Product Differentiation, Transition, and Economic Development

The Benefits from Product Differentiation in Modern Economies

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Public Governance as the Source of Quality and Variety Gains from Transition

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VORWORT

Bei den beiden vorliegenden Studien handelt es sich um die ersten Arbeiten der Gruppe I in der zweiten Phase von Forost, die in der Reihe des Forschungsverbunds veröffentlicht werden. Das Gruppenthema lautet *Wirtschaftliche, rechtliche und sprachliche Faktoren der Europäischen Integration*. Der Leitbegriff der Gruppe ist *Interessenkonflikt und Interessenausgleich*. Das von Prof. Hoffmann eingereichte und Dr. Frensch bearbeitete Projekt steht unter dem Thema *Osterweiterung und Währungsunion: Risikoabschätzung für die wirtschaftliche Entwicklung und Stabilität*.

Eine dauerhafte reale Währungsaufwertung kann auf sektoral unterschiedlichem Produktivitätswachstum beruhen (Balassa-Samuelson-Effekt). Innerhalb der EWU würde sich dies in signifikant höherer Inflation in den MOE-Ländern gegenüber dem EWU-Durchschnitt niederschlagen, mit entsprechende Risiken für die wirtschaftliche Entwicklung und Stabilität in diesen Ländern.

Die beiden hier vorgelegten Arbeiten befassen sich mit realwirtschaftlichen Vorgängen der qualitativen Verbesserung und der Zunahme der Vielfalt der Produktion als wichtiger Grundlage für die Entwicklung der realen Wechselkurse. Speziell wird in beiden Arbeiten darauf eingegangen werden, inwieweit Produktivitätswachstum auf *endogenen* technischen Fortschritt zurückzuführen ist. Endogener technischer Fortschritt wird als Vertiefung der Arbeitsteilung in der Ökonomie aufgefasst, die auf dem Handel mit, sowie der Imitation und Innovation von Produkten und Produktionsprozessen beruht. Diese Vertiefung der Arbeitsteilung schlägt sich in einer zunehmenden Produktdifferenzierung nieder, insbesondere in einer höheren Vielfalt und Qualität von Kapitalgütern und Zwischenprodukten.

In der Arbeit *The Benefits from Product Differentiation in Modern Economies* wird anhand eines umfassenden Datensatzes Ausmaß und Qualität der ökonomischen Arbeitsteilung im Sinne Adam Smiths nachgegangen. Es werden sowohl die langfristige Beziehung zwischen der Arbeitsteilung und wirtschaftlicher Entwicklung illustriert als auch Quellen zunehmender Produktvielfalt und -qualität in Außenhandel, Innovation und Imitation identifiziert.

Die Art und Weise wie die Transformationsländer Osteuropas diese Arbeitsteilung nutzen können und wie sich ihre Konkurrenzposition dabei gestaltet, wird für die weitere Integration in die EU und eine Aufnahme in die Währungsunion von erheblicher Bedeutung sein. Die Arbeit gibt dafür auf einer bisher einmalig breiten Datenbasis wichtige Anhaltspunkte.

In der zweiten Arbeit *Public Governance as the Source of Quality and Variety Gains from Transition* wird auf die im Verlauf der Transformation als immer wichtiger erkannte Frage der staatlichen Rahmenbedingungen und Steuerung (public governance) auf die qualitative Verbesserung und die Zunahme der Vielfalt der Produktion und der Produkte eingegangen. Dabei wird in der Arbeit ein deutlicher positiver Zusammenhang theoretisch nachgewiesen. Damit wird auch deutlich, dass die unter *public governance* zusammengefassten Rahmenbedingungen einen wesentlichen Einfluss auf die Fähigkeit eines Landes haben, sich in die internationale Arbeitsteilung einzubringen. Je besser die *public governance* ausgestaltet ist, umso stärker und qualitativ hochwertiger werden sich die Transformationsökonomien Osteuropas in die EU einbringen können, womit gleichzeitig das mögliche Konfliktpotential vermindert wird.

München, im März 2004 Hermann Clement

INHALT

The Benefits from Product Differentiation in Modern Economies

*Richard Frensch** and *Vitalija Gaucaite-Wittich***

The *division of labour* was already described in Adam Smith's example of the making of pins. A production process is split into subtasks, each of which is assigned to a worker specialised in carrying out that subtask. Technological progress embedded in a deepening division of labour, based on trading, imitating, and innovating products and production processes fosters long-run growth. This progress is reflected in more product differentiation, especially in a higher variety and quality of capital goods and intermediate inputs. Measures of product differentiation, such as variety and quality measures derived from the UN ComTrade database provide a unique framework, consistent across countries, for proxying the extent and the quality of the division of labour in an economy. Within this framework, this section illustrates the relationship between the division of labour and long-run economic development in the economies of the UNECE region. The potential for deepening the growth promoting division of labour by increasing the variety and quality of goods available in a country via trade, innovation, and imitation is also explored. The results shed light on the importance of research and development (R&D), education, and external liberalisation for competitiveness in a modern economy. The available data also allow for illustrating some other facets of product differentiation, e.g. the effect of economic development on consumption patterns.

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(i) Conceptual issues in product differentiation

"Diversity is the staff of economic life",[1] and there are numerous approaches to relate this notion to the specialized ways in which work is organized or to the variety of choices that confront the consumer in the real world. While theoretical approaches always have to reconcile explanatory aspirations with analytical tractability, empirical concepts of measuring diversity are often constrained by data availability. All these limitations necessarily imply some divergence between theory, measurement, and commonly held notions of diversity or variety.

The theoretical tool of dealing with diversity or variety is *product differentiation*: there are many different goods, each of which exists in a number of forms or variants. The differentiation of products can be vertical or horizontal, i.e., each product may exist in a number of qualities or in a number of variants of equal quality.[2] This includes the possibility of product differentiation by the country of origin, such that a German car is differentiated from a Japanese car, etc.[3]

Most consumers certainly prefer higher to lower quality. The existence of many consumers with either potentially different tastes over product variants or individual preferences for variety implies a preference for variety in aggregate demand subject to horizontal product differentiation. Models of horizontal product differentiation commonly impose an upper bound on the consumers' preference for variety on the supply side since firms tend to specialise due to internal returns to scale in production. The justification for combining these crucial assumptions on the demand and on the supply side is that both describe the most important stylized facts of industrial production.

The formal structure of this by now standard Dixit-Stiglitz approach to horizontal product differentiation describes the differentiated final goods case above,[4] but it can also be taken to illustrate production processes where product variants are in fact differentiated intermediate inputs – or components – to be assembled into a final homogenous output. The role of the consumers' preference for variety in the final goods case is here played by gains from the division of labour that are external to the firm assembling the final good such that its output

[1] S. Rosen, "Markets and diversity", Presidential Address to the one hundred fourteenth meeting of the American Economic Association, January 5, 2002, Atlanta, Georgia. Reprinted in the *American Economic Review*, Vol. 92, No. 1, March 2002, pp. 1–15.

[2] "Thus a pencil is a well-defined object and so is a refrigerator, a personal computer, a restaurant meal, and a haircut. Each one of these goods is a differentiated product, however, in the sense that there are many varieties of it available in the market and many more that could potentially be produced. There are red and yellow pencils, soft and hard pencils, white and green refrigerators, small and large refrigerators, 16K memory personal computers and 128K memory personal computers, Chinese meals and French meals, short style and long style haircuts, and so on." E. Helpman and P. Krugman, *Market Structure and Foreign Trade*, Cambridge, Mass., MIT Press, 1985, pp. 114-115.

[3] P. Armington, "A theory of demand for products distinguished by place of production", *IMF Staff Papers*, Vol. 16, No. 1, 1969, pp. 159–176.

[4] A. Dixit and J. Stiglitz, "Monopolistic competition and optimum product diversity", *American Economic Review*, Vol. 67, No. 3, June 1977, pp. 297–308.

increases with the number of components used even if the total component input remains constant.[5]

A number of economically meaningful concepts, especially in the context of international trade and growth, are tied to product differentiation. According to modern trade theories, in open economies, product differentiation both of final output and of intermediate inputs is the most important source of trade between similar countries, which gives impetus to *intra-industry trade* and the *vertical fractionalisation* of production and trade.

Most importantly, the recent economic theory of *endogenous growth* suggests that an increasing and more refined division of labour, based on deliberate product and process innovation and imitation, can help avoid diminishing marginal returns and sustain learning-by-doing, thus fostering long-run growth.[6] This technological progress embedded in the division of labour is reflected in more product differentiation, i.e. in a higher variety and quality not only of consumer but also of capital goods and intermediate inputs. Accordingly, in a modern economy the innovation or imitation driven expansion of the range and variety of production as well as quality improvements matter much more for competitiveness than factors that influence sheer volume growth.

Analysing the division of labour in terms of the improvement in the quality and variety of production seems particularly relevant for the assessment of the growth prospects of east European and CIS economies, where pre-transition production volumes were relatively high, while variety and quality of production were often fairly limited. In order to embark on a path of sustained growth, quality improvements and an expanding variety of production, as the result of firm restructuring and the proliferation of SMEs, are increasingly more important than the volume growth of production.[7]

However, so far there exists only a very small body of well-established empirical knowledge on quality and variety aspects of trade and growth, not least because of difficulties of measurement. The presented below attempt to assess the state and trends in domestically produced and available variety and quality of consumer, capital and intermediate goods across the UNECE region, in order to gauge the potential implications on its long-tem growth, is based on the trade-based measures (Box 1) and is rather tentative.

(ii) The variety and quality of production and consumption in the UNECE region

Chart 1 presents three different count measures of *variety* in all commodities across the majority of UNECE countries in 2001. Countries are sorted in descending order of available

[5] W. Ethier, "National and international returns to scale in the modern theory of international trade", *American Economic Review*, Vol. 72, No. 3, June 1982, pp. 389–405.

[6] See Ch. Jones, *Introduction to Economic Growth.* W.W. Norton, New York and London, Second Edition, 2002.

[7] Most accounts of transition have neglected this particular effect of liberalising a formerly planned economy. For a theoretical discussion, which asserts that a successful transition based on improved public governance involves a higher variety and quality of production at the cost of a lower volume of output, see R. Frensch, "Public governance as the source of quality and variety gains from transition", forthcoming in the *Journal of Comparative Economics*, June 2004.

Box 1: Trade-based measurement of product differentiation

Measures of the quality and variety of trade flows are commonly derived from detailed merchandise export and import data. Specifically, it has become common practice in the empirical trade literature to measure product quality in terms of relative export and import unit values. The variety of exports or imports can in the simplest way be measured by counting the number of exported or imported items within a sufficiently disaggregated level of a trade classification.[8]

One – empirically so far often neglected – way to increase data detail is to differentiate products both by economic item and by the country of origin. Using the country of origin of imports as an additional source of information on product differentiation enables one to introduce an additional dimension of variety which is absent in any other data sources.

For a lack of better alternatives, these trade-based measures of product quality and variety are also used in the empirical growth literature. This neglects the non-traded portion of goods production (such as goods sold exclusively in the country of origin; since services are excluded from this analysis, this portion is, however, much lower than the non-traded share of GDP). Other important drawbacks of using trade-based measures in a growth context are, of course, their sensitivity to the degree of openness of an economy, to its size and borders, to tariff and non-tariff barriers to trade, as well as to real exchange rate movements.

In this section, variety and quality are proxied by measures derived from merchandise export and import data of 45 UNECE member countries according to the 5-digit level of the SITC Rev. 3. Although the data selection used here is constrained to trade with partners within the UNECE region, Japan, China and south-east Asia (55 partner countries are covered), it reflects for most of these countries the bulk of their total trade. The geographical bias in the data is thus certainly smaller than the one resulting from study based on the mirror data provided by selected partners such as the EU or the OECD.

Count measures of ***item variety*** add up the number of a country's exported and imported items according to the 5-digit level of the SITC Rev. 3. The number of a country's exported items is assumed to proxy the item variety of domestic production (produced item variety). The number of items exported and/or imported is taken to correspond to the item variety available within a country (available item variety). Thus, item variety measures do not reflect product differentiation by the country of origin.

Count measures of ***product variety*** take account of product differentiation by the country of origin. They count the number of exported items and the number of imported items times the

[8] Count measures are unweighted. For an alternative, more sophisticated weighted measure of variety see R. Feenstra, "New product varieties and the measurement of international prices", *American Economic Review*, Vol. 84, No. 1, March 1994, pp. 157–177. The Feenstra measure and others derived from this have so far been applied in very few empirical studies quoted below. However, these more sophisticated measures also have their drawbacks as compared to simple count measures: when using these measures, a country trading substantially fewer differentiated items but doing so in a much more proportional way than another one might emerge as the one trading higher degrees of variety. This may be seen as an unsatisfactory outcome within the context of the commonly held notion of product diversity and variety. (The result may probably be improved if using different weighting schemes, but this involves more complex computational efforts.) In the analysis below the simple count measures are used while the more sophisticated measures are to be introduced in the follow-up research.

number of different places of origin. Produced product variety is therefore equivalent to produced item variety. The number of exported items plus the number of imported items times their places of origin corresponds to the product variety available within a country (available product variety).

Relative measures of item variety or product variety relate the absolute count measures to the respective maximum numbers attainable. SITC-5-digit level data provide for a maximum number of 3114 traded items. As the import data used here are based on each country's trade with 55 partner countries, the maximum count measure of the product variety of imports of all commodities in this data set (i.e., the maximum number of imported items times the maximum number of their places of origin) rises to 55 × 3114. Consequently, the maximum count measure of product variety available by either domestic production or by trade rises to 3114 + (55 × 3114) = 174,384. The theoretical view is that the variety produced domestically should be only a small subset of the total product variety available via domestic production or trade with the rest of the world: in fact, for the UNECE member countries studied here, this domestically produced subset is typically well below 5 per cent.

Quality is measured in terms of unit values of exports and imports relative to the average unit values of the same commodities in the aggregated EU trade flows.[9] The assumption is that the weighted average of an individual country's relative export (import) unit values (further ***relative export unit values*** or ***relative import unit values***) reflect the quality of domestically produced and imported items.[10] However, there is no straightforward way of combining relative export and import unit values in order to introduce an overall quality measure for available products (including the country of origin aspect), due in part to the different nature of reported prices in customs statistics (FOB for exports and CIF for imports) and to the difficulties in aggregating unit values of each item across countries of origin. The inconsistencies in the units of measurement used in quantity records (weight, number, volume, area, etc.) across the countries and across the years are substantial. In addition, the measurement units do not always match between exports and imports of the same item. Hence no direct quality proxy is assigned to available products.

All these measures exist for total exports and imports, as well as separately for the Broad Economic Categories of consumer, capital and intermediate goods. This distinction allows for selecting the appropriate category when illustrating theoretically justifiable links with economic development, or the innovative and imitative capacities of an economy. For a complete data description, see the Appendix.

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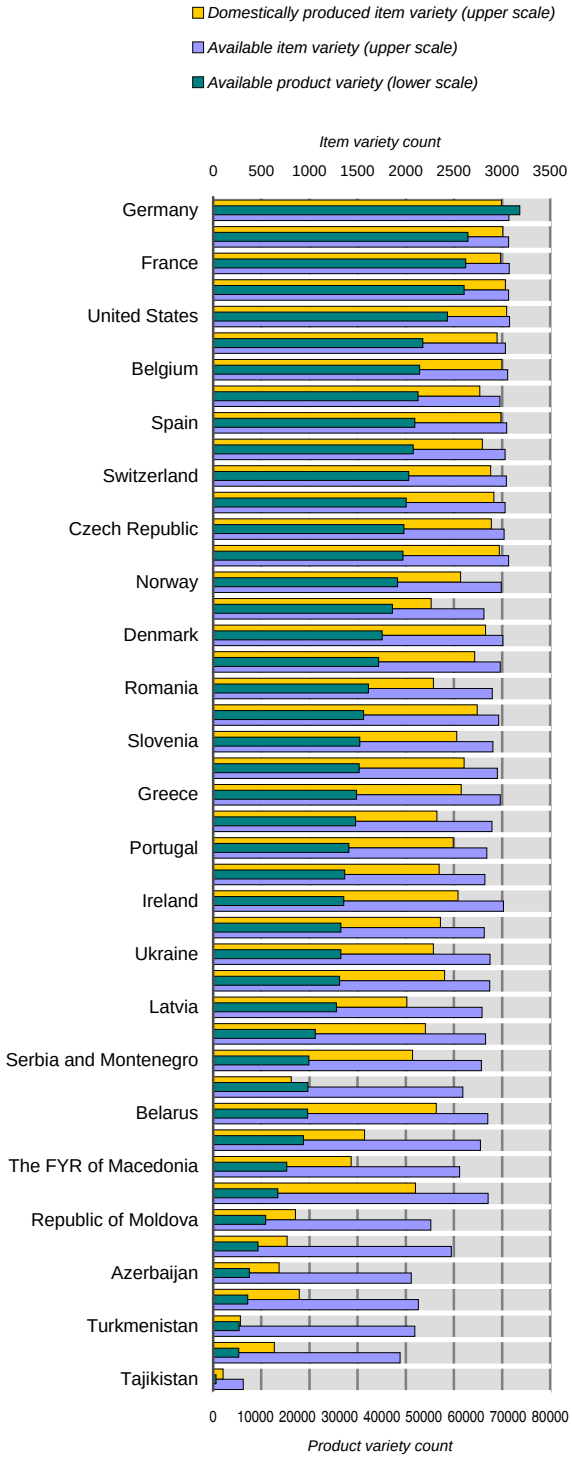
[9] The reference to the EU unit values (rather than those of the US, which are often used in the literature) was chosen in this analysis on two grounds: (1) quantity measurement units for merchandise trade flow records are currently better harmonised across the west and east European countries and CIS, albeit less so, which allows for higher commodity coverage in respect of computing unit values; and (2) there is a certain similarity in geographical distribution of trade flows across the majority of these countries, hence distortions arising from the price differences on very differentiated markets are reduced.

