The Dynamics and Differentiation of CIS Metal Exports

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Abstract

This study documents six stylized facts about the international trade patterns of Commonwealth of Independent States (CIS) metal producers over the past 15 years: (i) Relatively brisk CIS market share growth was driven by emerging source countries, new destination countries and a deeper range of core products; (ii) Market concentration declined among CIS exporters and export destinations; (iii) CIS specialization in metals has declined over time; (iv) CIS market share growth was primarily in high value-added metal products, though not necessarily the most differentiated products; (v) CIS specialization in metals is still primarily in low value-added products; and (vi) CIS market share is little affected by the changing product composition of global metal exports and more likely influenced by competitiveness factors.

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By 2008, the global metal market, defined here as international shipments of aluminum, copper, iron, lead, nickel, steel, tin and zinc, was a $1.1 trillion behemoth accounting for 7 percent of global merchandise trade. The value of global metal shipments increased at an average annual rate of 12 percent since 1994, 20 percent faster than the rate of other exported merchandise over the same period. This study analyzes the portion of this market coming from Commonwealth of Independent States (CIS) countries and evaluates some of the drivers of their export performance.[1] The results are summarized as six empirical facts about CIS metal exports.

To begin, CIS exporters are an increasingly important part of the international metal market. In 1994, the region accounted for 6.4 percent of global shipment value; by 2008, that figure was 9.8 percent. Much of this paper will focus on this brisk 3.4 percentage point (53 percent) increase in share, decomposed in several dimensions. The first stylized fact is that the main contributors to this rise in market share were not the biggest source countries, destination countries and metal products during the mid-1990s; rather, the majority of share growth is attributable to a combination of: (i) medium- and small-scale metal exporters, (ii) rapid growth in new destination countries, and (iii) expansion of the region's set of core traded products. These features of export growth imply greater diversification for the CIS region on a number of levels. For the region as a whole, participation in the international metal market is now more evenly distributed among CIS countries than it used to be, predominantly the export volumes of Ukraine and Kazakhstan relative to Russia. Moreover, better distribution of sales across products and destinations makes the region less vulnerable to the idiosyncratic shocks of each sub-market.

Higher market share for the CIS region, in turn, has implications for the global structure of the global metal market. The second stylized fact quantifies the declining concentration of metal export sources in the international market as a whole and looks at the contribution of CIS and other regions to that decline. As suggested by the first stylized fact, the concentration of CIS metal exports across source and destination countries has been falling, driven by fast export growth outside of Russia and entry into new products and markets. The trade data imply that source country concentration in CIS, as measured by a Herfindahl index of country market shares within the region, began at a much higher level and has declined at

[1] A more detailed list of products included in the definition of metals as well as lists of countries in each region can be found in the Appendix.

a much faster rate than in other developing metal-exporting regions such as Latin America and the Caribbean (LAC) or the European Union transition countries (EU10). In contrast, LAC and EU10 source country concentration did not change much over the same period.

With regard to metal export destinations, concentration of CIS exports declined sharply in the late 1990s to a level of about half that of LAC and EU10. Underlying this change were substantial decreases in export destination concentration for Russia and Ukraine which continued through the mid-2000s, as well as a marked decline in concentration among smaller exporters such as Georgia and Armenia in the mid-1990s. I also demonstrate the a key factor in the decline of destination concentration is the rapid proliferation of new destination countries; the region more than doubled the number of countries it serves between 1994 and 2000, driven by rapid increases in Russia and Ukraine and smaller, more steady increases in the smaller exporters.

The discussion of market concentration concludes with a discussion of the global distribution of metal source countries. Interestingly, in spite of the falling concentration within CIS, the region's contribution to global metal export concentration has been drifting up over time. This implies that its growing overall market share has concentrated the metal export market more than better intra-regional distribution has dispersed it. The fact that the region's increasing market share has taken place against the backdrop of falling export concentration in the rest of the world may additionally indicate that the market power of large competing exporters has been falling over time.

The reliance of the world on CIS for metal exports has a counterpart in the reliance of CIS on metal products for export revenue. The intensity of metal exports relative to total exports and the corresponding degree of specialization in regional trade are computed for CIS and other emerging market exporters, which brings us to our third stylized fact: CIS is characterized by a relatively high level of metal specialization, but one which has been falling relatively fast, particularly in the late 1990s. Taking the first three facts together, this pattern – simultaneous rising market share and falling specialization – is unique to CIS compared with other regions of similar development status and size in the metal market. For example, LAC specialization in metal exports moved up in tandem with its global market share over the same period. The EU10 transition countries decreased their specialization against the backdrop of a stable market share. One possible explanation for this configuration of statistics (and their timing) is that CIS went through a structural transition at the end of the 1990s in which exports expanded briskly across the board, with many products growing at a faster rate than metals. Another, potentially complementary, explanation is that share growth and de-specialization in metal do not move so closely together at the level of individual countries. Indeed, we find that most of the decrease in specialization took place in Russia, a country with relatively stable market share over time.

