com) | McDonald's and Ikea (per capita) |
| | Trade in books (% of GDP) |
| | C. Political Globalization |
| | Embassies in Country |
| | Membership in International Organizations |
| | Participation in U.N. Security Council Missions |
| | [b] For detail see KOF online (http://globalization.kof.ethz.ch/ ). |

*Source*: Gwartney and Lawson (2006). - Dreher (2006).

The EFW index is fairly comprehensive. One advantage is its focus on institutional factors. The institutional determinants of a country's openness appear well suited for estimating the effects of the globalization because they can be assumed to be causal to effects of globalization. A disadvantage of the EFW index is that it is available only on five years' intervals. Its use in a panel data analysis with annual data will require interpolations.

The *KOF index developed at the ETH Zürich* (Dreher 2006; Table 3, Figure 2) is a country-specific composite index explicitly designed to measure the globalization degree of each country. The index is a weighted average of three sub-indices, which focus on economic (weight: 36%), social (38%), and political (26%) aspects of globalization. Each sub-index comprises several components. It is a mixed index in that some of its components concern consequences of integration whiles other concern more fundamental, institutional determinants (e.g., A.i versus A.ii in Table 3), and still others concern determinants relating to the progress of IC&T technology (e.g., B.ii). The composite index ranges from 0 (no globalization) to 100 (complete globalization) and is available on an annual basis. The KOF index is convenient because it is available for a long period of time, starting in 1970. It may, however, give rise to serious endogeneity concerns because some of its components cannot be assumed to be exogenous to response variables like trade intensity, wages, or income. Moreover, the weights assigned to the sub-indices and variables are highly arbitrary.

Still, the KOF index also facilitates separating the institutional elements within the total index, which are publicly available. Thus, an institutional KOF sub-index can be derived by combining the sub-index of economic restrictions (A.ii), which is assigned the weight of 18% in the aggregate index, and the sub-index of political globalization (C; 26%). The evolution of this combined institutional sub-index for the EU15 countries is also displayed in Figure 2. The variety of institutional determinants covered by this institutional sub-index is much more limited than that of the EFW index. Still, the availability of yearly data could outweigh this disadvantage of reduced information, if the institutional KOF sub-index could be shown to be highly correlated with the EFW index.

Assessing in how far the various globalization indices can be substituted one by the other yields a rather mixed picture. Table 4 shows (Pearson) correlation coefficients between the EFW index, the KOF index and the institutional KOF sub-index across time and across countries for the EU15 countries; for convenience, the correlations with the world trade volume and with the time trend are also provided. Table 4 reports the means and the standard deviations of all country-specific cross-time correlations (upper triangle) and the means and the standard deviations of all year-specific cross-country correlations (lower triangle).

All indices prove to be highly correlated across time for most of the EU15 countries. Also, all indices are highly correlated with the world trade volume and even with the time trend. These correlations reflect that all indices analysed show an upward trend and that this upward trend is rather continuous. By contrast, the indices are much less correlated across countries.[11] Although all countries reveal upward trends for all indices, the respective slopes of these trends obviously vary considerably for each country with regard to each index. Unexpectedly, the correlations of the (by construction institutional) EFW index are always a little higher to the rather mixed general KOF index than to the extracted institutional KOF sub-index.

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[11] Country-by-country cross-time correlations and year-by-year cross-countries correlations are not shown here but are available on request from the authors. The latter reveal a time trend in that the cross-country correlations increase slightly first, from a particularly low level in the early 1970s until 1990, and decrease since.

*Table 4* — Correlations between different indices of globalization across time and across countries, 1970-2001[a, b]

| Across countries \ Across time | EFW | KOF | KOF_ Inst | World Trade | Time Trend |
|---|---|---|---|---|---|
| EFW | | 0.85 (.11) | 0.83 (.08) | 0.81 (.11) | 0.83 (.12) |
| KOF | 0.53 (.18) | | 0.92 (.07) | 0.94 (.06) | 0.95 (.07) |
| KOF_Inst | 0.36 (.24) | 0.84 (.05) | | 0.91 (.04) | 0.90 (.05) |
| World Trade | — | — | — | | 0.98 (.00) |

[a] The upper triangle reports, in each cell, the mean and standard deviation over the 15 EU countries of the country-specific Pearson correlation coefficients between the indices given in the column and the row heads across the time 1970–2001. The lower triangle reports, in each cell, the mean and standard deviation over the years 1970–2001 of the year-specific Pearson correlation coefficients between the indices given in the column and the row heads across the 15 EU countries. − [b] The across-countries correlation coefficients for the world trade index and the time trend are zero because both do not vary across countries.

*Source*: Gwartney and Lawson (2006). - Dreher (2006). - KOF online 2007. - World Bank data. – Own calculations.