[10] However, it has to be noted that unit value interpretations in terms of quality have to be regarded with reservation. Even at the 5-digit level of disagregation goods assigned to certain item are not homogenous, hence they may differ quite substantially in their specifications and price/quality. Aggregating products on the basis of their weight, number or volume, etc. blurs these distinctions even more.

Chart 1: Trade-based count measures of product variety across 44 UNECE countries (all commodities), 2001



Source: UN ComTrade and UNECE secretariat calculations. See the Appendix for a complete data description.

Note: Data on produced variety are derived from export data, available variety is measured by export and import data. The maximum attainable item or product variety numbers are 3 114 and 174 384, respectively. No 2001 data available for Kyrgyzstan.

product variety.[11] If no account is taken of product differentiation by the country of origin, there is obviously much more cross-country variation in produced as compared to available item variety. The latter is quite high in most UNECE economies, except for the poorest CIS economies. Trade clearly smoothes differences in this respect.[12] Once product differentiation by the country of origin is accounted for, however, the cross-country spread for available product variety rises substantially.

Sorting UNECE countries by any measure of variety reveals more or less the same rough pattern of country groupings:[13] the highest degrees of variety are observed in the West European and North American economies,[14] followed by the east European EU accession countries, other eastern Europe, and finally the CIS (see also the sub-regional results in Table 1).

This general pattern, however, glosses over a few notable exceptions, of which the case of Russia is probably the most striking. Owing partly to its share size, and perhaps also to the simplicity of the applied count measures,[15] Russia displays a level of variety similar to that of the high income economies. This result seems to be in conflict with the prevalent view of the Russian economy as being heavily dependent on the extraction and export of oil and related products. However, both views are probably correct: while Russia's exports, especially to the western markets, are dominated by energy products and metals, imports from high income economies and trade with the CIS and developing countries add significantly both to the domestically produced and the available variety in the economy. In respect of domestically produced item variety, this reflects Russia's still being a source of industrial goods for the majority of its CIS neighbours and other, mainly developing, economies outside North America and Western Europe: for instance, in 2000-2001, relative item variety of CIS imports from Russia amounted to 92 per cent.[16] Luxembourg and Iceland, on the other hand, represent two very small countries that are specialised in producing and exporting a rather narrow range of services or products.[17]

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[11] The highest relative product variety for all commodities is 41.7 per cent for Germany. The lower rank of the United States in respect of available product variety stems mainly from the biassed sample of import partners in this data set (see data appendix).

[12] Chart 1 indicates rather small differences between produced and available item variety in all goods for most Western, i.e., high income economies. This gap becomes larger in eastern Europe and even more pronounced in the CIS, with the exception of Russia. This suggests either that richer economies import the missing few items not produced at home, or that they engage to a high degree in intra-industry trade. The second alternative is supported by the literature as well as by data on import item variety not reproduced here for space constraints.

[13] Appropriate rank order correlations are well above 0.90.

[14] This regional group in fact also constitutes the UNECE's OECD members as before 1996, i.e., before the Czech Republic, Hungary, Poland, and Slovakia joined the OECD.

[15] Recall, these simple count measures are not weighted and the analysis at this stage does not account for the geographical size of the economy (see Box 1).

[16] Based on import records of ten CIS countries (detailed data are not available for Uzbekistan).

[17] Services account for 72 per cent of total employment in Luxembourg and for two thirds in Iceland. Due to the limited importance of industry in these two countries, trade in intermediate and capital goods is rather constricted. In respect of consumer goods, Iceland draws on only a limited number of partner countries to import from, probably due to geographical isolation. The reason for a similar pattern is less clear in the case of Luxembourg (re-export activities of neighbouring EU countries might be part of the explanation).

Table 1: Relative variety measures by Broad Economic Categories for selected UNECE sub-regions, 2001 (Per cent)

	Domestically produced item variety	*Available item variety*	*Available product variety*
All goods			
Western Europe and North America	91.4	97.2	27.1
EU-15	91.4	97.1	27.6
EU acceding countries	77.1	92.1	19.5
South-east Europe	60.4	88.2	14.5
Russia	89.0	95.7	27.9
European CIS	58.4	85.5	12.4
Caucasus and Central Asia	22.3	60.5	4.9
Consumer goods			
Western Europe and North America	96.7	99.1	31.7
EU-15	97.3	99.2	32.2
EU acceding countries	85.2	96.3	22.6
South-east Europe	70.5	94.0	16.4
Russia	91.5	98.2	32.1
European CIS	64.0	90.9	13.1
Caucasus and Central Asia	24.0	70.8	6.0
Capital goods			
Western Europe and North America	95.0	98.5	29.5
EU-15	94.5	98.5	29.8
EU acceding countries	84.6	95.4	22.4
South-east Europe	64.3	92.5	17.5
Russia	94.9	98.1	35.3
European CIS	70.1	89.3	15.5
Caucasus and Central Asia	33.5	68.2	6.7
Intermediate goods			
Western Europe and North America	88.7	96.3	25.0
EU-15	88.7	96.2	25.5
EU acceding countries	72.6	89.9	17.8
South-east Europe	56.1	85.4	13.4
Russia	86.8	94.4	24.8
European CIS	53.8	83.0	11.6
Caucasus and Central Asia	25.0	55.1	4.1

Source: UN ComTrade and UNECE secretariat calculations.

Note: Relative variety measures are given in per cent of respective maxima. Regional figures are unweighted averages of countries included. Belgium and Luxembourg are treated as one country. Western Europe and North America comprises the EU-15, Norway, Switzerland, Turkey, Canada and the United States. This corresponds to the UNECE members of the OECD (without Iceland) before 1996; EU acceding countries: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia; South-east Europe: Albania, Bulgaria, Croatia, Romania, The former Yugoslav Republic of Macedonia and Serbia and Montenegro; European CIS: Belarus, Republic of Moldova and Ukraine; Caucasus and Central Asia: Armenia, Azerbaijan, Georgia, Kazakhstan, Tajikistan, and Turkmenistan.

Differences between domestically produced and available variety across Broad Economic Categories are quite distinct in the UNECE region (Table 1). In general, relative variety produced at home is the highest for consumer goods, followed by capital and intermediate goods. While the divergence between consumer and capital goods probably reflects higher degrees of

increasing returns to scale in the production of the latter,[18] the result concerning intermediate goods is more difficult to interpret.[19] The CIS sub-regions pose interesting exceptions to this pattern: there is more variety produced there in capital goods, rather than in consumption or intermediate production. This may in fact still be the heritage of the Soviet period, when the priority was given to the heavy industry at the expense of consumer goods.[20] The respective patterns for variety made available at home either by production or trade differ, depending on whether one does or does not take product differentiation by country of origin into account. For the case of item variety, trade is obviously able to notably diminish the gaps between produced and maximum attainable variety in all sub-regions. Especially, the general ranking of a declining variety from consumption, over capital, to intermediate goods is now observed across virtually all UNECE regions, including the CIS. However, once product variety by country of origin is accounted for, the available product variety gap across different Broad Economic Categories widens.

During the decade between 1992 and 2001 variety increases in Western Europe and North America were more or less exclusively due to the "geographic spread of trade," i.e. to making more product variety available by trading with more partners than before. This particular feature holds also for the reforming East European and CIS economies, where the liberalisation of trade induced a geographical spread of trade that went well beyond the substitution of old Eastern with new Western trading partners (data presented in the third panel of Table 2 illustrates these developments during the second part of the decade).

This result complements earlier evidence on the liberalisation response of trade-based variety measures. Trade liberalisation has been found to imply that goods traded the least prior to liberalisation account for much higher shares in trade after liberalisation.[21] For developing and middle-income economies, however, much of this liberalisation effect appears to be due to the geographic spread of trade, especially when acknowledging the fact that barriers to trade have been substantially reduced almost everywhere over the past decades such that long trade time series may also be interpreted as mirroring trade liberalisation effects.[22]

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[18] This is much in the spirit of the theoretical approaches to product differentiation described in section 1.

[19] Partly, this may reflect the bias of trade-derived variety measure against non-traded goods. In some countries, low relative variety in the intermediate goods category may reflect a high degree of within-country specialization, but differences in resource endowments also may matter for lower levels of produced varieties of intermediate goods.

[20] However, during transition the growth of item variety captured in trade data has been highest not for consumer, but again for capital goods (Table 2).

[21] This results from studying the trade response of 18 North American and European countries to significant trade liberalisation. See T. Kehoe and K. Ruhl, "How important is the new goods margin in international trade?", mimeo, October 2002. However, theoretical predictions of the behaviour of quantities, varieties and qualities in response to trade liberalisation differ due to differences in the treatment of producers' market power. In constant returns to scale models producers face downward sloping world demand curves, while horizontal product differentiation creates market power and quality upgrading is rewarded with higher prices.

[22] On the export side, this particular feature has been noted (and termed "geographic spread of trade") in S. Evenett and A. Venables, "Export growth in developing countries: market entry and bilateral trade flows", mimeo, July 15, 2002. Accordingly, export growth of developing and middle income economies between 1970 and 1997 was only to a rather small part accounted for by the introduction of new items, largely, however, by greater exports to established trading partners, and to about one third by the sales of existing products to new trading partners. An attempt at incorporating the aspects of product differentiation by country of origin supports

Table 2: Average annual growth rates for variety measures by Broad Economic Categories for selected UNECE sub-regions and countries, 1992-2001 (Per cent)

	Domestically produced item variety						*Available item variety*						*Available product variety*					
	Consumer goods		*Capital goods*		*Intermediate goods*		*Consumer goods*		*Capital goods*		*Intermediate goods*		*Consumer goods*		*Capital goods*		*Intermediate goods*	
	1992-1996	*1996-2001*	*1992-1996*	*1996-2001*	*1992-1996*	*1996-2001*	*1992-1996*	*1996-2001*	*1992-1996*	*1996-2001*	*1992-1996*	*1996-2001*	*1992-1996*	*1996-2001*	*1992-1996*	*1996-2001*	*1992-1996*	*1996-2001*
Western Europe and North America	0.1	–	0.1	0.1	0.3	–	-0.1	–	-0.1	–	-0.2	-0.2	2.0	1.5	1.9	1.6	1.8	1.4
EU-15	–	–	-0.1	0.1	0.1	–	-0.1	–	-0.1	–	-0.2	-0.2	1.2	1.4	1.3	1.6	1.1	1.4
EU acceding countries																		
Czech Republic	-0.2	-0.1	0.4	-0.1	0.3	–	-0.2	-0.1	0.5	–	-0.1	-0.1	4.1	0.7	5.4	1.1	7.1	2.3
Estonia	..	0.6	..	–	..	1.8	..	..	..	-0.1	..	0.3	..	3.5	..	5.8	..	6.1
Hungary	0.1	0.5	2.0	0.1	2.4	1.0	0.1	0.4	0.9	0.2	0.2	-0.1	5.4	3.3	6.5	2.7	7.3	2.8
Latvia	..	2.2	..	1.2	..	1.8	..	0.4	..	0.8	..	0.6	..	6.9	..	7.2	..	6.4
Lithuania	..	-0.1	..	0.9	..	-0.3	..	-0.1	..	-0.3	..	-0.2	..	3.2	..	3.8	..	3.5
Poland	3.0	-0.3	0.9	1.2	4.7	0.4	3.1	–	3.1	-0.3	5.0	–	-8.4	2.2	-0.3	1.0	1.4	2.4
Slovakia	..	2.6	..	4.5	..	6.7	..	1.3	..	1.9	..	1.7	..	2.0	..	2.3	..	4.8
Slovenia	0.5	-0.4	2.6	0.3	0.3	0.1	-0.1	-0.1	0.2	–	-0.1	-0.3	11.5	1.7	9.0	1.5	5.7	2.2
South-east Europe																		
Albania	..	4.0	..	8.3	..	-0.8	..	1.1	..	0.8	..	0.8	..	4.0	..	4.7	..	2.3
Bulgaria	..	0.3	..	0.7	..	-1.7	1.4	0.4	1.7	0.4	1.5	0.4	..	7.2	..	6.3	..	5.3
Croatia	0.7	-0.7	3.7	1.1	-0.7	-0.7	0.8	-0.3	1.2	-0.2	0.2	-0.4	16.4	2.8	12.2	3.3	8.0	3.2
Romania	1.0	1.6	6.6	0.1	4.8	0.8	0.4	–	1.9	-0.1	1.3	0.1	10.9	2.4	16.7	3.0	16.7	4.0
Serbia and Montenegro	8.3	-1.1	7.9	-0.8	13.7	-3.4	1.5	-0.2	1.0	0.4	1.7	-1.0	11.9	..	10.3	1.1	11.0	-0.5
The Former Yugoslav Republic of Macedonia	..	2.8	..	2.6	..	-0.3	..	0.0	..	-0.6	..	-0.6	..	0.0	..	1.2	..	1.7
Russia	..	-0.4	..	-0.4	..	-0.7	..	-0.2	..	-0.1	..	-0.5	..	-5.4	..	-0.6	..	-1.6
European CIS																		
Republic of Moldova	..	-0.7	..	5.6	..	-1.4	..	1.0	..	1.6	..	0.7	..	6.0	..	7.7	..	6.7
Ukraine	..	-1.2	..	-0.5	..	-1.8	..	-0.3	..	-0.1	..	-0.4	..	-6.0	..	0.3	..	-0.1
Caucasian and Central Asian CIS																		
Armenia	..	-2.5	..	2.5	..	-9.6	..	2.9	..	3.4	..	3.3	..	9.1	..	12.4	..	12.5
Azerbaijan	..	-1.3	..	13.6	..	0.8	..	0.0	..	3.3	..	1.7	..	9.6	..	21.1	..	12.4
Kazakhstan	..	36.3	..	65.6	..	50.5	..	49.9	..	69.5	..	43.1	..	43.3	..	81.7	..	50.9
Turkmenistan	..	53.1	..	150.2	..	55.6	..	71.6	..	103.1	..	68.2	..	60.8	..	109.0	..	66.8

Source: UN ComTrade and UNECE secretariat calculations.

Note: Data are balanced according to data constraints (see the data appendix). Regional figures are unweighted averages of countries included. Belgium and Luxembourg are treated as one country. Western Europe and North America comprises the EU-15, Norway, Switzerland, Turkey, Canada and the United States. This corresponds to the UNECE members of the OECD (without Iceland) before 1996.

this notion of "geographic spread of trade" on the import side as well and finds that the 1986–92 trade liberalisation in Costa Rica led to a large increase in the average number of countries from which items are imported; see P. Klenow and A. Rodríguez-Clare, "Quantifying variety gains from trade liberalisation", Working Paper, University of Chicago, September 1997.

However, most East European and CIS economies also increased the variety available domestically during the 1990s by producing (exporting) many more items at home than before. This holds especially for capital or intermediate products, or both as in the case of Slovakia and Kazakhstan (Table 2).[23]

While there was some loss of variety produced or available in several countries in particular categories, the only country to consistently lose on all measures of variety over all Broad Economic Categories between 1996 and 2001 is Russia, although it exhibits a very high overall variety across the years. The loss of variety in Russia may have emanated from termination of some economically irrational activities, the legacy of central planning; however, the failure to renew more substantially the domestically produced item variety indicates the slow pace of industrial restructuring.[24] Similar observations hold for Ukraine, which has only seen some slight increase in the available product variety of capital goods, while it lost on all other counts.