The fourth and fifth stylized facts about CIS metal exports delve deeper into the *types* of metals that the region is exporting by discerning between upstream and downstream stages of production. The idea is to see whether the increase in CIS market share was driven by the changing composition of exports from relatively low value-added upstream products to relatively high value-added downstream products. To do so, the export data are categorized into three categories along the production value chain – from ores, having relatively low levels of processing and value-added, to worked metal products with more value-added – along the lines proposed in Mandel (2011). It turns out that most of the increase in CIS market share was accounted for by high-value added, downstream products; this is our fourth stylized fact. Success in these product types is suggestive that CIS exporters have been upgrading their production capabilities and sophistication over time.

Is it inherently desirable to be a downstream producer, compared to a successful exporter at any given point on the value-added chain? Arguably so. Production of downstream products may entail higher levels of skill than at lower levels of value added. For example, downstream products may be more technically sophisticated and may require higher levels of expertise to produce; thus the level of value added in production can be a reflection of technical ability. There may additionally be positive externalities due to the increased skill required to produce downstream products that compounds this effect. A related issue is the connection between high value-added products and the level of economic development. Imbs and Wacziarg (2003) argue that an economy's aggregate production tends to grow via two stages of sector diversification, increasing diversification at lower levels of development and decreasing diversification at higher levels. Klinger and Lederman (2004, 2005) corroborate this story using export data. Expansion into downstream varieties can thus be seen as a point towards the middle of this development continuum. So while it is always desirable to have higher sales at any stage in product processing, on the margin it is likely to be beneficial to deepen specialization downstream.

Recent studies have also shown a very high degree of quality differentiation among export varieties even within very narrow product categories.[2] Mandel (2011) demonstrates according to several measures of product differentiation that metals, particularly those in downstream stages, tend to be just as differentiated as non-commodity manufactures. The characterization of high- versus low-differentiated products suggests yet another reason to prefer to specialize downstream: differentiated downstream products have lower degrees of substitutability among competing varieties, and hence firms are able to charge higher average markups over their marginal cost of production. Producing in highly differentiated products also opens the possibility that quality upgrading is contributing to export success. Analogous to our conjecture about downstream stages being more sophisticated, upgraded varieties *within* a product group also tend to go hand-in-hand with higher exporter capability measures. For example, Manova and Zhang (forthcoming) use Chinese firm-level data to show that firms selling higher priced varieties of a given product tend to have higher revenues and a greater number of export destinations. This suggests that export success is being driven by higher output quality. Similar patterns for the unit values of U.S. exports are demonstrated in Baldwin and Harrigan (2011); export unit values are positively related to destination distance and negatively related to destination market size. This implies that an important channel by which exporters garner sales is by offering higher priced, higher quality varieties and, further, that relatively productive firms are the ones that furnish high quality varieties to the export market.

Using two measures of differentiation to rank each metal product, the increase in CIS market share is further decomposed into contributions from high- and low-differentiated products. Across value-added stages most market share growth was accounted for by products with a relatively low degree of differentiation. In downstream stages, which accounted for the bulk of market share growth, over half of the growth was in products below the median level of product differentiation. Thus, while CIS has had marked export success in downstream industries, it has expanded disproportionately into less differentiated products.

The fifth stylized fact reverts to the issue of CIS metal specialization, though this time conditional on the export of products in a given stage of production. In CIS, notwithstanding the fact that the majority of the decrease in overall metal specialization took place in lower

[2] Examples of the measurement of quality ladder length for US imports include Khandelwal (2010) and Mandel (2009).

value-added products, the region is still most specialized in low value-added products with a level in between LAC and EU10. The dynamics of specialization patterns, namely falling low value-added specialization in the 1990s and muted changes in all stages thereafter, is also unique relative to the other regions. While LAC specialization patterns also exhibited declines in the lowest value-added products, those declines took place throughout the time period analyzed. Changes in EU10 specialization patterns were not materially different across stages of production or time period.