Hence, the institutional KOF sub-index turns up to be no good substitute for the EFW index in representing the process of globalization. Moreover, it does not provide data for all EU15 countries. Accordingly, the EFW index appears to be most appropriate as a comprehensive and adequately specified indicator of the institutional side of globalization.

### 3.3 Correlations between the EU integration and the globalization indices

In Section 2, it is argued that it is possible to distinguish European integration from globalization in conceptual terms. Now the analysis turns to the question whether it is also possible to distinguish both in empirical terms. The effects of European integration cannot be identified separately from those of globalization in econometric models, if the respective indices are perfectly correlated. The indices must, at least to some extent, carry differing pieces of information that allow identifying the effects of European integration.

Figures 1 and 2 above already indicate that EU integration and globalization indices are likely to be all highly correlated across time since all indices tend to increase more or less continuously across time in all countries. This visual impression is confirmed by Pearson correlation coefficients given in Table 5 and Figure 3.

Accordingly, the country-specific correlations show the ECB indices and the globalization indices (EFW, KOF, world trade/GDP) to be almost perfectly correlated across time (upper row of Table 5, and upper graph of Figure 3). The correlation coefficients are >0.8 for the EU on average and for almost any country. The correlations are high for globalization indices focusing on institutional aspects and thus on the sources of globalization, such as the EFW index. But the correlations are even higher for globalization indices focusing more on the volumes and intensities of economic transactions and thus on the consequences of globalization, such as the composite KOF index and the world trade volume. Relatively low correlations are only found between the ECB index and the EFW index in the cases of Greece and Denmark, Germany, Belgium and Ireland (Figure 3, upper graph). On aggregate, it is therefore concluded

that the time dimension alone will not contribute much to distinguishing the effects of the European integration from those of the globalization in empirical studies.

*Table 5* — Correlations between indices of European integration and globalization across time and across countries, 1970-2001[a]

| ECB versus | EFW | KOF | KOF_ Inst | World Trade | Time Trend |
|---|---|---|---|---|---|
| Across time | 0.84 (.11) | 0.93 (.05) | 0.91 (.07) | 0.94 (.02) | 0.95 (.03) |
| Across countries | 0.13 (.39) | 0.18 (.35) | 0.19 (.38) | — | — |

[a] The upper line reports, in each cell, the mean and standard deviation over the 15 EU countries of the country-specific Pearson correlation coefficients between the ECB index and the indices given in the column head across the time 1970–2001. The lower line reports, in each cell, the mean and standard deviation over the years 1970–2001 of the year-specific Pearson correlation coefficients between the ECB index and the indices given in the column head across the 15 EU countries.

*Source*: Dorucci et al. 2002. - Gwartney and Lawson (2006). - Dreher (2006). - KOF online 2007. - World Bank data. – Own calculations.

*Figure 3* — Correlations between the ECB index of European integration and selected globalization indices across time and across countries, 1970-2001