Considering the *quality* of domestically produced and imported items, there too, as in the case of variety, the cross-country variation is much more pronounced for the former, in particular in the category of capital goods. In 2001, the coefficient of variation of relative export unit values across 38 UNECE countries was 0.25 for all goods, and 0.57 for capital goods, while the relative import unit values varied noticeably less (0.20 and 0.35, respectively). Although widely ranging, relative unit values of individual countries' exports of all commodities and for the groups of intermediate and capital goods reveal some distinctive patterns (Chart 2). The cross-country variation of quality is characteristically lower for intermediate goods, due in part to the high importance of intra-firm trade flows resulting from international fragmentation of production within multinationals. The highest variation in quality is observed for capital goods, which is partly due to the more explicit specialisation of countries and a more pronounced diversity of the items.[25]

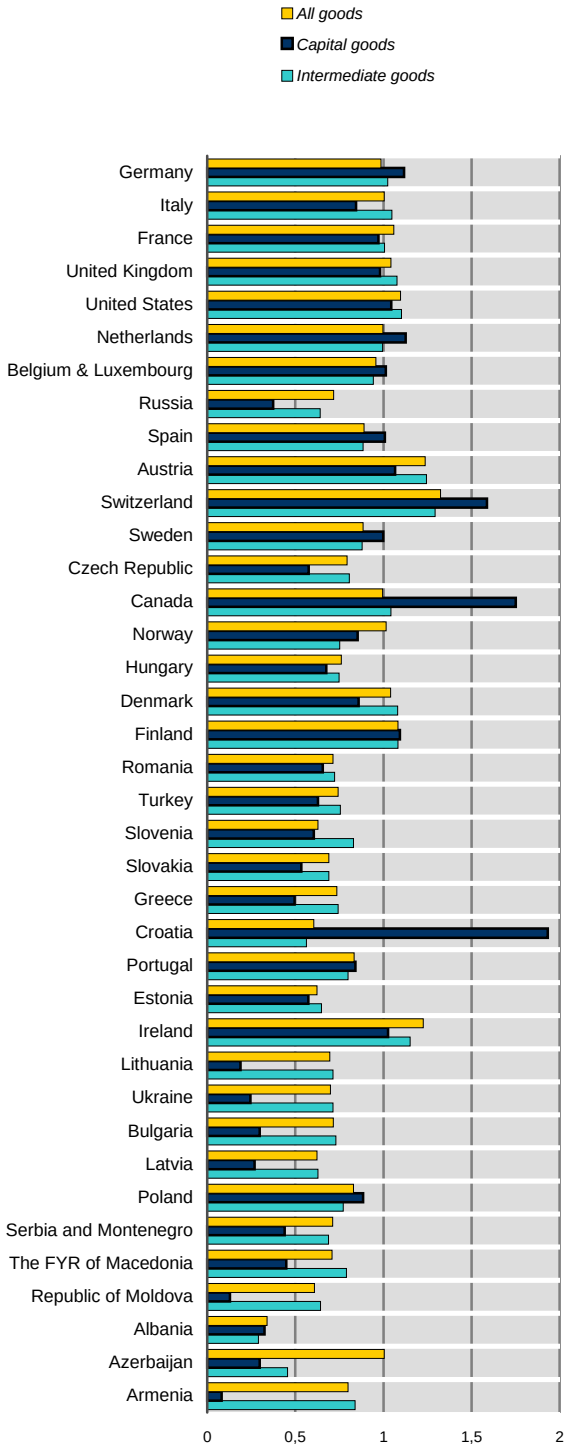
Regarding the ranking, a few small and wealthy west European countries situated in the middle ranks in respect of available product variety (Austria, Switzerland, Denmark and Finland) are in the highest ranks with respect to the quality for their domestically produced items. The rapidly growing Irish economy is also characteristically well above the quality average, ranking third among the countries under consideration. Among eight EU-acceding countries, only Poland, the Czech Republic and Hungary place in the middle quality ranks (some 17-24

[23] It has to be noted, however, that in the east European region the most notable changes in domestically produced item variety were observed during 1992-1996 when, for instance, item variety of intermediate and capital goods increased some 20 per cent in Poland and Romania, 10 per cent in Hungary and Slovenia. Since data for the first half of the nineties are sparse for the Baltic, South-east European and CIS countries, however, table 2 refers only to 1996-2001.

[24] These are *net* changes in variety, taking into account dropped and newly introduced items. Note, that during 1996-2001 Russia has introduced 84 "new" domestically produced items (i.e. items introduced on export list after 1996, the value of which exceeded $10,000 in any of the subsequent years), among them 54 items of intermediate goods and 22 of consumer goods. This, however, compares rather poorly with many west and east European countries that were at the similar levels of variety in 1996.

[25] The specialization argument holds well in case of Croatia – its specialization in shipbuilding is reflected in the very high relative export unit values for capital goods. The statistics shown for Canada is rather weakly based, in that the number of items for which relative unit values were established is very limited.

Chart 2: Export unit values relative to the EU average across 38 UNECE countries, 2001



Source: UN ComTrade and UNECE Secretariat calculations. See Appendix for a complete data description.

Note: Quantity weighted average of relative export unit values of all goods, capital goods and intermediate goods. In each case, the average EU export unit values equal one. Countries are sorted according to available product variety as in Chart 1.

per cent below the EU average), whereas the other five countries are situated in the midst of the bottom ten. CIS countries that in 2001 exhibited the lowest available product variety were higher up in the quality ranking, thanks mainly to their resource-based specialisation.[26] Similar explanation holds for some southeast European economies.

Russia, in its turn, ranks below these countries overall on the quality measure. The relative unit values of its exports are pulled down by its performance in capital goods, which chiefly go to CIS and developing countries. However, it also performs less favourably in resource-based intermediate goods and fuels exports, an important part of which is also sold to these countries at prices often below those of international markets.[27] The difference between Russia's high standing (and in part Ukraine's too) on variety and its low standing on quality measure confirms the notion of delayed industrial restructuring in the country.[28]

Combining the information provided so far reveals that most countries with higher initial levels of produced or available variety exhibit lower subsequent variety growth rates (Table 3). Notably, the highest growth rates of variety in the UNECE region were reached in countries that started from very low levels (Table 2 above). However, in the case of available variety measures, this negative relationship cannot be significantly confirmed for the group of North-American and West European countries, which are already closer to the frontier of variety according to the count measures. For the case of variety produced domestically, this finding indicates that imitation might have played a prominent role in the process of increasing variety, a topic that will be further analysed in section (iv) below.

Regarding relative unit values, the correlation between the initial levels and subsequent growth is much weaker for both exports and imports. The eight EU-acceding countries seem to exhibit quite consistent behaviour for the transitional period, improving quality of domestically produced items (and supposedly moving up in the value-added chain) and importing better quality final goods. However, the south European and CIS countries seem to show little progress in this respect.

(iii) Variety, quality and economic development

Relating measures of variety and quality to levels of economic development such as per capita income, reveals an array of potentially interesting links that are summarised in Table 4. Almost exclusively, measures of variety and quality are positively correlated with per capita income, often quite strongly. Correlations do, however, differ according to country groups:

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[26] In Azerbaijan, the internationally determined crude oil export prices were at the base of the country's high rank in relative export unit values. Armenia's high average relative export unit values indicated in Chart 2 were mainly due to the exports of specific sands, non-ferrous metals (aluminum, copper, zinc) and their products, prices for which are also mostly internationally determined.

[27] In the case of fuels, this pricing is most often policy-driven and not a matter of quality differences.

[28] Russia's and Ukraine's stand-out against other CIS in variety terms from the beginning of transition have been an inherited feature of the Soviet Union's central planning system's determination who produces what, which in turn was probably little related to comparative advantages across the ex-Soviet Union. Hence, while many ex-Soviet republics produced too little variety, Russian and Ukrainian enterprises were subsidized to produce probably too much of it, albeit at low quality.

Table 3: Cross-country correlation coefficients between 1996 levels and average annual growth of variety and quality measures in UNECE countries in 1996-2001

	Domestically produced item variety	*Available item variety*	*Available product variety*	*Export unit values* [a]	*Import unit values* [a]
North America and Western Europe					
Consumer goods	-0.30	-0.03	-0.03	0.04	-0.35
Capital goods	-0.69	-0.22	0.06	-0.68	0.61
Intermediate goods	-0.05	0.33	0.11	-0.31	-0.50
EU acceding countries					
Consumer goods	-0.67	-0.78	-0.40	-0.64	-0.77
Capital goods	-0.50	-0.85	-0.66	-0.26	-0.50
Intermediate goods	-0.56	-0.55	-0.67	-0.96	-0.18
South-east Europe and CIS					
Consumer goods	-0.62	-0.94	-0.58	-0.28	-0.21
Capital goods	-0.61	-0.92	-0.57	0.01	-0.72
Intermediate goods	-0.52	-0.85	-0.59	-0.46	-0.05
All UNECE countries					
Consumer goods	-0.62	-0.93	-0.55	-0.11	-0.15
Capital goods	-0.63	-0.91	-0.56	-0.34	-0.24
Intermediate goods	-0.50	-0.83	-0.54	-0.27	-0.37

Source: UN ComTrade and UNECE secretariat calculations.

Note: Country groups are defined as in Table 1. Data are balanced according to data constraints (see the data appendix).

[a] Based on data for 38 UNECE countries.

Table 4: Cross-country correlation coefficients between GDP per capita and measures of variety and quality in the UNECE region, 1992, 1996, and 2001

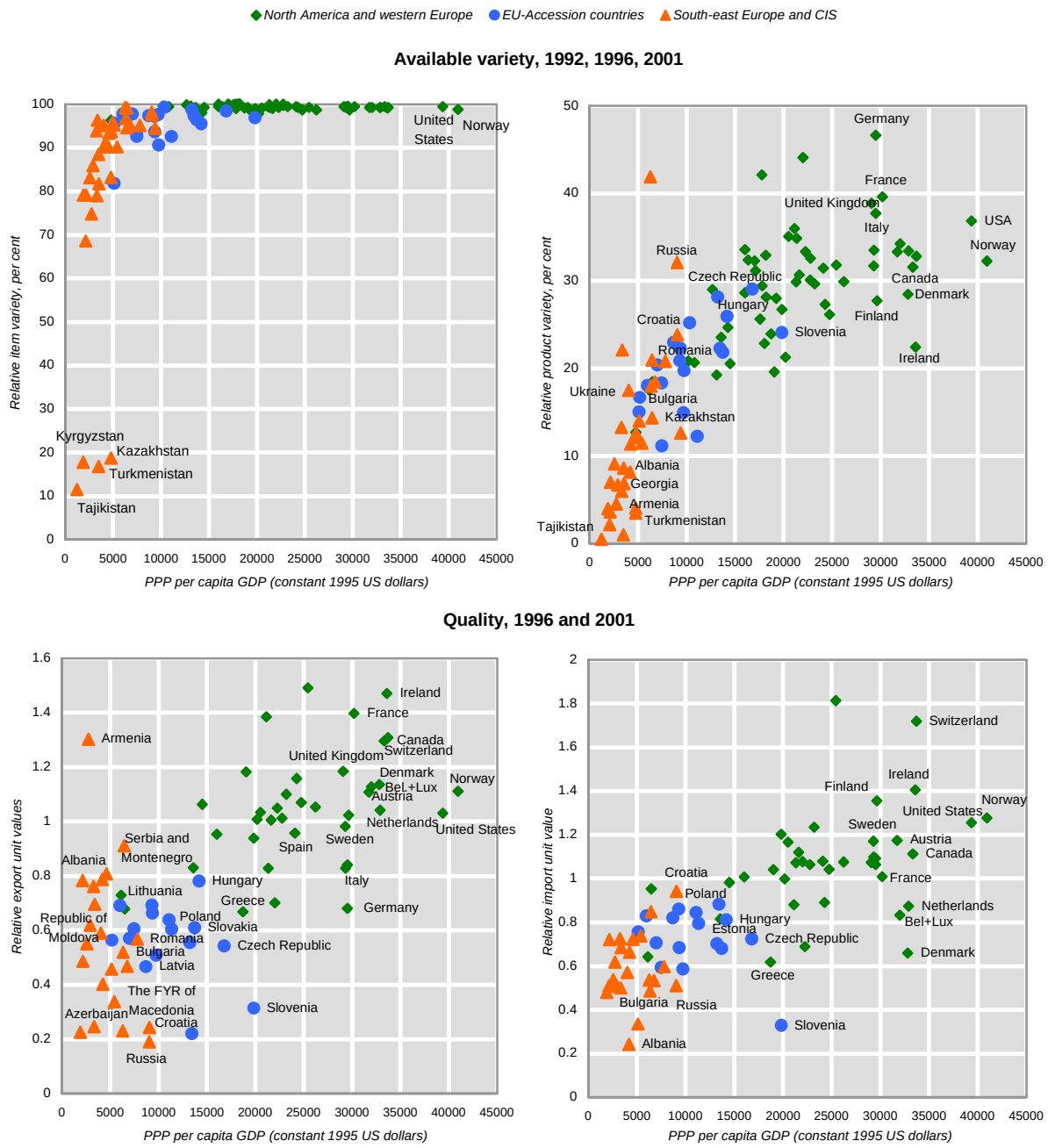
	Domestically produced item variety	*Imported item variety*	*Available item variety*	*Imported product variety*	*Available product variety*	*Relative export unit values* [a]	*Relative import unit values* [a]
North America and Western Europe							
Consumer goods	0.22	0.45	0.26	0.57	0.57	0.45	0.41
Capital goods	0.40	0.13	0.23	0.42	0.42	0.30	0.18
Intermediate goods	0.31	0.21	0.12	0.38	0.38	0.44	0.15
EU acceding countries							
Consumer goods	0.56	0.45	0.40	0.63	0.63	-0.39	-0.40
Capital goods	0.71	0.62	0.54	0.67	0.67	0.57	0.68
Intermediate goods	0.59	0.66	0.64	0.76	0.77	0.77	0.54
South-east Europe and CIS							
Consumer goods	0.68	0.52	0.49	0.68	0.68	-0.32	0.22
Capital goods	0.68	0.55	0.51	0.75	0.75	0.55	0.46
Intermediate goods	0.70	0.63	0.60	0.73	0.73	0.20	0.26
All UNECE countries							
Consumer goods	0.64	0.48	0.43	0.78	0.78	0.69	0.73
Capital goods	0.65	0.47	0.44	0.70	0.71	0.62	0.70
Intermediate goods	0.68	0.57	0.54	0.73	0.74	0.77	0.46

Source: UN ComTrade and UNECE secretariat calculations.

Note: Country groups are defined as in Table 1. Data are balanced according to data constraints (see the data appendix).

[a] Based on data for 38 UNECE countries and for 1996 and 2001.

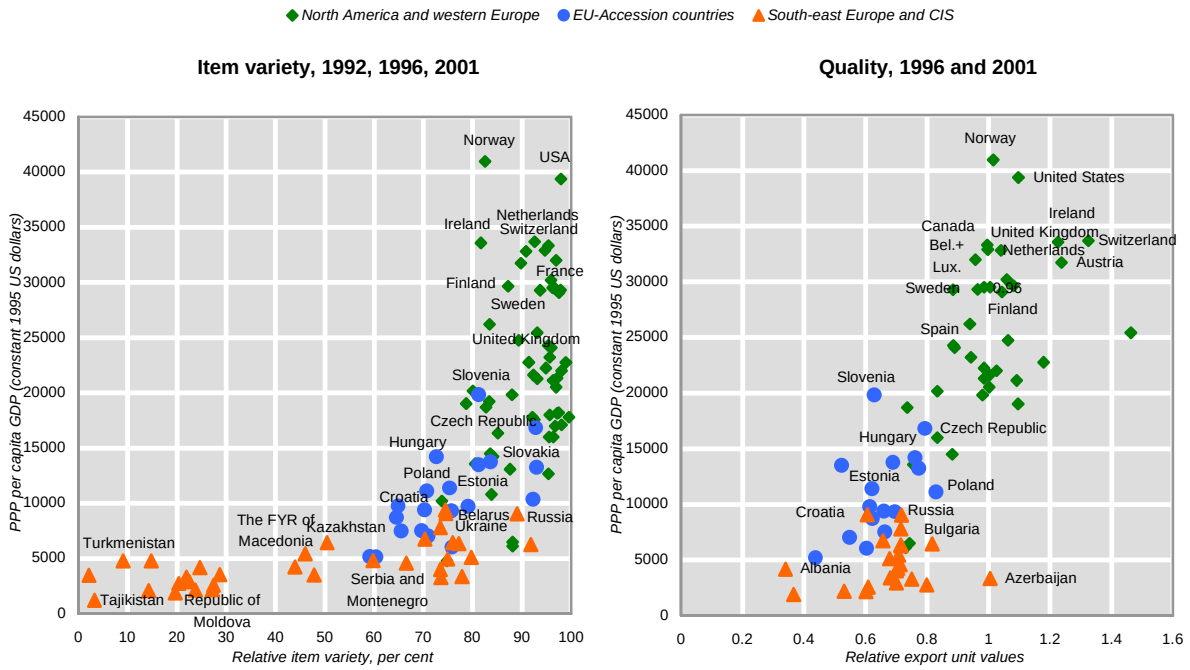
Chart 3: Per capita GDP and measures of available variety and quality in consumer goods in the UNECE region



Source: UN ComTrade and UNECE secretariat calculations.

Note: Country labels refer to 2001 data. Country groups are defined as in Tables 1 and 2. Data are balanced according to data constraints (see the Appendix).

Chart 4: Per capita GDP and domestically produced item variety and quality of all goods in the UNECE region



Source: UN ComTrade and UNECE secretariat calculations.
Note: Country labels refer to 2001 data.

Across consumer, capital and intermediate goods, the weakest correlations between variety measures and per capita income are always found in North America and Western Europe. Except for capital goods, this is not the case for quality measures. Moreover, there is no positive link between relative quality of consumer goods and per capita income in the EU-acceding countries (for both domestically produced and imported items) and South-east Europe and CIS (for domestically produced items).

However, the correlations between various measures of variety, quality, and per capita income may be due to very different underlying relationships hypothesised in distinct theoretical approaches conditional on additional explanatory variables. Some of these approaches can be illustrated with separate sets of variety and quality data by making use of the Broad Economic Categories and the conceptual distinction between domestically produced versus available item variety and product variety as defined in Box 1.