Finally, the paper discusses whether changes in market share in each stage of production are driven by the changing product composition of global metal trade versus other factors more closely related to competitiveness. To gauge competitiveness, one would ideally like to determine how big a role the changing productivity of CIS metal firms relative to their competitors has played in driving the region's increasing market share. The most direct way to address this question would be to compute relative productivity measures for all CIS export industries. However, in many instances, and particularly for international comparisons, the existing data are not detailed enough to gauge this directly. Thus, we proceed by process of elimination, considering another factor that might have raised the CIS export share in downstream products and assessing the extent to which it can explain the observed rise. I decompose the CIS metal market share into changes that are related to the changing composition of the global set of traded goods versus those that are more closely related to the relative performance of exporters. One established method of assessing the importance of composition for changes in trade shares is constant market share analysis. It involves separating the changes in aggregate market share into components, in our case: a commodity effect and a non-commodity effect. The commodity effect is less related to competitiveness since it is driven by the relative size of products in the global export basket. For instance, if the world simply imports more high value-added products, it would increase the global market share of any region exporting those products. Stylized fact number six it that changes in CIS market share were little affected by the commodity effect, an empirical observation that is consistent at both the region and the country level.

What do these facts tell us about prospects for future growth of CIS metal exports? The overall contours of the empirical results seem, on their face, to be quite favorable for the regional metal export outlook. Export growth has been distributed quite widely across CIS exporters, products, destination countries, and more so in downstream products. These successes have occurred against the backdrop of falling specialization, particularly in low value-added products, and have not been driven by changing metal export composition. On the other hand, the results also suggest several potential limitations to metal export growth, including: (i) stagnation of market share and specialization patterns in the 2000s, (ii) continued concentration of exports among Russia, Ukraine and Kazakhstan, (iii) exhaustion of new destination markets after having caught up to LAC and EU10, (iv) persistently high specialization levels in upstream products, and (v) the fact that a large share of exports is accounted for by less differentiated products with a lower scope for upgrading.

The paper proceeds as follows. The next section describes and analyzes CIS market share in metals as well as the region's metal intensity of exports (Facts 1-3). Section 2 focusses in on the contributions of higher value-added and more differentiated products to those export statistics (Facts 4-5). Section 3 discusses trends in metal export composition as it pertains to the relative performance of exporters (Fact 6). Section 4 discusses some potential implications of Facts 1-6 for future CIS metal export growth.

1 CIS market share and metal specialization

Fact 1: Relatively brisk CIS market share growth was driven by emerging source countries, new destination countries and a deeper range of core products

Our empirical starting point is metal export shipment value from CIS countries as a share of global metal shipment value:

$$s_{CIS} = \frac{X_{CIS}}{X}$$

where X is an annual flow measured in current US dollars. The contribution of each CIS country, indexed by i, to the region's market share in any given year is:

$$s_{CIS} = \sum_{i \in CIS} s_i = \sum_{i \in CIS} \frac{X_i}{X}$$

For this measure of share as well as others defined below, we use detailed international data-available through 2008 that break down world trade into several hundred disaggregate products. Bilateral industry-level trade flows for merchandise are based on NBER-UN Trade Data compiled by Feenstra, Lipsey, Deng, Ma, and Mo (2005).[3] Throughout the paper, we will also focus on two other metal-exporting regions with which to compare CIS metal trade: LAC and EU10. For a full list of included countries and metal products, see the Appendix. As we shall see, LAC and EU10 share several characteristics in common with CIS; they are emerging markets with a net specialization in metal products (broad-based across several key metal sectors) and global market shares in the same ballpark.

Figure 1 shows measures of s_{CIS}, as well as analogous measures for LAC and EU10 countries for the years 1994 through 2008. CIS market share grew rapidly in the 1990's, rising from 6.4 percent in 1994 to 10.1 percent in 2000; after ticking up to high point of 10.7 percent in 2004, it reverted back to roughly 10 percent thereafter. The dynamics of the LAC metal share were more subdued in the early part of the sample, staying very stable at 10 percent through 2004 before rising to the 12 percent level. EU10 exporters were even more stable over time, starting and ending the sample at 4 percent, with minor vacillations in the 3.5 percent range. Of note, the rapid growth of CIS share in the 1990s did not seem to come at the expense of LAC and EU10 exporters, as shipment values from those countries kept up with global growth of the metal market at that time (i.e., LAC and EU10 shares were stable).