Correlations across time, by country[a]
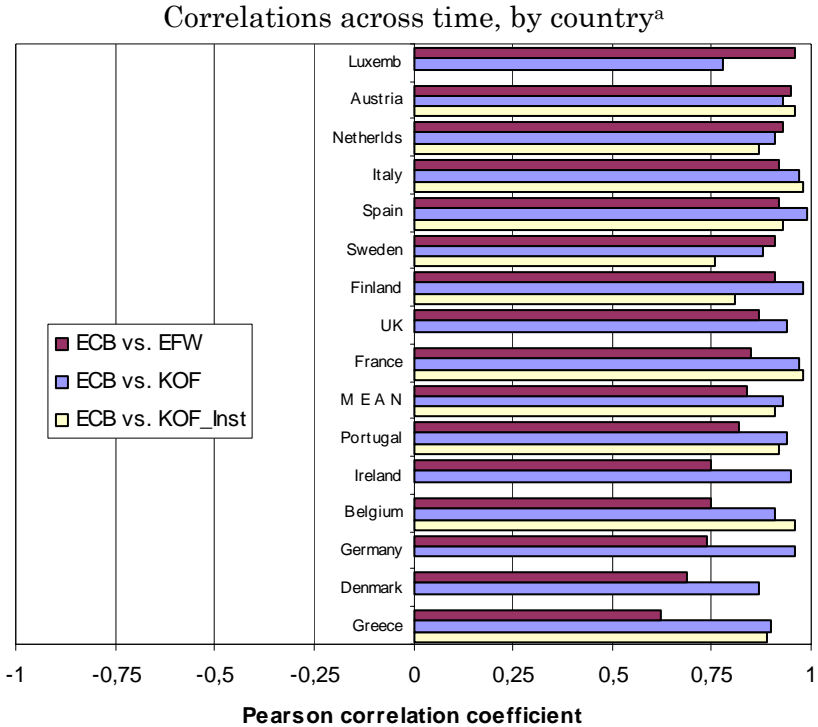


[a] Data are lacking for the KOF_Inst index in the cases of Germany, Ireland, UK, Denmark and Luxemburg.
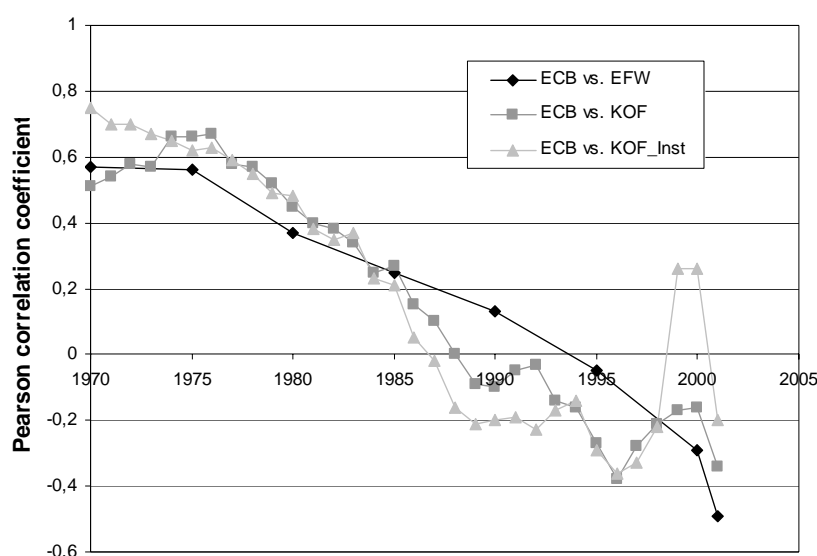
Correlation across countries, by year



*Source*: Dorucci et al. 2002. - Gwartney and Lawson (2006). - Dreher (2006). - KOF online 2007. – Own calculations.

Across the EU15 countries, by contrast, the ECB indices are virtually unrelated to those of the globalization indices, as reported for the year-specific correlations in Table 5 (lower row) and Figure 3 (lower graph). The average of the year-specific correlations varies between 0.19 (to the institutional KOF index) and 0.13 (to the EFW index).[12] However, this aggregate picture masks an interesting time trend (Figure 3, lower graph). For the 1970s and 1980s, the year-specific indices of European integration and of globalization appear to be positively related to each other. The EU countries most integrated within the EU also tended to be the most globalized countries. The intensity of this positive correlation decreased over time, however, and eventually turned negative, such that, in 2001, the EU countries most integrated within the EU tended to be the least globalized countries, and vice versa.[13] This is true for the two types of indices, the institutions-based indices (EFW; including the driving forces of globalization only), and the mixed, institutions- and transactions-based ones (KOF; including both the driving forces and consequences of globalization).

These decreasing correlations between European integration and globalization seem to highlight different evolution paths of the EU15 countries with respect to these two ways of economic integration: Whereas some countries seem to be more prone to EU integration, others seem to be more globalization-prone. Figure 4 plots the co-movement of the EU integration and globalization indices for various EU countries during the observation period 1970-2000. It shows for each country the combinations of ECB index and EFW index in five-year intervals (each point marks one of the years 1970, 1975, 1980, 1985, 1990, 1995, 2000). All original EU6 member states start in the first observation year 1970 at a European integration level slightly below the value of 50, all countries acceding later at a European integration level close to zero. The level of

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[12] Correlations for World trade index and time trend are zero because they do not vary across countries.

[13] The outliers in the correlations between ECB index and institutional KOF sub-index for 1999 and 2000 cannot be traced to any single underlying cause, but rather seem to be the random outcome of several causes.

globalization in the first observation year 1970 varies between values little above 5 (Sweden) and above 7 (Germany).[14]

From these starting points, some countries show a "European-integration-prone" evolution into a primarily upward direction (upper graph of Figure 4). That is to say, their position improves relatively fast with regard to European integration, less so with regard to globalization. Some of them, including the EU6 member states Germany, Luxemburg and the Netherlands, and the accession country Finland, evolve such on the background of a right from the start more elevated globalization level. Others remain less globalized throughout, including Belgium, Austria, Spain and Sweden. All of these countries but one reach the highest European integration level attainable in 2000 (close to a value of 90).

On the contrary, other countries show a more "globalization-prone" evolution not only in an upward direction but also towards the right-hand side (lower graph of Figure 4). Their position improved somewhat more slowly with regard to European integration yet relatively fast with regard to globalization. Some of them, including the EU6 member states France and Italy, and the accession countries Greece and Portugal, start from a particularly low globalization level to reach a medium level by 2000. Others, including Denmark, Ireland and the UK, reach a high globalization level between 7 and more than 8 by 2000 while staying behind regarding European integration.