A first causal link on the demand side may run from per capita income to variety and quality, as higher income economies should demand not simply more consumption, but especially a higher variety and quality of consumer goods.[29] In fact, U.S. experience suggest that high-

[29] This hypothesis is connected to Linder's approach to production and trade as being driven by similarities in income and preferences, implying most trade to occur as intra-industry trade between similar countries. S. Linder, *An Essay on Trade and Transformation*, New York, Wiley & Sons, 1961.

income countries' consumers have been heavily shifting their spending to goods characterised by rich variety over the past twenty years or so.[30]

Chart 3 provides evidence in support of this hypothesis, i.e. that a higher per capita income induces both a higher quality as well as a higher variety of consumption. The finer distinction provided by product differentiation by country of origin is obviously quite instrumental in more clearly illustrating the relationship between per capita income and variety in consumption.

Another demand side link between variety, quality and per capita income builds on the conjecture that higher exports, in turn driving up per capita income, should to a significant extent be due to appearance of new or higher quality domestically produced items among exportables.[31] This conjecture suggests a positive correlation between the domestically produced variety and quality of all commodities and per capita income, as already established in Table 4. Previous research has indeed found that, account being taken of size, richer economies export more in nominal terms than poor ones. They do so by exporting both larger quantities of each good and a higher variety of goods. Specifically, for any pair of economies, a higher item variety of exports accounts on average for about two thirds of the greater exports of the richer country. Furthermore, the richer of two economies has, again on average, been found to command (modestly) higher export prices while at the same time exporting higher quantities of each good, which implies higher quality of the richer economy's exports.[32] Chart 4 illustrates this hypothesis and supports this previous result, suggesting that there may be a threshold effect, below which the hypothesis may not hold.

From the perspective of the modern economy, however, the most important link between variety, quality, and per capita income is on the supply side, as suggested by the theory of endogenous growth. This theory conjectures that it is technological progress, embedded in an increasing and more refined division of labour based on deliberate product and process innovation and imitation, that fosters growth. As this advancement in the division of labour is reflected in more product differentiation, one of the simplest versions of an endogenous growth model could be one that describes steady-state per capita income as a function of the variety in intermediate goods available in an economy.[33]

However, a structural approach to endogenous growth should start out from the general hypothesis that per capita income depends on the accumulation of physical and human capital and on technological progress. Technological progress, embedded in the division of labour in production, is in turn endogenously determined by firms' investment decisions. Investment

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[30] M. Bils and P. Klenow, "The acceleration in variety growth", *American Economic Review*, Vol. 91, No. 2, May 2001, pp. 274–280.

[31] For a theoretical justification, see. P. Krugman, "Differences in income elasticities and trends in real exchange rates", *European Economic Review*, Vol. 33, No. 5, May 1989, pp. 1055–1085.

[32] For these results, based on a cross-sectional study of 1995 data, see D. Hummels and P. Klenow, "The variety and quality of a nation's exports", mimeo, December 2002. Note that this cross-sectional evidence does not contradict the time-series evidence, presented in section (ii), that between 1992 and 2001 variety increases in Western Europe and North America were more or less exclusively due to the "geographic spread of trade".

[33] As in P. Romer, "Endogenous technological change", *Journal of Political Economy*, vol. 98, no. 5, 1990, pp. S71–S102. More refined approaches introduce a trade-off between productivity gains from more variety and cost reductions resulting from learning-by-doing.

decisions (both in physical and in human capital) are thus both a direct source of a higher per capita income and instrumental for technological progress. Following the literature, technological progress in the division of labour in production depends predominantly on human capital rather than on physical capital investment. The direct effect of investment on per capita income is dominated by physical investment. This distinction allows for a simplified approach separating the study of per capita income subject to endogenous growth into two questions: how do physical investment and the division of labour drive per capita income? And how does human capital investment influence the division of labour? The rest of this section deals with the first one while the second question will be analysed in section (iv) below.

A visual inspection of 2001 cross-country data for the UNECE countries suggests that an increasing item variety in capital and intermediate goods available in each country contributes little to per capita income below a certain threshold level (Chart 5). This seems to change radically for higher levels of item variety. To gauge the extent of this contribution is more difficult for UNECE's member countries in North America and Western Europe: recall that many of them have for some time been rather close to the respective frontier of available item variety as measured by counting domestically produced and/or imported items (see Tables 1 and 2 above).

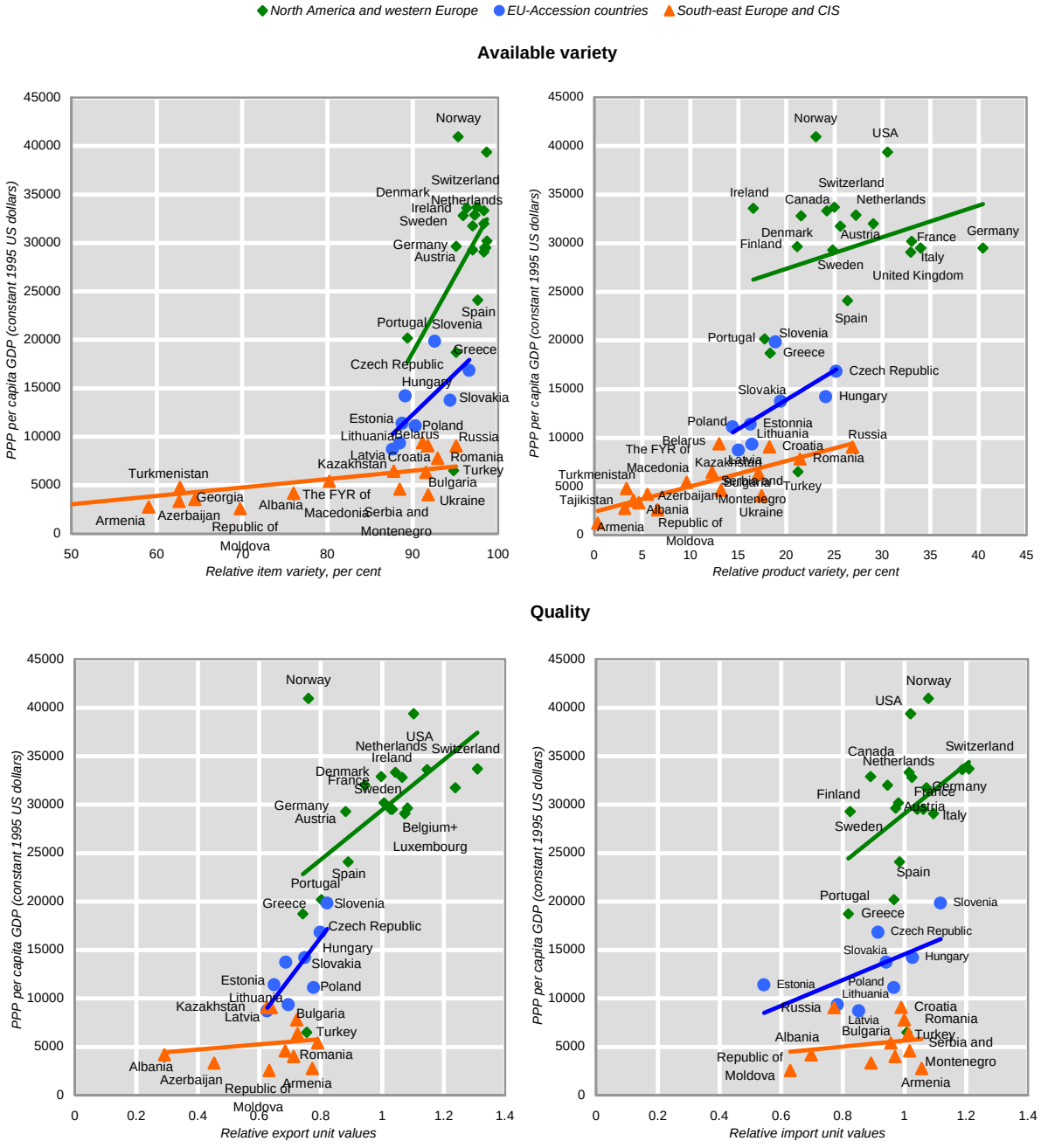
This, of course, may reflect the limitations of the level of aggregation of this analysis combined with weaknesses of simple non-weighted count measures that do not allow for variations according to asymmetries in item variety. However, this shortcoming might be overcome in at least two alternative ways: one is to apply more sophisticated – but also disputable – weighted measures of item variety; another one is to add a new dimension to the data, e.g., product differentiation by country of origin. Accordingly, when accounting for product differentiation by country of origin, the data suggest that a higher product variety in capital and intermediate goods might indeed be associated with higher per capita incomes for all three sub-regions (see also Table 4). There is no threshold effect perceptible by simple visual inspection of the product variety data (Chart 5).

As noted above, combining relative export and import unit value data into a measure of available product quality is far from straightforward. Separate inspection of exported and imported quality proxies of intermediate and capital goods, however, reveals positive correlations with per capita income (Table 4 and Chart 5). This is in line with the conjecture that not just a higher extent of the division of labour but also a higher quality of the products that result from it contributes to a higher per capita income.

The cross-country information for one particular point in time presented in Chart 5 may miss important aspects of economic development over time that are available in panel data. Furthermore, testing the hypothesis in a more stringent way requires a multiple regression approach, as based on the above-mentioned endogenous growth literature. The theoretical literature specifically suggests the existence of a log-linear steady-state relationship between per capita income, the share of physical investment in GDP, and the division of labour as represented by the available product variety of capital and intermediate products.[34] The links between per capita income and the quality properties of the division of labour have so far not been adequately explored either theoretically or empirically. The results of the little empirical

[34] Laid out, e.g., in Ch. Jones, *op. cit.*

Chart 5: Per capita GDP and measures of available variety and quality in capital and intermediate goods in the UNECE region, 2001



Source: UN ComTrade and UNECE secretariat calculations.

Note: Country labels refer to 2001 data. Data for Tajikistan are not included in the first panel. Otherwise data are balanced according to data constraints (see the Appendix). Relative variety measures of capital and intermediate goods combined are defined as the sum of absolute variety counts for both divided by the maximum attainable measures for both.

work linking variety and economic activity within this endogenous growth framework indicate that across OECD and selected East European countries item variety of industrial goods, together with physical investment, is significant for explaining variations in per capita income levels,[35] and that a higher item variety contributes to the lead in productivity growth.[36]

The steady-state aspect of this relationship refers to the very long run, i.e., to a time horizon when income per capita is influenced by supply side effects without transitory shocks, especially from the demand side. While all observed real world data incorporate deviations from their steady-state levels, this is by definition true for transition economies data. The usual approach in this respect is to capture demand side influences and other transitory effects by appropriate trends and fixed effects.[37] Table 5 reports the result of three different log-linear regressions – one for each Broad Economic Category – between GDP per capita, the share of physical investment in GDP, and available product variety. Distinguishing product variety by Broad Economic Categories reduces the danger of mixing supply and potential demand effects in this hypothetical relationship.[38]

The results of Table 5 may be seen as a first step towards identifying common driving forces of economic development in the UNECE region. The estimation results lend support to the conjecture that – besides physical investment – the extent of the degree of participation in the international division of labour as reflected in product variety is an important source of the variation in income per capita across a very diverse set of countries such as the members of UNECE.

Distinguishing variety measures by Broad Economic Categories thus appears to be a meaningful concept, especially combined with product differentiation by country of origin, when it comes to describing the role of the division of labour in long-run economic development. This is suggested by the significant role of intermediate and capital product variety in Table 5 as opposed to the insignificance of product variety in consumption in explaining income per capita variation in the UNECE region, as it in fact should be in line with the endogenous growth hypothesis.

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[35] M. Funke and R. Ruhwedel, "Product variety and economic growth: empirical evidence for the OECD countries," *IMF Staff Papers*, Vol. 48, No. 2, pp. 225–242, December 2001, and M. Funke and R. Ruhwedel, "Export variety and economic growth in East European transition economies," BOFIT Discussion Paper, No. 8, 2003, Helsinki.

[36] This has been demonstrated for the case of the productivity lead held by South Korea over Taiwan. R. Feenstra, D. Madani, T. Yang, and C. Liang, "Testing endogenous growth in South Korea and Taiwan", *Journal of Development Economics*, Vol. 60, No. 2, 1999, pp. 317–341. One recent work has suggested that a relationship between item variety of industrial goods and total factor productivity might also hold in terms of growth rates across a number of 29 developed and developing countries. See D. Addison, "Productivity growth and product variety: gains from imitation and education", *World Bank Policy Research Paper*, No. 3023, April 2003.

[37] This estimation approach thus basically follows M. Funke and R. Ruhwedel, *op. cit*.

[38] When testing for the relationship between the level of per capita income and variety measures, one should be concerned about potentially mixing supply and demand side effects implying potential contemporaneous correlation between these explanatory variables and the error term. This is e.g. due to the endogeneity of variety measures in consumption following the Linder hypothesis discussed above. While previous studies using aggregate variety data on all or just on industrial goods have dealt with this problem by instrumental variables approaches, distinguishing between Broad Economic Categories can also help to alleviate endogeneity problems.

Table 5: The estimated relationship between GDP per capita, product variety and fixed investment in the UNECE region, 1992-2001

Dependent variable: PPP per capita income, constant 1995 U.S. dollars			
	Capital goods	*Intermediate goods*	*Consumer goods*
Available Product Variety	0.40**	0.39*	0.16
	2.02	*1.74*	*0.96*
Investment-GDP ratio	0.34**	0.39***	0.38**
	2.42	*2.78*	*2.53*
Number of unbalanced panel observations	103	103	102
Sample period is 1992, 1996, 2001			
Estimation method: Pooled least squares			

Source: UN ComTrade, UNECE Common Database, and *World Development Indicators 2003*.

Note: The panel consists of the UNECE countries represented in the country groups defined in Table 1 minus the Central Asian CIS economies except Kyrgyzstan. The Investment-GDP ratio denotes the share of gross fixed capital formation in GDP. For Ireland, Norway, Slovenia, and the United States, unavailable 2001 Investment-GDP ratios were substituted by 2000 data. All variables are in logs, i.e. the reported coefficients are elasticities. Country-specific fixed effects and regional time trends are not reported. Heteroskedasticity-consistent *t*-values are reported in italics. * (** or ***) denotes significance at the 10 (5 or 1) per cent level.

(iv) Innovation and imitation as sources of variety and quality gains

Since the division of labour matters for long-run economic development, finding out about its driving forces is essential. If trade, as revealed in Section (ii) above, is a major tool for closing the gap between the variety in domestically produced items and internationally available product variety, the potential sources of the variety and quality of domestic production remain to be identified.

In economic literature, this has been dealt with both in the context of trade and growth theories. Most approaches to international trade in differentiated products are static, and a combination of increasing returns to scale on the supply side and a preference for variety on the demand side leads to variety produced in each country to be explained by country size. Intrinsically dynamic growth models, on the other hand, take variety to be the result of investment into human capital in order to innovate or imitate where the analogous reasoning in terms of quality is straightforward.

The available empirical evidence has so far not rejected the international trade or the growth literature view cited above. Trade-based measures of domestically produced item variety are correlated with country size in the long run,[39] while for changes in such measures both imitation and innovation seem to matter: the introduction of new items in countries with already very high levels of variety appears to be R&D driven. On the other hand, countries that are furthest away from the frontier of observable variety experience the highest growth rates of variety, which lends support to the hypothesis of existence of an imitation effect. It

[39] D. Hummels and P. Klenow, *op. cit.*

does take lower amounts of R&D investment to introduce into an economy the products or production processes already innovated elsewhere. The results in Table 3 above are consistent with the imitation hypothesis, as almost all measures of initial levels of the variety and quality of domestically produced items are negatively correlated with their subsequent growth. Also previous work supports the presence of interactive effects. A country's ability to imitate can be influenced by investment into human capital. Especially, educational attainment has been found to increase the growth rates of trade-based measures of domestically produced item variety in developing countries.[40]

According to the endogenous growth framework, innovation depends mostly on human capital rather than on physical capital investment. Especially, the rate of innovation of new products and production processes can be increased through deliberate investments in research and development. The potential for imitation arguably increases with the level of skills of the labour force. Skills can be raised directly through education or may profit from spillovers, especially from foreign direct investment (FDI). One of the benefits of FDI is that foreign firms generally demand skilled labour and invest in labour through training. Labour mobility is an important means of skill enhancement throughout the host country.

Consequently, a formal test starts out with the hypothesis that rates of change of domestically produced quality and item variety should be driven by initial conditions and sensible proxies for the innovative and imitative strengths of an economy as mentioned above.[41] The results of a formal estimation, presented in Table 6, suggest that across the UNECE region changes in variety and quality of domestically produced items indeed depend negatively on initial conditions, positively on FDI inflows and primary school enrolment (both proxying the imitative capacities of an economy), and innovation enhancing research and development expenditures. As for variety changes, this holds with particular significance for the growth of domestically produced variety in capital goods, which is arguably one of the most research and skill-intensive sectors in the economy (Table 6).[42] In particular, initial levels of both variety and quality have a highly significant impact on subsequent growth rates in all three estimations giving strong support to the imitation hypothesis. Additional support for it can be derived from the significant influence that FDI inflows exert on changes in variety and quality. While primary school enrolment always appears to have a positive influence, this is significant only in case of the growth of variety in capital goods. This may, however, reflect shortcomings of this measure as a proxy of educational achievement rather than a general lack of support to the hypothesis that the level of skills of the labour force, raised through education, increases the potential for imitation.