We now document the composition of CIS metal exports by country and product. Specifically, the regional share will be broken down into contributions from CIS exporting countries, foreign recipient countries and the different types of metal products. These decompositions are all based on the definition of export market share above. Figure 2 illustrates s_i for each of the CIS countries. It is evident that the vast bulk of CIS market share is accounted for by the region's top three exporters: Russia, Ukraine and Kazakhstan. These three countries, together, shipped 99 percent of CIS metal exports in 1994 and 98 percent in 2008. To be sure, the smaller exporters, such as Uzbekistan and Georgia that make up the tiny regional residual have been growing their market shares briskly, at 11 and 13 percent annual rates, respectively. Armenia, the smallest of CIS metal exporters, quadrupled its global share over that period. However, coming off of such low levels, these countries continue to be inconsequential for the overall region's market share dynamics.

[3] These data are updated through 2008 using international trade data from Comtrade.

Within the top three exporters, growth was driven almost exclusively by the smaller two countries, Ukraine and Kazakhstan. The share of those countries grew annually at 7.6 and 14.8 percent rates, respectively, and accounted for more than 3 percentage points (88 percent) of the region's 3.4 point total share growth. Russia, on the other hand, just kept pace with global growth in metal exports, with its share edging up by only 0.3 percent annually.

In product space, we can decompose the overall CIS share into contributions from each of the 47 SITC 4-digit metal products, indexed by j, exported between 1994 and 2008 as:

$$s_{CIS} = \sum_j s_j = \sum_j \sum_{i \in CIS} \frac{X_i^j}{X}$$

Figure 3 illustrates s_j for each underlying product category. Our first observation is that CIS countries participate in many different product categories, 46 of the 47 SITC products in our definition of metals. We also note that, while there is a good deal of concentration in certain product categories (i.e., the top 5 products by share contribution accounted for 58 percent of CIS overall share in 1994), the market share contributions by product are much more evenly distributed than those by country in Figure 2.

Over time, most growth in market share did *not* come from the largest incumbent products. The top five contributors in 1994 only accounted for 23 percent of the 3.4 point increase in market share, largely owing to the growth of a single product category: Blooms, Billets, Slabs and Sheet Bars of Iron or Steel (SITC 6725). The majority of growth came from five products that were relatively small contributors in 1994; the five fastest growth rates among these non-incumbents drove about half of the overall growth in market share.

Finally, Figure 4 shows an analogous decomposition of the CIS market share by destination country, indexed by k:

$$s_{CIS} = \sum_k s_k = \sum_k \sum_j \sum_{i \in CIS} \frac{X_{ik}^j}{X}$$

The distribution of s_k in Figure 4 shares several similar features with the product share contributions, s_j, in Figure 3. First, there are a large number of destination countries that CIS serves; by 2008, CIS exporters were shipping to 174 countries of the 258 recorded as metal importers in the UN-NBER international trade dataset. We also note only a moderate degree of concentration of export sales across destinations, illustrated by the fact that no single importer commands a dominant portion of CIS metal export share. The top five export destinations in 1994 (i.e., China, USA, Germany, Japan, Italy) composed 50 percent of the region's overall share.

Furthermore, similar to the decompositions of both source country and product category, the majority of growth in destination countries occurs outside the set of large incumbent destinations. In fact, 13 of the top 15 destinations in 1994 showed a decline in their portion of CIS export share over time; one of the exceptions, and the only top five incumbent to be included among the top five fastest growing share contributions, was Italy. Outside of the set of the largest destinations in 1994, the top five fastest growing shares (i.e., shipments to Turkey, Netherlands, Switzerland, Iran and Russia) represented over two thirds of the 3.4 point share increase between 1994 and 2008. Another important factor in the rise of CIS share was the increase in the number of destinations; that is, those countries that began receiving metal shipments from CIS exporters over the course of the sample. Excluding Russia and Iran (both of which began importing metal from CIS countries in 1995) there were 101 destinations with no imports in 1994 and positive imports in 2008 that together accounted for 49 percent of the overall increase in export share.

In summary, the steady increase in the share of CIS exports in international metal trade has been largely driven by emerging source countries, metal products and destination countries. The export performance of large incumbents was modest, or even under-performed, the rate of growth of the market as a whole.

Fact 2: Market concentration declined among CIS exporters and export destinations

A direct implication of the Fact 1 observation that smaller, faster-growing exporters and destinations are driving market share growth is that the level of market concentration for regional export sources and destinations has decreased. In this section, this effect is quantified for CIS exporters and compared to the concentration measures of other metal-exporting regions.