*Figure 4* – Co-movement of EU integration and globalization indices, 1970-2000



European-integration-prone countries

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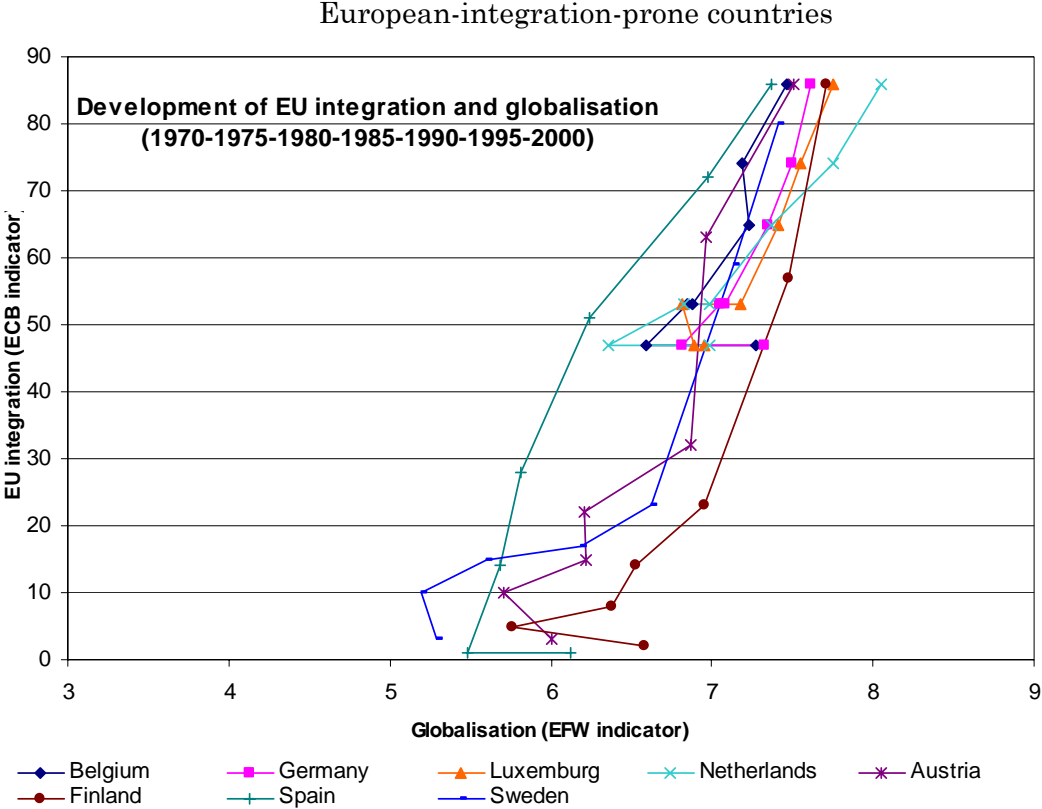
[14] For all countries, the globalization level decreases between 1970 and 1975 according to the EFW index (cf. Figure 4). This is a specialty of the EFW index, it is not observed for the KOF indices (cf. Figure 5).

Globalization-prone countries



**Development of EU integration and globalisation**
**(1970-1975-1980-1985-1990-1995-2000)**

EU integration (ECB indicator)

Globalisation (EFW indicator)