All UNECE economies exhibit innovative and imitative strengths at varying degrees. However, the evidence points at North American and West European economies to be the chief innovators of the proliferation of variety, and thus the refinement of the division of labour in the region. The poorest CIS economies, on the other hand, spend least on innovation enhancing research and development expenditures (Chart 6).

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[40] D. Addison, *op. cit.* Note that this imitation hypothesis is compatible with the market size hypothesis as long as there is income convergence across countries.

[41] This approach is in the spirit of D. Addison, 2003, *op. cit*, where, however, quality issues are neglected.

[42] Due to problems of measurement already noted above, the analogous result cannot be confirmed for the quality of domestically produced items at the same level of significance.

Table 6: Variety, quality, innovation and imitation across the UNECE region, 1996-2001

Dependent variables: Annual average growth rates of domestically produced			
	Item variety		*Quality*
	All goods	*Capital goods*	*All goods*
Item variety, 1996	-0.93**	-4.86***	
	-2.45	*-9.60*	
Quality, 1996			-9.20***
			-3.63
R & D expenditures	0.07	0.60**	2.96**
	0.38	*2.36*	*2.07*
Net FDI inflows	0.07**	0.18**	0.51**
	2.13	*2.42*	*2.30*
Primary school enrolment, 1996	0.03	0.03***	0.04
	1.38	*2.96*	*0.70*
Adjusted R^2	0.19	0.83	0.42
F-statistic	3.11	65.93	7.44
Number of observations	36	36	37
Estimation method: Least squares			

Source: UN ComTrade, UNECE Common Database, and *World Development Indicators 2003*.

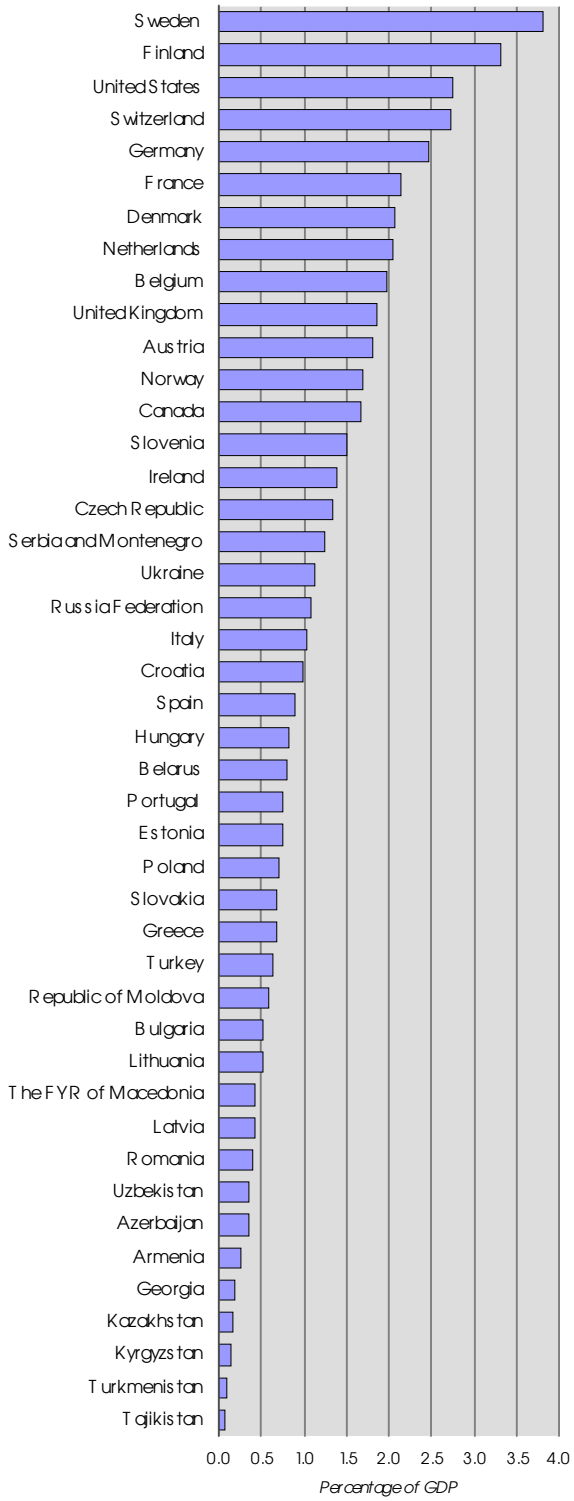
Note: The variety data cover the North American and western European countries as defined in Table 1, the reporting East European and CIS economies (see Table 2) minus the Central Asian CIS economies. Quality data country coverage is as in Tables 3 and 4. Dependent variables are expressed in per cent. Product item variety, 1996 and product quality, 1996 are the 1996 logarithmic values of the count measures of domestically produced item variety and export unit values relative to the EU, respectively. R & D expenditures and Net FDI inflows are relative to GDP, in per cent. On the construction of the R & D measure, see the Appendix. Primary school enrollment is the percentage ratio of total enrollment to the population of the corresponding age group. R & D expenditures, Net FDI inflows are 1996-2001 period averages.

The intercept is not reported. Heteroskedasticity-consistent *t*-values are reported in italics. * (** or ***) denotes significance at the 10 (5 or 1) per cent level.

On the other hand, the highest rates of imitation of the proliferation of variety, and thus of the enhancement of the division of labour as well, can be observed in the CIS and South-east Europe. For the case of capital goods this is illustrated in Chart 7. Notably, the highest growth rates of variety in domestically produced capital goods in the UNECE region during the second half of the nineties were reached starting from very low levels. This is particularly true for the natural resource intensive economies of Central Asia, as illustrated by data on Kazakhstan and Turkmenistan.[43] Again, the eight EU-accession countries cover a middle ground.

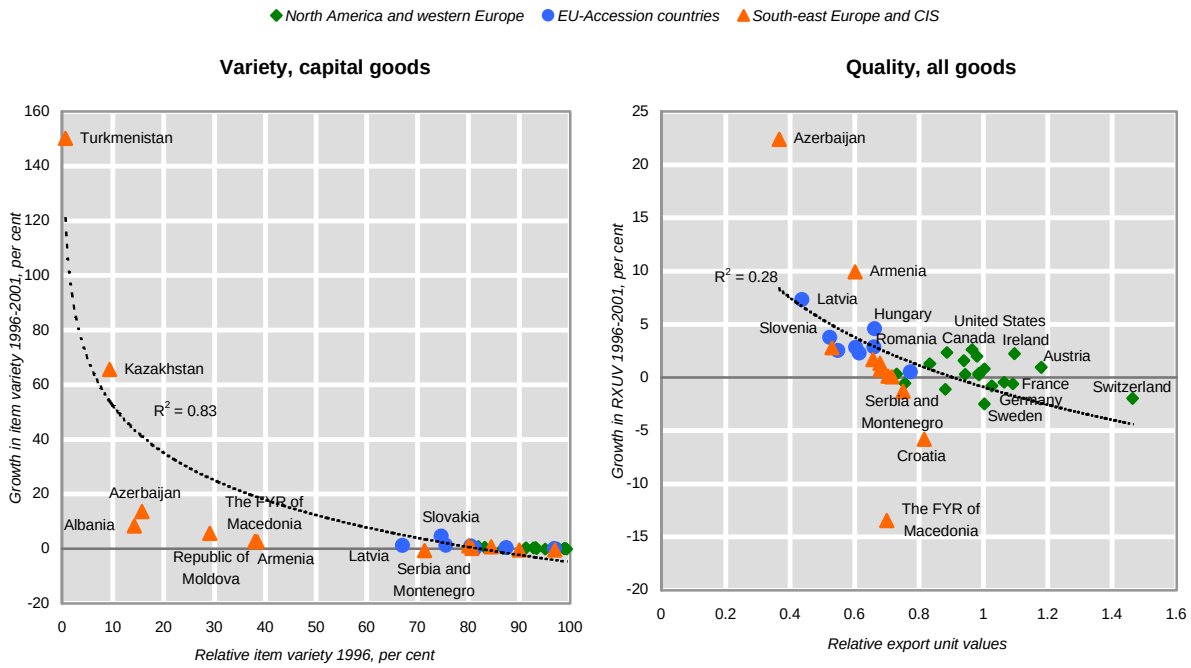
[43] The significance of the relationship between levels and subsequent growth of the variety of domestically produced capital goods depicted in Chart 7 is not sensitive to these two extreme data points. The negative relationship depicted for all countries in Chart 7 in fact holds for each of the three country groups separately. However, a base effect should be taken into account here: starting from very low levels of a count measure implies high relative changes in consequence of small absolute changes in the count measure.

Chart 6: R&D intensity in the UNECE region: Gross expenditures on research and development as percentage of GDP, 2000



Source: UNECE Economic Survey of Europe, No. 1, 2002, p. 168.

Chart 7: 1996 levels and average annual growth of quality and domestically produced item variety across the UNECE in 1996-2001



Source: UN ComTrade and UNECE secretariat calculations.

Note: Data are balanced according to data constraints (see the Appendix). Country groups are defined as in Tables 1 and 2.

(v) Policy conclusions

The existing considerable disparities in per capita income and growth across countries are among the major policy challenges in the ECE region. Understanding the sources of these disparities is important in order to devise effective policies to tackle this problem.

This section suggests that extending the degree of participation in the international division of labour, especially in higher quality and variety of intermediate and capital goods, could have a significant growth-promoting role. There are several ways how to increase quality and available variety of production, and thus to deepen the division of labour: trade, innovation, and imitation may all contribute. However, they contribute in different ways across countries and over time. While all countries widen the available variety of goods by trade, the particular mix of innovation and imitation capacity depends to a certain degree on their development level and readiness to absorb technological change. The leading industrial countries expand the quality and variety of domestically produced items to a significant extent by innovation. As analysis above has shown, south-east European and CIS countries have done this in the past decade or so mainly by imitation while the eight east European EU-accession countries appear to cover a middle ground in this respect. The resulting increase in domestically produced item variety is impressive in both of the latter two groups, while quality improvements,

which may be also taken to indicate a movement towards higher value-added, is more a characteristic of the EU-acceding east European countries.

Further implications of the findings above are manifold. Growing by deepening the division of labour, or by selling a higher variety of items abroad, has been shown in several investigations to be more sustainable: such a pattern of growth may result in fewer and less severe current account balance deficits during the catch-up process,[44] which is of particular importance for the EU-accession countries. In as much as the division of labour depends on human capital and skills that advance innovative and imitative strengths, human capital investments and their concentration on knowledge-intensive sectors of the economy would support the sustainability of growth.

In a modern economy, deepening the division of labour stems from individual firms' innovation and imitation decisions, which are often subject to country-specific comparative advantages. For some time into the future, the majority of East European and CIS economies are likely to rely on trade and imitation, rather than on innovation, to expand the available variety of goods and to improve product quality. This obviously calls for policies that increase the access to and the quality of skill-enhancing educational systems and favours international openness, especially FDI inflows.

The key objective should be to enhance the ability of firms to assimilate and take advantage of technical knowledge from abroad and to internalize new processes and innovations efficiently. By encouraging specific technology absorption-oriented aspects of R&D and supporting supply-network building as a way for technological upgrading, well-targeted public policies could increase the rate of imitation and pave the way for innovation. In turn, priorities in favour of skill-enhancing education (and re-education) could be an important driving force towards the creation and absorption of new technology, thus innovation and imitation; these would involve improved funding in order to increase access to and the quality of education. The recognition of potential positive FDI spill-over effects on the level of skills of the domestic labour force and their encouragement by appropriate government measures could yield additional benefits, such as access to private funding for training.

[44] See Paul R. Krugman, 1989, *op. cit*. In Krugman's model, faster-growing countries export new items, and maintain balanced trade without suffering deterioration in the terms of trade. For an attempt to empirically test this approach, see J. Gagnon, "Productive capacity, product varieties, and the elasticities approach to the trade balance", Board of Governors of the Federal Reserve System, *International Finance Discussion Papers*, No. 781, October 2003.

Appendix: Data description

Data for trade-based variety and quality measures were extracted from the UN ComTrade database in April 2003, complemented and corrected in a few cases using COMTRADE-on-line in July-August 2003. The cut-off value used is $501 (which rounds up to $1 thousand).

Classifications used:

Standard International Trade Classification, Revision 3 (SITC Rev. 3), all disaggregation levels (1-, 2- and 3-digit level for checking up totals, 4- and 5-digit for counting product variety).

There are in total 3121 basic headings in SITC, Rev. 3: 2824 at 5-digit level and 297 at 4-digit that are not disaggregated further. The 3-digit level group 334 (Petroleum products), which is divided into 8 final headings in SITC, Rev. 3, is in fact not divided further by many reporting countries, so in this data set it is also considered to be a single heading. Thus there are 3114 basic headings, further called items or goods.

Classification by Broad Economic Categories (BEC), which allows for commodities defined in terms of SITC Rev. 3 headings to be grouped into 19 basic categories covering primary and processed foods and beverages, industrial supplies, fuels and lubricants, capital goods and transport equipment, and consumer goods according their durability. BEC also provides for the rearrangement of these nineteen categories (on the basis of commodities' *main* end-use) to approximate aggregates for the three basic SNA classes: capital goods, intermediate goods, and consumer goods.

Capital goods cover 471 headings at 4- and 5-digit level of SITC, Rev. 3 and include machinery, such as electrical generators and computers; industrial transport equipment, such as finished ships, road vehicles, aircraft, railway and tramway rolling stock; and other manufactured goods, such as medical furniture, which are used by industry, government and non-profit private institutions.

Intermediate goods cover 1899 SITC Rev. 3 headings and include primary and processed food and beverages designated mainly for industry; primary and processed industrial supplies (raw materials), parts and accessories of capital goods and transport equipment. By definition it should also include primary and processed fuels and lubricants (other than motor spirit), but in this data set the category of 'Fuels and lubricants' that covers 32 headings at 4- and 5-digit SITC, Rev. 3, is not included.

Consumer goods cover 704 headings at 4- and 5-digit SITC and include primary and processed foods and beverages designated mainly for household consumption, non-industrial transport equipment, such as motorcycles and bicycles, other consumer goods.

Because of its dual use the SITC Rev. 3 heading 7812 'Motor vehicles for the transport of passengers' is not included into either capital or consumer goods category. The same holds for motor spirits.

BEC 7 'Goods not elsewhere classified' that covers 14 basic headings of SITC and includes military equipment, including arms and ammunitions, special transactions, postal packages, etc. are also not included into any of three main categories.

Countries covered:

Reporting countries: Data were extracted for 45 countries from the ECE region: 15 European Union countries (Belgium and Luxembourg reported jointly in 1992 and 1996), 8 acceding-EU countries, 3 EFTA countries (Switzerland and Liechtenstein report jointly), 11 CIS (Uzbekistan's data not available), 6 south-east European countries, Canada and USA. However, for unit value calculations the dataset could be completed for only 38 countries, due to the highly unreliable quantity data for exports and imports for a number of CIS countries (Belarus, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan). Unit value data for Iceland are also excluded from this data set.

Partner countries: World (for both exports and imports); and 55 partner countries from the ECE region and Asia (for imports). These partner countries in general account for 80-95 per cent of reported imports. However, in the case of Canada and USA, which trade quite extensively with south American countries that are not among the above mentioned 55 partners, the geographical coverage of the trade partner world is for this reason somewhat lower.

Periods covered:

Three benchmark years are used: 1992, 1996 and 2001. In some cases, owing to lack of data, other years been substituted: 1993 data for 1992 (the Czech Republic); 1997 data for 1996 (Armenia and Turkmenistan); and 2000 data for 2001 (Armenia, Bulgaria, Georgia, Kazakhstan, Tajikistan, Turkmenistan, Ukraine, Serbia and Montenegro). For unit value calculations, 1992 data were omitted altogether.

Relative export and import unit values:

To derive a comparative set of unit values, only dollar values of exported and imported items for which quantities are expressed in weight measures are taken into account (the unified measure is dollars per kilogram). In general, the number of such items accounts for 70-75 per cent of all traded items. The commodity coverage, however, varies, and not only across the countries, but also across the years and trade flows, for a number of reasons (use of different quantity units, appearance of new items, etc.). In case of the EU – the average unit values of which are used as reference – the coverage is nearly complete: the lowest number of items for which such unit values were estimated was 3026 (out of 3114) in 2001. The coverage is notably lower in the case of Canada and the US, where trade statistics often report quantity in units other than weight.

The “relative unit values” (for exports or imports) are quantity-weighted averages of the ratios of individual country’s unit value for a given commodity against the average EU unit value of the same commodity. The weights are the individual commodity’s share in total quantity of all commodities exported (or imported) by the country in that year.

In order to derive an average EU unit value for a given commodity, unit values for individual Member countries that were 100 times higher or lower than the average unit value of the other 14 EU countries were excluded, on the assumption that within this group of countries, trading in similar goods under similar conditions, variations of such magnitude are likely to be due to recording errors. For other reporting countries the exclusion bound for such outlier observations was set at a thousand times above or below the EU average unit value.