Knowing what we already know about CIS metal exports from Fact 1, one might expect the region to have: (i) a relatively more unequal distribution than other emerging market exporters due to Russia's size and relatively large share within the region, and (ii) an export concentration across CIS countries and destination countries that has been falling over time. To be more concrete about what is happening to the distribution of export sales within the region, we compute a derivative of the Herfindahl index that conditions on the CIS's overall market share, as follows:

$$H_{CIS} = \sum_{i \in CIS} \left(\frac{s_i}{s_{CIS}} \right)^2 = \sum_{i \in CIS} \left(\frac{\frac{X_i}{X}}{\frac{X_{CIS}}{X}} \right)^2 = \sum_{i \in CIS} \left(\frac{X_i}{X_{CIS}} \right)^2$$

Figure 5 shows this measure for CIS, LAC and EU10. Indeed, CIS export concentration across countries is much higher than in LAC and EU10. It has also been falling over time while the other regions have been flat or rising moderately. After rapid decline in the 1990s, the CIS concentration ratio levelled off at roughly double that of the other regions.

An alternative measure of concentration aggregates across destination countries instead, where we use the definition of destination share, s_k, from above:

$$H'_{CIS} = \sum_{k} \left(\frac{s_k}{s_{CIS}} \right)^2$$

Figure 6 illustrates the time series of H'_{CIS} as well as that of LAC and EU10. Here, in stark contrast to the stable destination concentration of LAC and EU10, CIS concentration fell rapidly through 2001 before settling at a level of approximately half of the other regions. Figure 7 shows the same statistic for several CIS countries. It is evident that both Russia and Ukraine contributed substantially to the fall in destination concentration in the 1990s, particularly Ukraine where the concentration more than halved between 1996 and 2002. Russian export concentration across destinations also stepped down, albeit by a smaller amount, at the end of the 1990s. In the bottom panel, consisting of the smaller metal exporters, the evolution of destination concentration is more heterogeneous across countries. Armenia and Georgia are both very reliant on a small number of destinations in the mid-1990s, subsequently falling to the lower levels of Kazakhstan and Uzbekistan. Of note, all of the smaller exporters have higher concentration than Russia and Ukraine.

In principle, destination concentration for CIS exporters could be falling because: (i) sales are becoming more evenly distributed among existing destination countries, (ii) more destination countries are being served over time, or (iii) both (i) and (ii). The export sales data imply that the evolution in the number of destinations was a key factor in the decline of destination concentration in the early part of the sample. This is hinted strongly by Figure 8, showing a count of destination countries by region and over time. The entry of CIS into new destination markets most likely played a role in the fall in concentration in the 1990s, as this period corresponded to a more than doubling of destinations served by CIS exporters. By 2001, CIS had caught up to LAC and EU10 in terms of number of destinations and levels off, corresponding to the period in which destination concentration remained fairly flat. The composition of countries accounting for the rise in export destinations is also consistent with the important role of entry into new markets. As illustrated in Figure 9, Russia and particularly Ukraine made significant contributions to the number destinations, with dynamics similar to their measures of concentration. Yet another intriguing feature of Figure 6 is the divergence of the level of destination concentration among regions. In spite of the fact that the number of destination countries converged across regions, CIS remains well below the level of concentration of LAC and EU10. This implies that, conditional on the number of destinations, CIS is less concentrated in any given destination market.

Finally, we will examine the concentration across source countries for the global metal market as a whole. To gauge the concentration of the global metal market a Herfindahl index is computed and decomposed into the contributions from different regions. Let us define the concentration of the international metal market across *all* source counties as follows:

$$H = \sum_i s_i^2 = \sum_i \left(\frac{X_i}{X}\right)^2$$

H takes on values between 0 and 1, where 1 indicates a single country dominates the market and values close to zero indicate the presence of a very large number of exporting countries each having a minute market share. We will apply H to measure the concentration of the 235 exporters of metal products. Further, since the Herfindahl is a linear combination of individual country shares, it is straightforward to decompose the overall index into components by region:

$$H = \sum_{i \in CIS} \left(\frac{X_i}{X}\right)^2 + \sum_{i \in LAC} \left(\frac{X_i}{X}\right)^2 + \sum_{i \in EU10} \left(\frac{X_i}{X}\right)^2 + \sum_{i \notin CIS, LAC, EU10} \left(\frac{X_i}{X}\right)^2$$

The level of any particular component of this expression depends on the size of market share for each region and also the distribution of market shares within each region. Figure 10 shows the contributions of CIS, LAC and EU10 to the overall concentration of metal exports, as well as the concentration index computed over all exporters. The regional contributions for LAC and EU10 are rising moderately at the end of the sample and flat throughout, respectively, consistent with the dynamics of their respective market shares. The CIS contribution, on the other hand, is rising fairly modestly over time, which implies that there are decreases in intra-regional concentration offsetting the rise in its overall market share. Of note, none of the three regions contribute meaningfully to the global decrease in concentration that took place between 1994 and 2004. Therefore, it must be other (most likely larger) metal exporters whose shares are declining, decreasing the overall concentration of the market.