France  Italy  Denmark  Greece  Ireland  Portugal  UK
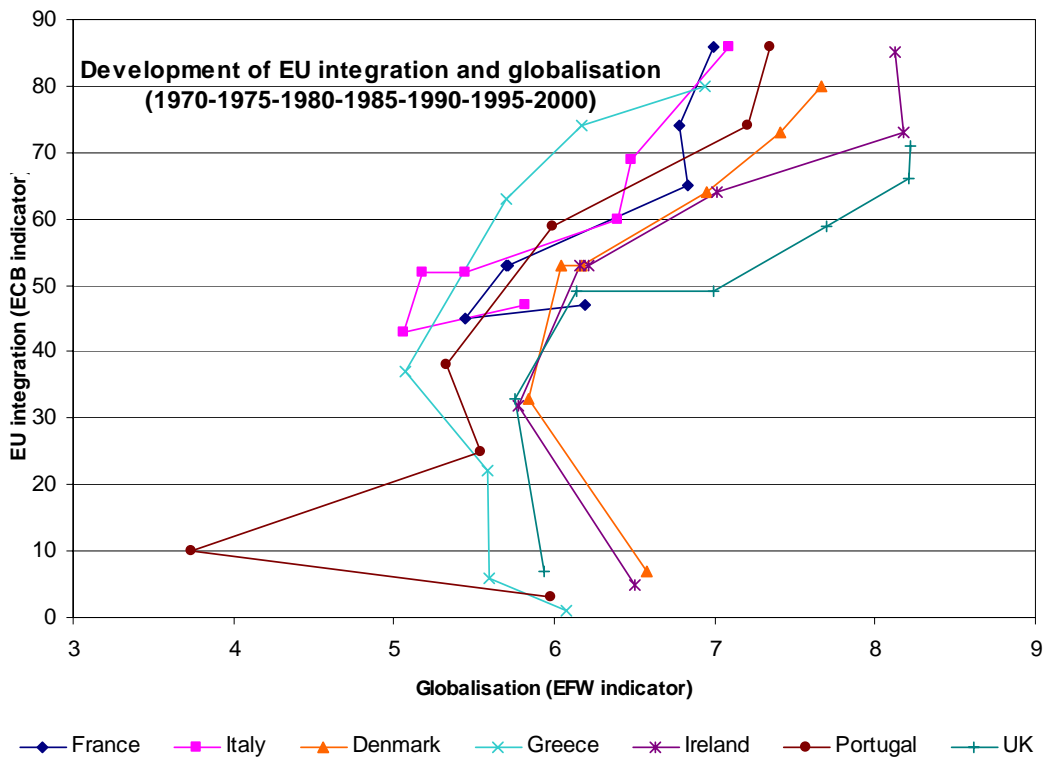
*Source*: Dorucci et al. 2002. - Gwartney and Lawson (2006). – Own illustration.

Several implications can be drawn from these empirical results, on the relationship between driving forces and consequences as well as on the relationship of the driving forces among themselves. First, driving forces and consequences of the globalization process appear to be closely related: Among each other, the globalization indices are highly correlated irrespective of whether they represent driving forces or actual transactions (as part of the consequences). Also, the correlations between the ECB index and the various globalization indices do not differ much, irrespective of whether the respective globalization indices focus on the driving forces or on actual transactions. Second, the different driving forces (institutional progress, IC&T technology, innovations in industrial organization, innovations on financial markets, etc.) seem to be closely related among each other: The empirical result of a high correlation between only one driving force of globalization (institutional progress) and the general consequences suggests that the other driving force(s) might either be irrelevant for the consequences or impact similarly on them. As a consequence, a globalization index based solely on the institutional progress may still be a sufficient proxy for all driving forces including those that are more difficult to measure.

To sum up, the ECB index as an indicator of European integration is empirically distinct from indicators of globalization such as EFW and KOF indices. In particular, viewed across time, the indices carry differing pieces of information for each country, as the countries seem to follow different pathways with respect to European integration and globalization.

# 4 Illustration: Indicators of economic integration in a gravity model of the EU

## 4.1 Empirical model and data

To illustrate the workability of the chosen integration indicators for econometric analysis, an estimation of a simple panel gravity model is now presented that uses these indicators to isolate the effects of the EU integration on intra-European trade intensities, controlling for those of globalization. The very purpose of this model is to further analyse the relations between the integration indicators; it is not meant to contribute to the vast and ever more sophisticated gravity approach literature (for reviews of the gravity approach literature cf. Baier, Bergstrand, 2007, and Anderson, van Wincoop, 2004). The baseline of the analysis is a simple panel gravity model of trade among the EU15 countries that is augmented by assuming border costs as functions of the degree of integration among the EU15 countries and their integration into the global economy, and by assuming technological progress.

The baseline gravity model is

$$
\begin{aligned}
\ln X_{ijt} = {} & \alpha_1 \ln GDP_{it} + \alpha_2 \ln GDP_{jt} + \alpha_3 \ln POP_{it} + \alpha_4 \ln POP_{jt} \\
& + \delta \ln D_{ij} + \gamma_{ij} + DIC + \varepsilon_{ijt}
\end{aligned}, \tag{1}
$$

where $X_{ij}$ denotes exports from country $i$ to country $j$, $(i, j = 1, \ldots, N)$, GDP and POP the (nominal) gross domestic product and the population size, $D_{ij}$ the bilateral distance, $\gamma_{ij}$ a set of country-pair fixed effects, and $\varepsilon_{ijt}$ an idiosyncratic error term. The country-pair fixed effects account for the effects of time-independent fundamental characteristics of both the individual countries, and the country pairs on trade intensities.[15] These effects include, on the one hand, the individual countries' exogenous comparative advantages (e.g., resource endowments) and their consumers' preferences. The effects include, on the other hand, the average trade intensities between the pairs of countries.[16] To account for a possible structural break in the intra-EU trade intensities due to the fall of the iron curtain in 1989, a dummy variable *DIC* is added that is one for all years before the fall of the iron curtain, and 0 after its fall.