Special notes on R&D expenditures as used in Table 6:

The innovative strength of an economy can be measured by several measures which are highly correlated. The measures used in this section are (1) R&D expenditures as a percentage of GDP, (2) GDP shares of gross expenditure on R&D, (3) Personal computers per 1,000 people, (4) Information and communication technology expenditure as a share of GDP, and (5) Scientists and engineers in R&D per thousand people. Data sources are the *World Development Indicators 2003* (for 1, 3–5), and the UNECE's *Economic Survey of Europe*, No. 1, 2002 (for 2).

The data availability of these measures, however, varies across countries and over time. Especially, the coverage of each of these five measures is significantly lower than the coverage for data used to measure variety and quality. In order to increase the coverage, one single synthetic measure of R&D expenditures as a percentage of GDP was estimated based on the above mentioned five highly correlated measures. In a first step, measures 2 – 5 above were regressed one by one on the first measure, i.e. on original data on R&D expenditures as a percentage of GDP. Fitted values from these four regressions can be used to create "R&D expenditure estimates" for those countries and years, for which measure 1 is unavailable. In fact, these fitted values were used individually – in declining order of fit of the four regressions – to fill step-by-step the unavailable original R&D expenditure data. The resulting synthetic R&D expenditure series thus covers many more panel data points than the original R&D expenditure series and is based on data highly correlated with this original series.

Public Governance as the Source of Quality and Variety Gains from Transition

Richard Frensch*

Abstract

Two economies, a centrally planned economy (CPE) and a post-transition regulated mixed market economy (RMME), are modeled in a static general equilibrium setting that allows for trade-offs among the quantity, quality and variety of production. Equilibrium in these economies is determined by the quality of public governance. In real world transitions from a CPE to a RMME, quality improvements and an increasing variety of production matter more than output volumes. Our model indicates that improvements in public governance, connected with a successful political transformation, facilitate such changes. This result is compatible with the view that the post-transition output path can be accounted for by observable initial conditions and liberalization policies. However, both are completely determined by the quality of governance in the pre-transition and post-transition states.

JEL classifications: P51, D73

Keywords: transition, governance, product differentiation

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1. Introduction

More than ten years of transformation of centrally planned economies into market economies have led to markedly different outcomes in the economies of Central and Eastern Europe and the Commonwealth of Independent States. Campos and Coricelli (2002) provide two distinct reasons for these differences from empirical research. Some researchers maintain that the impact of liberalization and structural reforms is the determinant reason for the differences in outcomes, e.g., Selowsky and Martin (1997), Berg *et al.* (1999), Havrylyshyn *et al.* (1999), and de Melo *et al.* (2001). Others, especially when taking care of the simultaneity between output performance and reform policies, find empirical support for the significant influence of initial conditions, such as pre-transition macroeconomic imbalances and structural distortions, e.g., Krueger and Ciolko (1998), Heybey and Murrell (1999), and Falcetti *et al.* (2002). The 1999 EBRD Transition Report and recent papers by Kaufmann *et al.* (1999, 2000, 2002 and 2003) introduce the concept of public governance to this discussion. For a broad group of countries, Hall and Jones (1997) stress that differences in economic success are due to basic system determinants, such as primarily institutions and government policies. Hence, we focus on public governance as a crucial ingredient in the success of transition.

The quality and the variety of production and consumption are addressed only rarely in the literature on CPEs with Roland (1988) being a notable exception. Most models of transition also neglect these aspects in considering the liberalization of a formerly planned economy, although Berkowitz and Cooper (1997), Adachi (2000), Boeri and Oliveira Martins (2000), and Bose and Kemme (2002) are exceptions. We model both a centrally planned economy (CPE) and a post-transition regulated mixed market economy (RMME) in a simple static general equilibrium setting that allows for trade-offs among the quantity, quality and variety of production. Equilibrium in each of these economies is determined by the quality of public governance. Using comparative statics, we relate transition outcomes to changes in the quality of governance. This approach is particularly useful for assessing the outcomes of transition with respect to market entry and changes in product quality, output and welfare.

Our paper combines two strands of literature; one encompasses the view that improvements in the quality of public governance provided by the state and its bureaucracy are good for transition. Myrdal (1970) and Stiglitz (2002) are examples in which good governance is based on more accountability and democratic progress. The second literature analyzes the quantity-quality-variety trade-off in international trade, but it can be applied to transition economies. CPE production volumes were impressive, but both the variety and the quality of production were low. To support sustainable growth quality improvements resulting from firm restructuring and an increasing variety of production from the growth of small and medium enterprises are more relevant than the growth of output. Our model indicates that improvements in the quality of public governance, connected with a successful political transformation, facilitate such changes.

The next section outlines the general properties of the institutional framework. Section 3 presents the basic features of the formal model, while section 4 applies this framework

to a CPE to characterize the initial conditions for the transition. Section 5 models the RMME; section 6 demonstrates that a successful transition from a CPE to a RMME depends fundamentally on improvements in the quality of governance. This result is compatible with the view that the post-transition output path can be accounted for by observable initial conditions and liberalization policies. However, both are completely determined by the quality of governance in the pre-transition and post-transition states. Section 7 concludes with policy implications and suggestions for further research.

2. The Quality of Governance

Kaufmann, Kraay, and Zoido-Lobatón (2000) define governance in terms of the traditions and institutions that determine how authority is exercised. These include the process by which governments are selected and held accountable and the capacity of governments to manage resources efficiently and to formulate, to implement, and to enforce sound policies and regulations. By concentrating on resource allocation, much of the literature focuses on the interactions of an inefficient bureaucracy with private markets. E.g., Hall and Jones (1997) view a corrupt bureaucracy as acting as a tax on the productive activities in the economy. However, agency problems between the state and its bureaucracy may also have an impact on output and growth if the latter provides public goods and services. In this literature, the bureaucracy is assumed to be better informed than the political authority about its own technology and acts in its self-interest.[1] Both approaches to public governance conclude that productive inefficiency results from bureaucratic intervention, either in the private or in the public sector. Our paper is closer to the latter approach; however, we do not assume *a priori* that the government maximizes welfare. Moreover, our focus is not on productive inefficiency but rather on the distorted allocation of resources.

Initially, we explore the relevant features of relationships among the state, the government, the bureaucracy, and the public. We do not distinguish between the state and the government but use both terms interchangeably to refer to the political authority. Among bureaucratic agencies, we differentiate between a central bureaucracy, i.e., a central planning agency in a CPE or a regulatory agency in a RMME, and the management of state-owned enterprises (SOEs). The relationship between the political authority and the public raises the fundamental issue of whether the government acts as the agent of its citizens or as the instrument of some ruling elite that has captured the state (Hellman and Schankerman, 2000). This paper follows Grossman (2000), who conjectures that characterizing the state as the agent of its citizens involves a paradox. If the state is to enforce collective choices over resource allocation and income distribution, the citizenry must subject itself to the state's power to tax and to spend. Hence, the state can use the sovereign powers to exploit its citizens so that it becomes an instrument of a ruling elite that appropriates the net revenues of the state. We assume that this net revenue is a constant fraction of the total size of the state-owned economy, i.e. total SOE output. We also assume that this benefit to the elite does not diminish the representative consumer's consumption.[2] However, the proprietary state faces constraints in maximizing the wealth

of the ruling elite because of the potential threat of the elite's deposition from power. In a CPE, the ruling elite consists of the Communist Party and the planning bureaucracy. In a RMME, the ruling elite consists of the members of a multi-party system plus the regulatory bureaucracy.[3] Thus, bureaucratic central agencies are always part of the state's ruling elite.

In a CPE, all production takes place within SOEs; in a RMME, the potential benefits from SOE activity motivate government restriction of non-state market access. The SOE management's objective is to maximize its discretionary budget, which implies a principal-agent relationship between the government and SOE management. In addition, the government guarantees to balance SOE budgets in return for output benefits. Hence, the government may tax consumers to subsidize producers. While this situation may be most relevant to a pre-transition CPE, it also applies to various institutional settings, especially those in post-transition economies.

Based on this discussion, we consider three economic agents. These are the public, i.e. a representative consumer, SOE management, which is joined by non-state firms in the RMME, and the government acting in the interest of a ruling elite that includes the central bureaucracy. Modeling the behavior of a proprietary state involves the maximization of the wealth of the ruling elite subject to explicitly formulated constraints referring to the features of the political system that determine the probability of the ruling elite's deposition from power. However, to simplify the model, we proxy government behavior as maximizing a weighted objective function of total SOE output, which is the source of benefits to the ruling elite, and of consumer welfare. The respective weights indicate the strength of the constraints upon the state. The quality of governance is defined as the degree to which the government maximizes consumer welfare. We assume that a successful political transition towards more accountability and more democracy reduces the power of the ruling elite and increases the constraints upon the state, i.e. it improves the quality of governance.

3. The Model

The CPE and the RMME are sufficiently similar to allow for a treatment within a standard regulatory model. The model consists of a representative consumer maximizing utility subject to a budget constraint, many producers of differentiated industrial products maximizing profits, augmented by government subsidies in the case of SOEs, and the government, which maximizes a social welfare function subject to the constraint that subsidies be covered by tax receipts. In order to focus on the product market, we assume that the representative consumer supplies a fixed amount of labor L. Since producers maximize profits by employing L, full employment is always assured. The nominal wage rate is normalized to 1 throughout.

The treatment of consumption follows Dixit and Stiglitz (1977) but takes account of product quality. Product quality, denoted q_j, takes continuous values between low quality, q_l, and high quality, q_h, such that $0 < c < q_l < q_j < q_h$, where c is a constant and $q_l - c$

is arbitrarily close to 0. Utility is represented by:

$$U = \left[\sum_j (\alpha_j x_j)^\beta\right]^{1/\beta}, j = 1, \ldots, n; 0 < \beta < 1; \beta = 1 - 1/\sigma, \tag{1}$$

for all available n products.[4] The constant elasticity of substitution between any product pair is denoted σ; $\alpha_j = q_j - c$ describes the consumer's quality preferences, and x_j indicates quantity consumed of each product variant. Maximizing (1) subject to a budget constraint yields aggregate demand functions for each product variant j as:

$$x_j = \frac{(p_j/\alpha_j^\beta)^{1/(\beta-1)}}{P^{\beta/(\beta-1)}} Y^d, \tag{2}$$

where $P = [\sum_j (p_j/\alpha_j)^{\beta/(\beta-1)}]^{(\beta-1)/\beta}$, for $j = 1, \ldots, n$, is the dual price index to (1) aggregating individual product variant prices p_j.[5] Disposable income, denoted Y^d, is defined as labor income L minus a lump sum tax T:

$$Y^d = L - T. \tag{3}$$

When all products are of the same quality q and are priced equally, they are consumed in identical volumes so that demand (2) simplifies to $x = Y^d/np$, which is equivalent to the representative consumer's budget constraint. Thus, equilibria that satisfy this budget constraint are also market clearing. Utility simplifies to:

$$U = \alpha X n^{\frac{1}{\beta}-1}, \tag{1'}$$

where $X = nx$ is total consumption. The equilibria considered in this paper will be of this simplified type. *Ceteris paribus,* consumers prefer more variety, quality and volume.

Differentiated consumer products are produced subject to a symmetric production function given by:

$$x_j = \frac{l_j - f}{q_j}, \tag{4}$$

where $l_j > f$ denotes labor input and f is a positive constant. Since the nominal wage rate is 1, total costs are given by:

$$K_j = q_j x_j + f, \qquad j = 1, \ldots, n, \tag{5}$$

where a higher product quality implies higher variable costs of production. Each producer's total revenue, including any government subsidy s_j, is:

$$R_j = p_j x_j + s_j, \quad j = 1, \ldots, n. \tag{6}$$

The government's budget constraint ensures that $\sum_j n s_j$ equals the lump sum tax T paid by the representative consumer

Anticipating the equilibrium property that all products are of the same quality and are produced in the same quantities, summing equation (4) over all producers characterizes the fundamental trade-offs among total output, variety, and quality as:

$$X = \frac{L - nf}{q}. \tag{7}$$

Ceteris paribus, total output X is maximized when $n = 1$, assuming n to be a positive integer. Substituting (7) into (1') yields:

$$U = \frac{\alpha}{q} n^{(\frac{1}{\beta}-1)}(L - nf), \tag{1"}$$

which is strictly concave in n and is maximized for $n^* = (1 - \beta)L/f$.[6]

The objective function maximized by governments is a combination of consumer welfare and public sector output given by:

$$Z = (\gamma X)^{\theta} U^{1-\theta}, \tag{8}$$

where γ is the fraction of SOE output in total output; θ describes the weight which the government puts on total SOE output, and $(1 - \theta)$ defines the quality of governance measured by the weight put on consumer welfare. Although the usual technical constraint requires $0 \leq \theta \leq 1$, we assume that $0 \leq \theta \leq c/q_l < 1$. By assumption, $q_l - c$ may be arbitrarily close to 0 so that this does not imply a loss of generality.

Governments have various instruments available to realize their choices; the CPE government implements product diversity, i.e. the number of producers, by *fiat*. Regulation of entry in a RMME is also implemented by *fiat*. In a CPE, prices and subsidy incentive schemes guide firm behavior towards meeting the quantity and quality plan. However, regulators in a RMME lack the power to create these incentives but instead use price regulation and subsidies to ensure zero profits for public enterprises. Product quality and quantity are determined by the interaction between government regulation, SOE subsidization, and the monopolistic producers that maximize profits.

4. The Centrally Planned Economy

In a CPE, all production takes place in SOEs such that $\gamma = 1$ in equation (8). Equilibrium is established by the government's optimal plan, which is instituted by $fiat$ and SOE subsidization. The CPE government formulates a plan $\{n^{cp}, x^{cp}, q^{cp}\}$ for the number of equal-sized SOEs n^{cp}, which determines product variety, SOE size x^{cp}, and product quality q^{cp} by maximizing the objective function (8). In implementing the plan, the CPE government balances SOE budgets based on differential information about n, x and q. The government can observe and control the number of producers easily and has some information over firm-level production volumes for which it may create appropriate firm-level incentives. However, due to prohibitively costly decentralized monitoring, the government has no information on firm-level product quality. Rather, costless monitoring on the market provides information on the average quality produced by all firms.

Substituting (1") and trade-off (7) for U and X in (8), the CPE government objective function becomes:

$$\begin{aligned} \hat{Z} &= \left[\frac{(L-nf)}{q}\right]^{\hat{\theta}} \left[\frac{\alpha n^{(1/\beta-1)}(L-nf)}{q}\right]^{(1-\hat{\theta})} \\ &= \frac{\alpha^{1-\hat{\theta}}}{q}\, n^{(1/\beta-1)(1-\hat{\theta})}(L-nf), \end{aligned} \tag{9}$$

where CPE values are indicated by a circumflex. Equation (9) is a separable function of n and q that already incorporates the trade-offs in (7). When formulating the optimal plan, the government aspires to efficient production. The first-order condition for maximizing (9) with respect to n is:

$$\begin{aligned} \frac{\partial \hat{Z}}{\partial n} &= [\alpha^{(1-\hat{\theta})}/q][(1/\beta-1)(1-\hat{\theta})n^{(1/\beta-1)(1-\hat{\theta})-1}(L-nf) \\ &\quad -fn^{(1/\beta-1)(1-\hat{\theta})}] = 0. \end{aligned}$$

Algebraic manipulation yields:

$$(1/\beta-1)(1-\hat{\theta})(L-nf)/n = f,$$

which gives the CPE government's most preferred variety of production as:

$$n^{cp} = \frac{(1-\beta)(1-\hat{\theta})}{1-\hat{\theta}(1-\beta)}\frac{L}{f}. \tag{10}$$

From (10), $dn^{cp}/d\hat{\theta} < 0$. Obviously, if $\hat{\theta} = 0$, i.e., if the CPE government maximizes consumer welfare, $n^{cp} = n^* = (1-\beta)L/f$. If $\hat{\theta}$ approaches c/q_l, the government's objective comes close to $\hat{Z} = X$, which is maximized at $n^{cp} = 1$. Hence, the one-firm economy of the Stalinist planning ideal is optimal in this case.[7]

To derive the solution for optimal quality from (9), the first-order condition requires that:

$$\begin{aligned} \frac{\partial \hat{Z}}{\partial q} &= \frac{(1-\hat{\theta})\alpha^{-\hat{\theta}}q - \alpha^{(1-\hat{\theta})}}{q^2}\left[n^{(\frac{1}{\beta}-1)(1-\hat{\theta})}(L-nf)\right] \\ &= \frac{\alpha^{-\hat{\theta}}}{q^2}\left[(1-\hat{\theta})q-\alpha\right]\left[n^{(\frac{1}{\beta}-1)(1-\hat{\theta})}(L-nf)\right] = 0. \end{aligned}$$