In summary, CIS metal exports are relatively concentrated across source countries and relatively diffuse across destination countries relative to LAC and EU10. The source country concentration is driven by Russia's large share, the contribution of which has been falling over time as Ukraine, Kazakhstan and other smaller exporters grow their share at a proportionately faster rate. The fall in concentration across destinations was largely a function of CIS entry into new markets during the 1990s. Having converged to the same number of destinations as LAC and EU10 by 2000, CIS destination concentration levelled off, but remained significantly more diversified across destinations than the other regions.

Fact 3: CIS specialization in metals declined over time

Having described the level and diffusion of the CIS share of metal markets, we now turn to the share of metals in the broader basket of CIS exports. What this decomposition will suggest is the degree and evolution of the region's specialization in metal production. We begin by summarizing the share of exports of all products, X_{CIS}^{all}, accounted for by metal products in a given year as:

$$metal_{CIS} = \frac{X_{CIS}}{X_{CIS}^{all}} = \frac{\sum_{i \in CIS} X_i}{\sum_{i \in CIS} X_i^{all}}$$

Figure 11 shows the evolution of $metal_{CIS}$ over time as well as comparable measures for LAC, EU10 and the set of all metal exporters. The ratio of metal exports to total exports for the set of all exporters indicates the global intensity of metal trade; this has been fairly steady between 4 and 6 percent since 1994. Not surprisingly, the metal intensity of trade for each region is higher than the global average, though their behavior over time is highly idiosyncratic. The LAC and EU10 metal intensities both started just above 10 percent. While the EU10 metal intensity of exports drifted downwards over time, LAC metal intensity drifted upwards. The metal intensity of CIS exports began at the highest level of over 25 percent but quickly fell to 15 percent by 2001, where it stayed through 2008.

Going from metal intensity to a measure of metal specialization is as simple as dividing the regional metal intensity by that of all exporters ($metal_{CIS}/metal_{world}$). This is a variant of Balassa's (1965) measure of revealed comparative advantage (RCA). In this instance, since global metal intensity does not change much over time, regional metal intensity is a sufficient statistic for specialization. We thus have three very different specialization stories across regions: CIS claimed an increasingly large part of the metal market while simultaneously rapidly diminishing its specialization in metals. LAC specialization increased over time, particularly in the 2000s when its market share was rising. And EU10 exporters decreased their metal specialization moderately against the backdrop of steady global market share.

The country and product contributions of the decline in CIS metal intensity are shown in Figures 12 and 13, respectively. Figure 12 paints a very uneven picture of the change in specialization across CIS countries, with Russia more than fully accounting for the 12.4 percentage point drop in metal intensity. The fact that all other countries each contributed less than 1 point in either direction indicates that the share of metal in their export basket stayed roughly flat. In product space, the products with the highest initial contributions to metal intensity were also the biggest contributors to the decline over time; the top five largest products by intensity in 1994 accounted for 71 percent of the overall regional decline through 2008. Similar to the trends in market share in Fact 2, the concentration of metal intensity is decreasing over time whether across CIS countries or metal products.

In summary, CIS specialization in metal fell dramatically at precisely the time that CIS market share was rising the fastest. At the country level, however, changes in specialization and market share were not tightly correlated, with Russia accounting for all of the change in specialization and virtually none of the change in market share.

2 Value added and differentiation of CIS metal exports

Fact 4: CIS market share growth was primarily in downstream metal products, though not necessarily the most differentiated products

In this section we decompose the set of metal products into three categories in order of their degree of processing and value-added: ore, unwrought products and worked metal products. Ores are the least processed type of metal, unwrought products are semi-processed intermediates and worked products are the most refined. The concordance of SITC products to each of these categories is based on the classification scheme developed in Mandel (2011). In the case of most manufactured goods, quantifying upgrading across related products requires a detailed knowledge of the production inputs and technology of those products. However, the special nature of metals processing suggests a short-cut. In many metals industries, the input-output structure is fairly 'steep' with the inputs of each processing step largely composed of outputs from the previous step. We thus use the sequential stages of processing as a proxy for incremental value-added.