This baseline model is further augmented by adding, separately for the respective exporting and importing countries, the ECB index as the chosen indicator of the integration of the countries into the EU (Section 3.1; see Figure 1), the EFW index as the chosen indicator of the institutional integration of the countries into the global economy (Section 3.2; see Figure 2), and a time trend as an indicator of global technological progress. This procedure is aimed at reducing endogeneity problems (as pointed out, e.g., by Baier and Bergstrand 2007) as far as possible: Time- and country-variant indicators are employed instead of dummies to mirror the continuous ongoing

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[15] It is referred to the dependent variable as reflecting trade intensities rather than to export values because the GDP and population variables on the right-hand side of the regression equation can be interpreted as controlling for the effects of the absolute country sizes or per-capita income levels.

[16] For simplicity, the product of the unobservable price indices of traded goods in the exporting and importing countries is ignored. Based on a simple trade model with product variety and monopolistic-competition, Anderson and van Wincoop (2004: eq. 12) derive a gravity equation that differs from (1) in that it comprises as explanatory variables the real instead of the nominal incomes of the trading countries as well as two additional variables, the CES price index of exported goods in the exporting country and the CES price index of imported goods in the importing country. (1) will be approximately equivalent to the model (12) in Anderson and van Wincoop, if the ratios of the price indices for traded goods and all goods do not change significantly over time. Investigating the effects of the changes of these ratios over time on trade is left to future research.

process of economic integration, the phasing-in effects in case of new entrants to the EU and the different levels of integration achieved by different countries; this aims at reducing measurement errors. Separate indicators for regional integration, for globalisation, and for global technological progress are included to reduce biases from omitted variables. Indicators that reflect the institutional integration into the EU and into the global economy are preferred to those that reflect the changes of transaction costs, in order to reduce the problem of simultaneity. The model then becomes

$$\ln X_{ijt} = \alpha_1 \ln GDP_{it} + \alpha_2 \ln GDP_{jt} + \alpha_3 \ln POP_{it} + \alpha_4 \ln POP_{jt} + \delta \ln D_{ij} + \gamma_{ij} + DIC$$
$$+ \beta_1 I_{it} + \beta_2 I_{jt} + \beta_3 G_{it} + \beta_4 G_{jt} + \beta_5 T_t + \varepsilon_{ijt}. \tag{2}$$

$I_{it}$ and $I_{jt}$ denote the levels of institutional EU integration of the two trading countries $i$ and $j$ into the EU, $G_{it}$ and $G_{jt}$ their levels of institutional integration into the global economy, and $T_t$ the indicator of the technology. A country that is more integrated into the EU is expected to have greater opportunities to trade with other EU countries because exporters and importers face lower institutional border impediments for intra-EU trade. A country that is more integrated into the global economy is expected to have greater opportunities to trade with non-EU countries. This may affect the intensity of its trade with EU countries either positively or negatively, depending on whether the trade with non-EU countries complements or substitutes for the trade with EU countries. The global technological progress, finally, is expected to extend the opportunities to trade with other EU countries by generating new traded goods and making non-tradable goods tradable.

Equation (2) is estimated in first differences to account for a possibly serially correlated error term; this in turn eliminates the country-pair fixed effects. The first differencing also eliminates the distance term, $D_{ij}$, because the distances are fixed over time. And it removes the time trend from the EU integration and globalization indices, thereby reducing multicollinearity induced by their high correlation over time (see Section 3.3). The augmented gravity model (2) is estimated for the period 1970–2000. Since the EFW index is available only for every fifth year, there are seven observations in time, ranging from 1970 to 2000, or six observations in the first-differenced model. The data on trade (exports) among the EU15 countries (variable $X_{ijt}$), nominal GDP ($GDP_{it}$, $GDP_{jt}$) and population ($POP_{it}$, $POP_{jt}$) are available from the OECD. Exports and GDP are in current-year US-$. Belgium and Luxembourg are merged to one country because trade data are available only for the aggregate of both countries for several years.[17] The ECB index is divided by 10 to get parameter estimates comparable in magnitude to the EFW index: Both indices thus range from 0 to 10. The descriptive statistics for the explanatory variables are depicted in Table A2 in the Appendix.

## 4.2 Results

The results of the estimation of equations (2) in first differences by panel OLS are reported in column (1) of Table 7. The estimates for the indicators of the GDP and population of the trading countries have the correct signs and are of plausible magnitudes. The parameters of the two population variables are not significantly different from zero, which, however, is not too surprising because the per-capita incomes (GDP/POP) do not vary substantially across the 15 EU countries. The positive and significant parameter of the dummy for the iron curtain indicates that the trade intensities were, ceteris paribus, higher in the 1970s and 1980s than thereafter. Some trade between the Western European EU members has apparently been diverted towards Eastern Europe after the fall of the iron curtain.