Because (7) requires that $L > nf$, $\partial\hat{Z}/\partial q = 0$ if and only if $(1-\hat{\theta})q - \alpha = 0$, i.e. for $q = \frac{q-\alpha}{\hat{\theta}}$. From the definition of $\alpha = q - c$,

$$q^{cp} = c/\hat{\theta}. \tag{11}$$

With (7), the quantity part of the optimal plan $\{n^{cp}, x^{cp}, q^{cp}\}$ becomes:

$$x^{cp} = \frac{\hat{\theta}\beta f}{(1-\hat{\theta})(1-\beta)c}. \tag{12}$$

With full information, the government can determine directly the equilibrium number of producers by *fiat* such that:

$$\hat{n} = n^{cp} = \frac{(1-\hat{\theta})(1-\beta)}{1-\hat{\theta}(1-\beta)}\frac{L}{f}. \tag{13}$$

However, equilibrium product volumes and quality are determined as the solution of a simple static non-cooperative game between the government and the firms. Subject to guaranteeing SOE budget balance, the government chooses prices and subsidies given its information on quantity and quality, while firms choose quantity and quality of production to maximize their budgets Φ_j, i.e. total revenues including subsidies minus the costs of meeting the plan, taking prices and the plan as given. From the cost and revenue functions in (5) and (6), the firm's budget is:

$$\Phi_j = (p_j - q_j)x_j + s_j - f. \tag{14}$$

When devising an incentive-compatible subsidy, the government replicates the solution to the firm's problem by maximizing Φ_j. Assuming no informational asymmetries, the government may formulate individual incentives for both the quantity and the quality of output such that $s_j = s_j(q_j, x_j)$. Especially, as the government wants to implement $x_j = x^{cp}$ and $q_j = q^{cp}$, this requires from (14) that

$$\begin{aligned}\frac{\partial \Phi_j}{\partial q_j} &= -x_j + \frac{\partial s_j}{\partial q_j} \gtreqless 0, \text{for } q_j \lesseqgtr q^{cp}, \text{and} \\ \frac{\partial \Phi_j}{\partial x_j} &= p_j - q_j + \frac{\partial s_j}{\partial x_j} \gtreqless 0, \text{for } x_j \lesseqgtr x^{cp}.\end{aligned} \tag{15}$$

(15) yields two necessary conditions for subsidy design, namely $\partial s_j/\partial q_j \gtreqless x_j$ for $q_j \lesseqgtr q^{cp}$, and $\partial s_j/\partial x_j \gtreqless q_j - p_j$ for $x_j \lesseqgtr x^{cp}$. As can be easily checked, these conditions are satisfied by a subsidy scheme such as $s_j = q_j(q^{cp} + \frac{x_j - q_j}{2}) + x_j(x^{cp} - p_j + \frac{q_j - x_j}{2}) + d$, where d is a constant. The equilibrium condition $\Phi_j = 0$ determines $d = f - \frac{(q^{cp})^2 + (x^{cp})^2}{2}$, such that:

$$s_j = q_j(q^{cp} + \frac{x_j - q_j}{2}) + x_j(x^{cp} - p_j + \frac{q_j - x_j}{2}) - \frac{(q^{cp})^2 + (x^{cp})^2}{2} + f. \tag{16}$$

Given this subsidy scheme, the firm's objective function becomes:

$$\begin{aligned}\Phi_j &= (p_j - q_j)x_j + s_j - f \\ &= q_j(q^{cp} - \frac{q_j}{2}) + x_j(x^{cp} - \frac{x_j}{2}) - \frac{(q^{cp})^2 + (x^{cp})^2}{2}.\end{aligned} \tag{17}$$

If the firm maximizes (17) over x_j and q_j, the optimal plan given by (10), (11), and (12) is established as the informationally unconstrained first-best solution with $\Phi_j = 0$. Uniform pricing, i.e., $p_j = p$, ensures that the consumer's budget constraint is met and that markets clear.

Compared with the full information benchmark, consider the situation in which actual product quality q_j differs from the average quality level observed by the government, $\bar{q}$. This will not change the optimal plan derived under full information. However, if the government offers the same subsidy scheme, the informational constraint will result in:

$$s_j = \bar{q}(q^{cp} + \frac{x_j - \bar{q}}{2}) + x_j(x^{cp} - p_j + \frac{\bar{q} - x_j}{2}) - \frac{(q^{cp})^2 + (x^{cp})^2}{2} + f. \tag{16'}$$

The firm's objective function becomes:

$$\begin{aligned}\Phi_j &= (p_j - q_j)x_j + \bar{q}(q^{cp} + \frac{x_j - \bar{q}}{2}) + x_j(x^{cp} - p_j + \frac{\bar{q} - x_j}{2}) - \frac{(q^{cp})^2 + (x^{cp})^2}{2} \\ &= -q_j x_j + \bar{q}(q^{cp} + \frac{x_j - \bar{q}}{2}) + x_j(x^{cp} + \frac{\bar{q} - x_j}{2}) - \frac{(q^{cp})^2 + (x^{cp})^2}{2}. \end{aligned} \tag{17'}$$

Maximization of (17') yields a corner solution with respect to quality choice, because:

$$\frac{\partial \Phi_j}{\partial q_j} = -x_j < 0.$$

By the assumption of large numbers, an individual firm's quality choice does not influence $\bar{q}$. Hence, the subsidy scheme (16') cannot implement the optimal plan so that the government may try to adjust the subsidy taking account of the informational asymmetry.

However, the government can observe, and thus provide incentives for, individual production volumes but only for aggregate qualities. No subsidy that incorporates an incentive for the individual SOE to raise quality can be derived. Rather, each individual SOE acts as a free rider and chooses a lower quality level. Thus, no internal optimal solution exists for $\hat{q}_j$ so that:

$$\hat{q}_j = q_l.^{8} \tag{18}$$

The first-order necessary condition for maximizing (17') with respect to output choice is given by:

$$\frac{\partial \Phi_j}{\partial x_j} = \bar{q} - q_j + x^{cp} - x_j = 0,$$

which implies $x_j = x^{cp}$ for $q_j = \bar{q} = q_l$. However, because SOEs produce minimum quality and identical quantities in equilibrium, the combination $\{x^{cp}, q_l\}$ is inefficient in terms of the trade-offs represented in (7). In order to restore efficiency, the government may increase the output incentive in the subsidy scheme (17'). From (15), every output-related bonus system with $\partial s_j / \partial x_j > q^{cp} - p_j$ will provide such an incentive. The trade-off (7) limits each firm's production to the maximum feasible quantity given by:

$$\hat{x} = \frac{\beta f}{q_l(1 - \hat{\theta})(1 - \beta)}. \tag{19}$$

Thus, asymmetric information means that the CPE government's most preferred choice is unattainable. The consequences of this can be modeled in two ways. First, the government may change its plan, taking firms' quality and quantity choices given by (18) and (19) into account as constraints; this constrained optimal plan is implementable. Second, the government may leave its optimal plan intact; in which case, the plan will not be met. Although we follow the second option in the tradition of the optimal planning literature, switching to the first alternative would not alter any of our results, with the exception of Proposition 1.[9]

Uniform pricing $p_j = \hat{p}$ ensures that the consumer's budget constraint is met and that the markets clear. The residual of net costs to be covered by the subsidy is:

$$\hat{s} = (q_l - \hat{p})\hat{x} + f. \tag{20}$$

This subsidy is contingent upon *ex post* producer behavior, which differentiates a soft budget constraint from an *a priori* announced subsidy (Mitchell, 2000). However, note that $\hat{p}$ has no informational content; the producer is indifferent between prices and subsidies as sources of revenue. From the consumer's perspective, the effective price, denoted p_e, takes into account both the product price and the producer's subsidy. Hence, $np_e x = npx + ns = L$ such that, from (7), $\hat{p}_e = q_l L/(L - \hat{n}f)$. Using (13), we have:

$$\hat{p}_e = \frac{q_l[1 - \hat{\theta}(1-\beta)]}{\beta}. \tag{21}$$

Equations (13) and (19) yield total SOE production as:

$$\hat{X} = \frac{\beta L}{q_l[1 - \hat{\theta}(1-\beta)]}, \tag{22}$$

which is increasing with $\hat{\theta}$. From (1"), consumers in the CPE are left with welfare of:

$$\hat{U} = \frac{q_l - c}{q_l}\hat{n}^{1/\beta}\left(\frac{L}{\hat{n}} - f\right), \tag{23}$$

which is decreasing in $\hat{\theta}$ because $\hat{U}$ is increasing in $\hat{n} < n^*$ and $\hat{n}$ is decreasing with $\hat{\theta}$. We collect these results in the following proposition.

PROPOSITION 1: Central planning results in the actual variety of production meeting the plan, $\hat{n} = n^{cp}$, a product quality lower than planned, $\hat{q} < q^{cp}$, and physical overproduction, $\hat{x} > x^{cp}$. Welfare (total SOE output) is increasing (decreasing) with the quality of governance in the CPE.

From Dixit and Stiglitz (1977), the equilibrium of a private ownership market economy without government interference is a welfare maximum subject to a zero profit constraint for producers. Taken together with Proposition 1, we have the following corollary.

COROLLARY 1: If the government's objective can be described by any strictly quasi-concave function combining X and U, welfare in a CPE will always be lower than welfare in a private ownership market economy.

5. The Post-transition RMME

A successful political transformation increases the constraints on the state's ability to maximize the wealth of the ruling elite, i.e., it improves the quality of governance. Since the power of the ruling elite rests on its ability to capture the output of state-sector activity, a successful political transformation requires changes in the institutional balance towards more non-state activity and less scope for the government to implement its own objectives. Hence, we consider the transition to be a process of replacing a CPE by a RMME with CPE equilibrium characterizing the initial conditions. Importantly, we assume that this requires no closure of inherited old SOEs, which may or may not be partially privatized, but does involve the entry of m new non-state firms. However, the market access of these new firms is regulated by the government.

With the entry of non-state competitors, the central plan is no longer applicable. However, the government may continue to balance SOE budgets by price regulation and subsidization. As in the CPE, the RMME government derives benefits only from SOE output. Therefore, only SOEs are subsidized although price regulation applies to all producers. Both types of firms are assumed to behave as regulated monopolistic profit maximizers having identical technologies.[10] The informational constraints on the government remain so that it cannot distinguish between privately and publicly provided product quality.

In this new environment, the RMME government's objective function, derived from (8), is:

$$\tilde{Z} = (\hat{n}x)^{\tilde{\theta}} U^{1-\tilde{\theta}}, \tag{24}$$

where $\hat{n}$ is the number of state-owned enterprises from the CPE level, a tilda denotes a RMME value, and $0 < \tilde{\theta} \leq \hat{\theta} < \frac{c}{q_l} < 1$ to underscore we are dealing with the economic consequences of a successful political transformation. After substituting for U from (1') and anticipating the equilibrium property that all products are of the same quality and are produced at the same quantities because of identical technologies, $\tilde{Z} = (\hat{n}x)^{\tilde{\theta}}(\alpha N^{1/\beta}x)^{1-\tilde{\theta}} = \alpha^{1-\tilde{\theta}}\hat{n}^{\tilde{\theta}} X N^{(1-\tilde{\theta}-\beta)/\beta}$, where $N = \hat{n} + m$. Incorporating the trade-off in (7), the RMME government's objective function can be written as:

$$\tilde{Z} = \hat{n}^{\tilde{\theta}} \frac{\alpha^{1-\tilde{\theta}}}{q} N^{(1-\tilde{\theta}-\beta)/\beta}(L - Nf). \tag{25}$$

Government preferences are derived by maximizing (25) over N and q. The first-order conditions for this problem are:

$$\frac{\partial \tilde{Z}}{\partial N} = \hat{n}^{\tilde{\theta}} \frac{\alpha^{1-\tilde{\theta}}}{q} N^{(1-\tilde{\theta}-\beta)/\beta} \left[\frac{(1-\tilde{\theta}-\beta)}{\beta} \frac{1}{N}(L - Nf) - f \right] = 0,$$

which requires that:

$$\frac{(1-\tilde{\theta}-\beta)}{\beta} \frac{L - Nf}{N} = f,$$

and

$$\frac{\partial \tilde{Z}}{\partial q} = \hat{n}^{\tilde{\theta}} N^{(1-\tilde{\theta}-\beta)/\beta}(L - Nf)\frac{(1-\tilde{\theta})\alpha^{-\tilde{\theta}}q - \alpha^{1-\tilde{\theta}}}{q^2} = 0,$$

which implies that:

$$(1-\tilde{\theta})q = q - c.$$

Using the trade-off in (7), these conditions yield government preferences over $\{N^R, q^R, x^R\}$ such that:

$$N^R = \max\left\{\hat{n}, \frac{1-\tilde{\theta}-\beta}{1-\tilde{\theta}}\frac{L}{f}\right\}. \tag{26}$$

This specification allows for the possibility of a corner solution because the restrictions on $\tilde{\theta}$ and β do not exclude $1-\tilde{\theta}-\beta < 0$. In addition, we have:

$$q^R = c/\tilde{\theta}, \text{ and} \tag{27}$$

$$x^R = \frac{\tilde{\theta}}{c}\left(\frac{L}{N^R} - f\right). \tag{28}$$

Market access is regulated by *fiat* so that $\tilde{N} = N^R$. Comparing (26) with the CPE equilibrium in (13) indicates that post-transition market entry will never occur if $\tilde{\theta} = \hat{\theta}$. Rather, straightforward algebraic manipulation yields the result in the following proposition.

Proposition 2: Post-transition entry of non-state producers requires more than simply a marginal increase in the quality of governance. Market entry, i.e., $\tilde{N} > \hat{n}$, occurs if and only if $\tilde{\theta} < (1-\beta)\hat{\theta} = \hat{\theta}/\sigma$.

Proposition 2 indicates that the ratio of post-transition to pre-transition values of governmental power, given by $\tilde{\theta}/\hat{\theta}$, must be lower than the inverse elasticity of substitution between the industrial products to allow for *de novo* market access. Suppose that, for $n < n^* = (1-\beta)L/f$, each additional product variant increases welfare but decreases total output linearly in the CPE objective function given by (9). However, equation (25) does not include total output; it depends on SOE output only. Therefore, each new non-state firm increases consumer welfare but decreases total SOE output more the higher is the elasticity of substitution between product variants. Hence, θ must decrease by the value of this elasticity to allow for market entry.

Equilibrium product quality is determined by the interaction between government regulation, SOE subsidization, and the profit-maximizing behavior of the monopolistic producers. Now, SOEs react to quality-sensitive market demand. Given the representative

consumer's income as $Y^d = L - T$,[11] demand for each individual product variant simplifies from (2) to:

$$x_i = \frac{(p/\alpha_i^{\beta})^{1/(\beta-1)}}{P^{\beta/(\beta-1)}}(L - T) \tag{2'}$$

for all $i = 1, \ldots, \hat{n}, \hat{n}+1, \ldots, \hat{n}+m = N$, where p denotes the uniform regulated price imposed on all producers. Profits of non-state firms are $\pi_k = (p - q_k)x_k - f, k = 1, ..., m$. SOE profits are augmented by subsidies, $\pi_j = (p - q_j)x_j + s - f, j = 1, ..., n$. Under the large numbers assumption, individual firms cannot influence the price index P in (2'). Hence, profit maximization over individual quality choice, taking the regulated price p as given, yields the following first-order condition for all producers:

$$\frac{\partial \pi_i}{\partial q_i} = (p - q_i)\frac{\partial x_i}{\partial q_i} - x_i = 0. \tag{29}$$

From (2') $\partial x_i/\partial q_i = \dfrac{\beta}{1-\beta}\dfrac{x_i}{q_i - c} > 0$. From (29), each firm's quality choice is given by:

$$p = \frac{q_i - (1-\beta)c}{\beta}, \tag{30}$$

for all i. With uniform price regulation, product quality will be identical for all state and non-state firms in the RMME. From (2'), outputs will also be identical. Since the regulated price depends on the occurrence of market entry, we distinguish two cases to determine equilibrium price $\tilde{p}$, SOE subsidy $\tilde{s}$, and product quality $\tilde{q}$ in the RMME.

Without market entry and based on its informational constraints, the government determines a price p and a subsidy level s to balance SOE budgets according to the following average-cost pricing rule:

$$p = \bar{q}(\tilde{m} = 0) + (f - s)/x, \tag{31}$$

where $\bar{q}(\tilde{m} = 0)$ represents average product quality. Since average-cost pricing implies zero profit distribution to consumers, $x = (L - \hat{n}s)/\hat{n}p$ from the consumer's budget constraint. Given the trade-off in (7), the government determines the regulated price to be:

$$p = \frac{L - \hat{n}s}{L - \hat{n}f}\bar{q}(\tilde{m} = 0). \tag{32}$$

Individual quality choice (30) and price regulation (32) together imply:

$$\frac{L - \hat{n}s}{L - \hat{n}f}\bar{q}(\tilde{m} = 0) = \frac{q - (1-\beta)c}{\beta}. \tag{33}$$

Since subsidies increase profits, budget balance for SOEs implies a reduction in quality because market demand reacts positively to higher quality. Hence we have the following Lemma:

LEMMA 1: Subsidizing SOE production in the RMME without market entry provides a disincentive for SOE quality improvement.

PROOF: See Appendix.