For instance, Figure 14 illustrates the pyrometallurgical processing steps of copper, starting from the mine and increasing in purity and processing to semi-processed and processed intermediate goods. Inputs in the production of the highly refined cathode are composed essentially of three things: lesser refined anodes, labor and machines for refining. This implies that country or regional strengths in cathode markets are closely related to those in anode markets, and suggests that spill-overs may exist between lower and higher value added outputs. Our key identifying assumption is that the intensity of the other production inputs, labor and machines, does not alter the value added ranking determined by the order of production stages.

Given this classification scheme, the products are concorded to the international trade data. For copper, this concordance is shown on the right side of Figure 14. For example, "copper ore and concentrates" (SITC 2871) consists of all products from the mine to low levels of agglomerate purity, with 45-60 percent pure copper matte at the high end of that category. "Unwrought copper and copper alloys" (6821) groups together the outputs of all production steps leading up to the 99.99 percent pure copper cathode, while "worked copper and alloys" (6822) traces the shaping of cathodes into a diversity of products. This 3-stage concordance of ore, unwrought and worked SITC categories is applied to: aluminum, copper, lead, nickel, tin and zinc. In the case of iron and steel, in addition to continued purification of downstream products, the process of chemical reduction and the subsequent mixture of alloying agents actually alters product composition. However, production still consists of essentially three stages, shown in Figure 15: agglomeration of iron, alternate processes for the generation of carbon steel and alloy steel, and the formation of semi-finished and finished goods from those intermediate materials. The iron and steel SITC products are allocated to the three sections of the value chain accordingly.

Building on the notation from Fact 1, we decompose CIS's market share into contributions from each stage of production, each indexed by $l \in \{ore, unwrought, worked\}$. This is a direct analogy to the contributions by product, since each product is uniquely assigned to a stage of production:

$$s_{CIS} = \sum_{l} s_l = \sum_{l} \sum_{k} \sum_{i \in CIS} \frac{X_{ik}^{l}}{X}$$

Figure 16 illustrates the evolution of s_l over time for each stage. It is evident that the downstream products account for much of the growth in market share through 2008, with 70 percent of the 3.4 point increase coming from worked products. The remaining quarter of the increase is divided more or less evenly among ores and unwrought products.

One can be even more precise about the relative level of differentiation of export products *within* each value-added stage. The level of differentiation within a sector, in turn, can be inferred from the sector's degree of intra-industry trade, where a country's simultaneous import and export of like products implies distinctiveness across the products' varieties. To measure the prevalence of intra-industry trade across sectors, a variant of the Grubel-Lloyd (1975) index is computed for each SITC product j in country i as:

$$IIT_i^j = 100 * \left(\frac{X_i^j + M_i^j - \left| X_i^j - M_i^j \right|}{X_i^j + M_i^j} \right) \tag{1}$$

where M denotes a country's import volume. It is immediate that $IIT = 0$ if a country only imports or exports a given product and $IIT = 100$ if it imports and exports a product in equal values. The measure is computed for each of the 46 products traded by 258 countries, resulting in 112,905 country-product-year measures of IIT, which are then aggregated using average trade weights (X+M) across exporters and years. The output of this procedure is a ranking of products according to their average IIT. For the purposes of exposition in our analysis, the products are then divided into quartiles according to this ranking, with the first quartile representing the least differentiation products and the fourth quartile representing the most differentiated products. The correspondence between metal products and their quartile of IIT is listed in the Appendix.

What is the relationship between the level of value added and the level of product differentiation? It is not obvious ex ante whether these two measures should be positively or negatively correlated. Lower value-added ores might be less differentiated than higher value-added worked products if the ore varieties are less distinct than processed metal products. On the other hand, ores might be more differentiated than worked products if heterogeneous quality across mines overwhelms the effect of the greater variety in downstream products. The correspondence of IIT quartiles and stage of production strongly indicate that ores are less differentiated and unwrought/worked products are more differentiated. Ores are composed exclusively of products in the lower two quartiles of the IIT distribution, indicating the lowest levels of differentiation; unwrought products are composed exclusively of products in the second and third quartiles; worked products are composed of products in the top three quartiles, indicating the highest degree of differentiation.