A higher *institutional integration of a country into the EU* fosters its exports to other EU countries to a greater extent than its imports from other EU countries, according to

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[17] Data on exports from and to Belgium and Luxembourg are not available for the years before 1997.

the estimates. The parameter of the ECB index of the exporting country is estimated to be 0.033; that of the importing country only 0.016. Moreover, the parameter for the importing country appears to be not significantly different from zero. This is, however, due to multicollinearity between the two ECB indices.[18] The estimated parameters of the two EU integration indices suggest that any unit increase of a country's ECB index raises, ceteris paribus, its exports to other EU countries by 3.3% and its imports from other EU countries by 1.7%. A parallel unit increase of the ECB index for the exporting and importing country raises the trade intensity between these two countries consequently by 5% ($e^{0.033+0.016} \approx 1.05$).

*Table 7*: Regression results

|  | (1) parm | Std.dev | (2) parm | Std.dev | (3) parm | Std.dev |
|---|---|---|---|---|---|---|
| ln(GDP exporter) | 0.341 | 0.056*** | 0.368 | 0.057*** | 0.372 | 0.058*** |
| ln(GDP importer) | 0.677 | 0.056*** | 0.689 | 0.058*** | 0.721 | 0.058*** |
| ln(POP exporter) | -0.309 | 0.334 | 0.329 | 0.382 | 1.415 | 0.472*** |
| ln(POP importer) | -0.432 | 0.268 | -0.150 | 0.257 | 0.863 | 0.288*** |
| dummy iron curtain | 0.136 | 0.037*** | 0.129 | 0.030*** | 0.052 | 0.031* |
| EU integr. (ECB) exporter | 0.033 | 0.012*** | 0.062 | 0.011*** | — | |
| EU integr. (ECB) importer | 0.016 | 0.012 | 0.044 | 0.011*** | — | |
| globalization (EFW) exporter | -0.065 | 0.029** | — | | — | |
| globalization (EFW) importer | 0.071 | 0.028** | — | | — | |
| technology (time trend) | 0.123 | 0.020*** | — | | — | |
| R-squared | 0.644 | | 0.628 | | 0.600 | |
| Adj. R-squared | 0.640 | | 0.623 | | 0.595 | |
| SSR | 95.7 | | 99.9 | | 108.4 | |
| No of obs | 1014 | | 1014 | | 1014 | |

Panel OLS regressions in first differences; dependent variable: logged exports 1970–2000. White-robust standard deviations (Std.dev); *, **, ***: significant at the 10%, 5%, 1% level.

These estimates do not easily compare to those employing a dummy approach, yet they seem to be of comparable magnitude. Baier and Bergstrand (2007) find the forming of a FTA to affect an average trade increase between 14% and 114% (according to estimation model). If considering that acceding the EU raises the ECB index between accession country and incumbents by approximately 75 score points during two 5-year periods (cf. Figure 1), the accession is calculated to effect, ceteris paribus, a mutual trade increase by 44% ($e^{7.5*0.033+7.5*0.016} \approx 1.44$), which is in the range of the result s of Baier and Bergstrand. Bun and Klaassen (2007) find trade intensities to be 6% higher, if both trading countries belong to the Euro zone. If assuming an increase of the ECB index by 20 score points, which is equivalent to completing one stage of integration, e.g., from a free trade area to a customs union, trade volumes are found to be raised, ceteris paribus, by 10%, which again is fairly close to the estimates by Bun and Klaassen. The estimates differ, however, significantly from those reported by Rose (2000) and Glick and Rose (2002), who find the trade intensities to be 100% higher, if both trading countries belong

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[18] If the product of the two indices, $I_{it}$ x $I_{jt}$, is specified as a single variable, a higher EU integration of the exporting and importing country taken together is estimated to be 0.098 and highly significant. The estimates for this model, which are not reported here, are available from the authors upon request.

to the Euro zone. Bun and Klaassen argue that these high estimated trade effects of free trade areas are mainly due to omitted country-pair-specific time trends in Rose (2000) and Glick and Rose (2002). In the present study, the country-specific time trends are part of the EU integration and globalization indices, and are eliminated by first-differencing.