Adding quality-sensitive market demand as a source of finance to the firm provides sufficient incentives to forego state subsidies. The subsidy consistent with the government's quality preferences expressed by (27) is either 0, if the quality of governance is unchanged from CPE levels, or negative. If the quality of governance is higher than under central planning but not high enough to allow free market entry, i.e., $(1-\beta)\hat{\theta} \leq \tilde{\theta} \leq \hat{\theta}$, the government should impose lump-sum taxes on SOEs and redistribute the revenues to consumers. However, the relationship between the government and SOEs depends on offering non-negative subsidies in return for the benefits from SOE output. Hence, we conclude that $\tilde{s}$ must be zero as the following proposition states.

PROPOSITION 3A: Without market entry, SOEs will not be subsidized in the RMME.

PROOF: See Appendix.

From (A1) and $\tilde{s} = 0$, we derive the quality choice of SOEs as:

$$\tilde{q}(\tilde{m} = 0) = c/\hat{\theta}. \tag{34}$$

Now the regulated price can be derived from (30) to be:

$$\tilde{p}(\tilde{m} = 0) \quad = \quad \frac{c}{\beta\hat{\theta}}[1 - (1-\beta)\hat{\theta}]. \tag{35}$$

When market entry occurs, SOEs may again be subsidized, although the new non-state firms will not receive government assistance. Price regulation is imposed on all firms and is based on an average-cost price for SOEs. Due to asymmetric information, the government is unable to differentiate between the product quality of old and new firms so that:

$$p = \bar{q}(\tilde{m} > 0) + (f - s)/x, \tag{31'}$$

where p applies both to SOEs and to non-state firms. Hence, all firms choose the same product quality, q, and both firm types will be of the same size x. The profits of an SOE equal $\pi_j = (p-q)x + s - f$, and the profits of a new non-state firm are $\pi_k = (p-q)x - f$. Market entry requires non-negative profits and regulation implies a budget balance for SOEs.[12] Both conditions together result in $s \leq 0$, which immediately gives the result in the following proposition:

PROPOSITION 3B: In the presence of market entry, SOEs will not be subsidized in the RMME.

The profit-maximizing individual quality choice is given by equation (30) for both firm

types. Without subsidization and in the presence of non-state producers, product quality satisfies the following condition for all producers:

$$\frac{L}{L-Nf}\bar{q}(\tilde{m}>0)=\frac{q-(1-\beta)c}{\beta}. \tag{33'}$$

Hence, we have Proposition 4.

PROPOSITION 4: Product quality is higher with market entry than without, i.e., $\tilde{q}(\tilde{m}>0)=\frac{(1-\beta)c}{\tilde{\theta}}$.
PROOF: See Appendix.

From equation (30), price regulation in the presence of market entry yields:

$$\tilde{p}(\tilde{m}>0)=\frac{(1-\beta)c}{\beta\tilde{\theta}}(1-\tilde{\theta}), \tag{35'}$$

which is higher than without market entry and also increases with the quality of public governance.

6. The Transition from a CPE to a RMME

Propositions 3A and 3B indicate that SOEs will not be subsidized in the RMME so that we state the following result.

COROLLARY 2: Transition from a CPE to a RMME hardens the budget constraints of SOEs.

In the unregulated monopolistic competition market economy of Dixit and Stiglitz (1977), equilibrium prices satisfy the condition that marginal cost equal marginal revenue. For equal product qualities, this implies that product variants are priced according to $p^*=q/\beta$ from (2), (5) and (6). From (29), $\partial\pi/\partial q>0$ for $p^*=q/\beta$, which implies a corner solution for quality choice, such that all unregulated monopolistic competitors choose maximum quality $q^*=q_h$. From (34), (35), Proposition 4 and (35'), we thus have $\tilde{p}(\tilde{m}=0)<\tilde{p}(\tilde{m}>0)<p^*$ and $\tilde{q}(\tilde{m}=0)<\tilde{q}(\tilde{m}>0)<q^*$. If price regulation is considered to be more market-oriented when the resulting prices are closer to market prices so that they induce higher product qualities, Propositions 2 and 4 imply the following result.

COROLLARY 3: Higher post-transition qualities of governance imply more market-oriented policies with respect to market access and price regulation.

Preliminary empirical work linking post-transition political systems and reform choices confirms that competitive democracies have made the greatest progress in implementing market-oriented reforms, while non-competitive regimes have made the least (World

Bank, 2002). Other work, i.e., Dethier *et al.* (1999), EBRD (1999), and Fidrmuc (2003) asserts that democratization facilitates economic liberalization in transition countries. Our analytical results are consistent with these interpretations.

In the post-transition economy, consumer welfare equals $\tilde{U} = (\tilde{\alpha}/\tilde{q})\tilde{N}^{(1-\beta)/\beta}(L-\tilde{N}f) = [(\tilde{q}-c)/\tilde{q}]\tilde{N}^{(1-\beta)/\beta}(L-\tilde{N}f)$ from (1"). If $(1-\beta)\hat{\theta} < \tilde{\theta} \leq \hat{\theta}$, i.e. with no market entry, $\tilde{U}(\tilde{m}=0) > \hat{U}$ because $\tilde{q}(\tilde{m}=0) = \dfrac{c}{\tilde{\theta}} > q_l = \hat{q}$ due to hardened budget constraints. For $\tilde{\theta} < (1-\beta)\hat{\theta}$, i.e. with market entry, welfare will increase more because of further gains in quality and variety from Propositions 2 and 4. Using (7), total post-transition output $\tilde{X}$ equals $(L-\tilde{N}f)/\tilde{q}$ so that the above result on welfare holds for $\tilde{X}$ in reverse. Therefore, we state the following proposition.

pt Proposition 5: The transition from a CPE to a RMME raises welfare due to quality and variety gains but reduces total output. In addition, post-transition welfare (total output) is increasing (decreasing) in the post-transition level of public governance.

Output per firm also decreases so that total SOE output, from which government benefits are derived, is lower. Hence, a successful transition from a CPE to a RMME must involve a reduction in government power as the driving force of institutional change. This highlights the genuinely political aspect of transition.[13]

De Melo *et al.* (2001), Krueger and Ciolko (1998), Heybey and Murrell (1999), Stuart and Panayotopoulos (1999), and Falcetti *et al.* (2002) find empirical evidence that transition's initial conditions, i.e., pre-transition macroeconomic and structural distortions, have a significant influence on post-transition output. Within our framework we can connect a pre-transition CPE equilibrium to output in a post-transition RMME without explicit reference to the fundamental quality of governance. Due to the assumptions on the labor market and the general symmetry properties in production and consumption, equilibrium outcomes in all institutional settings imply respectively identical prices, identical production volumes and identical qualities for all types of active producers. Using the consumer budget constraint, $\hat{p}_e\hat{n}\hat{x} = L = \tilde{p}\tilde{N}\tilde{x}$ and

$$\tilde{X} = \frac{\hat{p}_e}{\tilde{p}}\hat{X}. \tag{36}$$

While the effective price in a CPE, $\hat{p}_e$, is given by (21), $\tilde{p}$ varies in a RMME according to whether *de novo* market entry occurs. Hence we have:

$$\tilde{p} = \begin{cases} (c/\beta\hat{\theta})\,[1-(1-\beta)\hat{\theta}], & \text{for } \tilde{m}=0, \text{ and} \\ [(1-\beta)c/\beta\tilde{\theta}]\,(1-\tilde{\theta}), & \text{for } \tilde{m}>0, \end{cases} \tag{37}$$

from (35) and (35'). Without market entry, $\hat{p}_e/\tilde{p}(\tilde{m}=0) = q_l\hat{\theta}/c = q_l/q^{cp}$. From (7) and the CPE equilibrium properties, this equals $x^{cp}/\hat{x} = 1/\hat{\Theta}$, where CPE plan fulfillment $\hat{\Theta}$

is an observable term. Therefore, we have:

$$\tilde{X} = [\tfrac{(1-\tilde{M})}{\hat{\Theta}} + \tilde{M}(\hat{p}_e/\tilde{p})]\hat{X},$$
$$\text{where } \tilde{M} = \begin{cases} 0 \text{ for } \tilde{m} = 0, \text{ and} \\ 1 \text{ for } \tilde{m} > 0. \end{cases} \tag{38}$$

For the transition from a CPE to a RMME, equation (38) indicates that post-transition total output is a function of both initial conditions, i.e., CPE price, output, and plan fulfillment, denoted by $\hat{p}_e$, $\hat{X}$, and $\hat{\Theta}$, respectively, and of post-transition liberalization policies, i.e., market access and the extent of price regulation, denoted by $\tilde{M}$ and $\tilde{p}$. From Proposition 5, post-transition output decreases with improvements in the quality of public governance, which in turn implies more market-oriented policies from Corollary 3. Therefore, the following major proposition holds.

Proposition 6: Post-transition output can be accounted for by observable initial conditions and liberalization policies. In particular, total post-transition output increases with pre-transition output and decreases with more liberal market access and more market-oriented price regulation. For post-transition output to depend on something other than initial conditions, entry of *de novo* firms is required.

Finally, this result has an important policy implication that is contained in the following corollary.

Corollary 4: Proposition 6 describes a spurious relationship because both initial conditions and liberalization policies are fully explained by the quality of governance in the pre-transition and post-transition states.

Transition's initial conditions are CPE price, output, and plan fulfillment. The CPE price is determined in (21) and CPE output is determined in (22). Both are functions of parameters, i.e., β, describing consumer tastes, L, total labor assumed constant, q_l, the minimum quality, and of the quality of public governance, i.e. $\hat{\theta}$. Plan fulfillment is the ratio of CPE output to planned CPE output, both of which are functions of parameters and the quality of public governance. Regarding liberalization policies, i.e., market access and the extent of price regulation, the condition for market entry is given in Proposition 2. It depends on the quality of governance in the pre-transition and post-transition states and parameters of the utility function. The post-transition price depends on market entry, parameters from the utility and cost functions, and the quality of public governance in the RMME, i.e. $\tilde{\theta}$. Hence, given the parameters of the model, the quality of governance in the pre-transition and post-transition states determines initial conditions, post-transition liberalization policies, and thus by (38), post-transition output completely.

7. Conclusions

A successful transition from a CPE to a RMME based on improvements in the quality of public governance is shown to yield higher product variety and quality at a cost of lower output. This result is consistent with the usual description of the long-term economic benefits of transition from a CPE having as its main feature large quantities but low quality and little variety of output. Our results do not depend on productive inefficiency but highlight the role of public governance so that they complement the literature focussing on efficiency gains within the firm due to better corporate governance (Estrin, 2002). However, low-quality public governance need not be outright corruption; distorted government choices drive our results. Although the model is static, the results suggest that changes in the quality of governance and accountability of government are underlying forces of path dependency in post-transition economic performance. Hence, path dependency in transition is more a political, rather than an economic, phenomenon.

This framework may help empirical research address the serious problem of mismeasurement of real income in Eastern Europe and the CIS because the largest portion of this bias is probably due to uncaptured quality and variety effects. By combining measures of output, variety and quality of production, a more reliable picture of recent economic developments in these countries can be presented. Applying trade-based measures of product differentiation might be instrumental in such an approach. Trade-based measures have already been used to study the links between variety and per capita income in an endogenous growth context (Funke and Ruhwedel, 2003) and between variety and export performance of transition economies (Funke and Ruhwedel, 2002; Kandogan, 2003).

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Appendix

A.1. Proof of Lemma 1

In equilibrium, qualities are identical and correctly observed by the government, i.e. $q = \bar{q}(\tilde{m} = 0)$. Equation (33) implies:

$$\frac{L - \hat{n}s}{L - \hat{n}f} = \frac{q - (1-\beta)c}{\beta q},$$

or

$$\frac{(1-\beta)c}{\beta q_j} - \frac{1}{\beta} = -\frac{L - \hat{n}s}{L - \hat{n}f}.$$

Expanding the RHS numerator gives:

$$\frac{(1-\beta)c}{\beta q} - \frac{1}{\beta} = -\frac{L - \hat{n}f + \hat{n}f - \hat{n}s}{L - \hat{n}f}.$$

Rearranging yields:

$$\frac{(1-\beta)c}{\beta q} - \frac{1}{\beta} - 1 = \frac{\hat{n}s - \hat{n}f}{L - \hat{n}f}$$

or

$$\frac{1-\beta}{\beta}\left[\frac{c}{q} - 1\right] = \frac{s/f - 1}{L/(\hat{n}f) - 1}.$$

Making use of the definition of $\hat{n}$ in (13) and verifying that $L/(\hat{n}f) - 1 = \beta/(1-\hat{\theta})(1-\beta)$, we derive:

$$\frac{1-\beta}{\beta}\left[\frac{c}{q} - 1\right] = \frac{s/f - 1}{\beta}(1-\beta)(1-\hat{\theta}),$$

such that:

$$\frac{c}{q} - 1 = \frac{s - f}{f}(1-\hat{\theta}),$$

which implies:

$$\tilde{q}(\tilde{m} = 0) = \frac{cf}{(1-\hat{\theta})s + \hat{\theta}f}, \tag{A1}$$

with $\partial\tilde{q}/\partial s < 0$. q.e.d.

A.2. Proof of Proposition 3A

Rearranging (A1) yields:

$$s = \frac{f}{(1-\hat{\theta})}\left(\frac{c}{\tilde{q}(\tilde{m}=0)} - \hat{\theta}\right).$$

Substituting $q^R = c/\tilde{\theta}$ for $\tilde{q}(\tilde{m}=0)$ from (27) gives:

$$\tilde{s} = \frac{f}{(1-\hat{\theta})}(\tilde{\theta} - \hat{\theta}) \leq 0,$$

for $(1-\beta)\hat{\theta} \leq \tilde{\theta} \leq \hat{\theta}$. q.e.d.

A.3. Proof of Proposition 4

In equilibrium, $q = \bar{q}(\tilde{m} > 0)$. By the definition of $\tilde{N} = N^R$ in (26), equation (33') implies:

$$\left[1 - \frac{1-\tilde{\theta}-\beta}{1-\tilde{\theta}}\right]^{-1} q = \frac{q-(1-\beta)}{\beta},$$

i.e.,

$$\frac{1-\tilde{\theta}}{\beta} q = \frac{q}{\beta} - \frac{(1-\beta)c}{\beta},$$

such that

$$\left[\frac{1-\tilde{\theta}}{\beta} - \frac{1}{\beta}\right] q = -\frac{(1-\beta)c}{\beta},$$

defining a quality level of:

$$\tilde{q}(\tilde{m} > 0) = \frac{(1-\beta)c}{\tilde{\theta}}$$

for both firm types. Since market entry $\tilde{m} > 0$ requires that $\tilde{\theta} < (1-\beta)\hat{\theta}, (1-\beta)c/\tilde{\theta} > c/\hat{\theta}$ and $\tilde{q}(\tilde{m} > 0) > \tilde{q}(\tilde{m} = 0)$.

q.e.d.

Endnotes

1. Niskanen (1971) analyzes principal-agent relationships between a welfare-maximizing political sponsor and bureaus acting to maximize their discretionary budget, i.e., the difference between the total budget and the cost of producing the required output.

2. The ruling elite is assumed to be interested in exerting power as a goal in itself. Excluding the consumption or resale of potential private benefits abstracts from the corruption aspect of governance, which is the focus of papers by Shleifer and Vishny (1993), Banerjee (1997), and Ehrlich and Lui (1999).

3. Since regulation implies the absence of pure competition, regulatory power may be exercised by entering into collusive agreements with the regulated firm (Laffont and Meleu, 2001).

4. The notation in equation (1) does not allow product variants to be consumed in different qualities. This anticipates the equilibrium property of one-product-variant firms, i.e. that each product variant is produced and consumed only in one quality specification.

5. For a derivation of demand equation (2), see Venables (1987) where our quality preference term α_j is introduced as a preference over country-specific product variants.

6. The first-order condition is $\partial U/\partial n = \dfrac{\alpha}{q}\left[\dfrac{1-\beta}{\beta} n^{1/\beta-2}(L-nf) + n^{1/\beta-1}(-f)\right] = 0$. Algebraic manipulation yields the solution for n^*.

7. If the government's objective can be described by a quasi-concave function over X and U, it is maximized by some n such that $1 < n < (1-\beta)L/f = n^*$.

8. This confirms the result in Roland (1988, p. 129) that "product quality will always be sub-optimal for the consumer, regardless of his preferences, if the producer's decision of the 'quantity-mix' is based on a certain class of output-related bonus functions."

9. Whichever alternative is chosen, n^{cp} always remains a second-best optimum; due to the separability of the government's objective function in (9), n^{cp} is independent of x^{cp} and q^{cp}.

10. Technological differences are often used as a substitute for the efficiency differences between private and public sectors that result from different corporate governance practices. However, we do not consider corporate governance issues so that the only difference between SOEs and non-state enterprises is that the former benefit the government.

11. We show below that the profits of all non-state firms are also zero, i.e. there are no profits to be distributed to consumers.

12. The consequences of the informational asymmetry between governments and firms are different between the CPE and the RMME. In a CPE, the asymmetry results in the non-attainability of the full-information benchmark solution. In a RMME, the informational asymmetry between government and firms implies that all firms be subject to a zero profit constraint. As there is no free private entry, this is important.

13. This may not hold in a model that allows for productive inefficiency under central planning that interferes with the correlation between total output and welfare changes across pre-transition and post-transition situations. Hence, for less efficient CPEs, welfare-increasing reforms that do not decrease government power, are possible.

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