A higher institutional integration of a country *into the global economy* reduces its exports to other EU countries but fosters its imports from other EU countries according to the estimates presented here. The parameter of the EFW index of the exporting country is estimated to be –0.065; that of the importing country 0.071. Both parameters are, in spite of some multicollinearity, significant at the 5% level. This indicates that a country's higher integration into the global economy diverts some exports away from the EU, possibly towards non-EU countries, but generates additional imports from other EU countries. EU countries that focus more on removing barriers to trade with other EU countries than on opening up towards the rest of the world apparently still participate indirectly from global openness of other EU countries by selling more to these countries. Both effects taken together, a parallel unit increase of the EFW index for the exporting and importing country raises the trade intensity between these two countries consequently by only 0.6% ($e^{-0.065+0.071} \approx 1.006$).

The *global technological progress*, finally, which is proxied by a time trend, is estimated to impact strongly on trade intensities. The trade increase facilitated by global technological progress is estimated to be 13% within the 5-year period.

Over the whole observation period from 1970 to 2000, the average partial effect of European integration accounted for an increase by 38%, that of (institutional) globalisation for an increase by 1.2%, and that of technological change for an increase by 109%. As a combined effect, economic integration in total is estimated to almost have doubled trade volumes between any two EU15 countries (increase of 191%; $e^{1.072*0.033+1.108*0.016-0.203*0.065+0.213*0.071+0.123} \approx 2.91$). During the same time, however, the mere average rise of GDP per capita has increased trade volumes between European countries by 947%. As to total effects, all in all, (nominal) trade volumes even rose by more than 2500%.

Columns (2) and (3) of Table 7 report control regressions. Column (2) shows that the effects of the EU integration will be overstated significantly, if the effects of the globalization and the global technological progress are not controlled for explicitly. The parameters of the two ECB indices are twice as high as those in column (1). As expected, they pick up at least a part of the effects of the globalization and the technological progress on trade intensities. Column (3) shows that ignoring the effects of EU integration, globalization and technological progress completely yields implausible results. The parameters of the two population variables assume positive and highly significant values, which implies that the trade intensities decrease with increasing per capita income. In addition, the iron-curtain dummy looses much of its influence.

# 5  Conclusion

This paper searches for operational indicators for analyzing empirically the effects of European integration on trade, division of labour, income, employment and growth. It addresses two major problems: to define an informative indicator adequately describing the European integration process, and to distinguish the effects of European integration from similar effects of globalization.

Conceptually, it is suggested to distinguish European integration from globalization by addressing the specific driving forces that are behind the integration processes. With the ECB index (Dorucci et al 2002) and the EFW index (Gwartney and Lawson 2006) there are indicators of European integration and globalization available that describe comprehensively the institutional progress specific to each of these processes.

Empirically, the ECB index of European integration is found to be distinct from the EFW and other indices of globalization. In particular, viewed across time, the indices carry differing pieces of information for each country, as the countries seem to follow different pathways with respect to European integration and globalization (Finland and Germany, on the one end, seem to be more prone to European integration whereas the UK and Ireland, on the other end, seem to be more prone to globalization).

The illustrative gravity model demonstrates that including indicators for the processes of European integration, globalization and technological progress in empirical analyses may improve the quality and plausibility of the results decisively, and may allow distinguishing different effects from EU integration and globalization.

According to the findings of this paper, the ECB index and the EFW index are considered suitable measures to assess the impact of EU integration and globalization, respectively.

Future research may explore by sensitivity tests in how far the existing integration indices depend on their arbitrary weights, and in how far such dependencies bear the danger of misinterpretations. Also, future research may focus on finding more adequate concepts and measurements for other driving forces of economic integration such as innovations in IC&T technologies, industrial organization and financial markets.

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# Appendix

*Table A1 –*    Descriptive statistics for variables used in the illustrative regression

| Variable (first differences) | Mean | Std.dev | Minimum | Maximum |
| --- | --- | --- | --- | --- |
| $\ln X_{ijt}$ | 0.546 | 0.515 | -1.153 | 2.388 |
| $I_{it}$(ECB index exporter) | 1.072 | 0.862 | -0.400 | 3.600 |
| $I_{jt}$(ECB index importer) | 1.108 | 0.876 | -0.400 | 3.600 |
| $G_{it}$, (EFW index exporter) | 0.203 | 0.544 | -2.235 | 1.804 |
| $G_{jt}$ (EFW index importer) | 0.213 | 0.562 | -2.235 | 1.804 |
| time trend | 1 | 0 | 1 | 1 |
| $\ln GDP_{it}$ | 0.401 | 0.440 | -0.380 | 1.088 |
| $\ln GDP_{jt}$ | 0.403 | 0.434 | -0.299 | 1.088 |
| $\ln POP_{it}$ | 0.024 | 0.031 | -0.014 | 0.255 |
| $\ln POP_{jt}$ | 0.025 | 0.032 | -0.014 | 0.255 |
| dummy iron curtain | -0.167 | 0.373 | -1 | 0 |