Figure 17 decomposes the CIS market share further into contributions by stage and IIT quartile within each stage. Starting with the lower stages of value-added, it is apparent that the largest export share contributions, and growth in those contributions over time, are in relatively low-differentiated products. For ores, the first quartile contribution was more than double the second quartile contribution. The fact that this ratio stayed roughly constant over time implies that share in the first quartile ore products was growing roughly twice as fast as that of the second quartile products. The unwrought share is clearly dominated by second quartile products, with the contribution of the third quartile products barely visible. Finally, recall from Figure 16 that the bulk of share growth was in worked products. For these types of products, the distribution in both the level and growth rate of share contributions across IIT quartiles was decidedly more even. About half of the share growth over time was in second quartile, 14 percent in the third quartile and 37 percent in the fourth quartile. Put another way, half of share growth was in products below the median level of product differentiation, with the other half above.

Figure 18 shows analogous decompositions of the metal market share for a selection of CIS countries. The observation that market share levels and growth rates are disproportionately driven by less differentiated products is fairly consistent across countries. Russia and Ukraine, for which a large portion of share is accounted for by worked products, have share levels and growth rates pretty evenly distributed among quartile 2, 3 and 4 products. For Kazakhstan and Georgia, most growth was in quartile 2 unwrought products. One exception appears to be Kazakhstan, where market share in quartile 3 and 4 worked products has been growing steadily over time.

Yet another way of measuring differentiation is to employ data on the *prices* of metal varieties trade bilaterally, as opposed to their quantities used in the measure of intra-industry trade above. It was argued in Mandel (2011) that price dispersion within product categories can act as a proxy for product differentiation. The idea is that a simple arbitrage condition would constrain the free on board trade prices of homogeneous goods sold in the same market to be identical, so the distance from this benchmark can be interpreted as an index of the distinctiveness of a product's varieties. Here, I take advantage of the fact that the UN-NBER and Comtrade data report quantities sold (Q) to compute unit value prices (i.e., trade value divided by quantity, $P = \frac{X}{Q}$) for each exporter-importer-SITC combination. These unit values, denoted P_x and P_m for export and import prices respectively, are then fed into the same IIT formula as above:

$$IIT\_PRICE_i^j = 100 * \left(\frac{P_{xi}^j + P_{mi}^j - \left| P_{xi}^j - P_{mi}^j \right|}{P_{xi}^j + P_{mi}^j} \right) \tag{2}$$

The measure corresponds to the similarity (or dissimilarity) of export and import prices for a given country and product. Higher values of IIT_PRICE indicate more heterogeneity in import and export prices and imply higher differentiation. The measure is aggregated as above and then divided into quartiles, with the highest quartile corresponding to the highest level of differentiation. The correspondence of IIT_PRICE, IIT and SITC metal products is listed in the Appendix.

The decomposition of CIS metal market share into stages of production and price differentiation is shown in Figure 19. In spite of some differences relative to the IIT-based measure of differentiation used in Figure 17, the qualitative result that share growth occurred primarily in low differentiation products is preserved. Among ores, 1st quartile products grew faster than 2nd quartile products. Among unwrought products, 3rd quartile products grew much faster than 4th quartile products. And, similar to Figure 17, over half of the share growth of worked products was accounted for 2nd quartile products. Again, as shown in Figure 20, the pattern is qualitatively consistent among the largest metal exporters.

In summary, while the majority of market share growth took place in downstream products, CIS exporters grew disproportionately in products with a relatively low degree of differentiation.

Fact 5: CIS specialization in metals is still primarily in low value-added products

Having documented that the majority of growth in CIS metal market share was in high value-added products, we now return to the relative size of metals in the broader CIS export basket, which we have been referring to as 'specialization.' It was documented in Fact 3 that CIS specialization in metals was diminishing over time, driven primarily by the decrease in Russian specialization in metals. In this section, we decompose the aggregate decline in specialization patterns among the value added stages of production, and then compare the CIS profile of specialization with that of other regions.

To this end, Balassa's measure of revealed comparative advantage is applied once again, and defined by stage of production, l. For exports from country i, in stage l of a given year and sector (i.e., aluminum, copper, iron/steel, lead, nickel, tin, zinc), revealed comparative advantage is:

$$RCA_i^l = \frac{\frac{X_i^l}{X_i}}{\frac{X^l}{X}} = \frac{\frac{X_i^l}{X^l}}{\frac{X_i}{X}} \tag{3}$$

In the first equality, RCA takes on a value of 1 if the intensity of a given stage of metal exports in a country's export basket is equal to that of the rest of the world. The second equality rearranges variables into units of market share; if a country's market share in a given stage is greater than its market share in overall global trade, then RCA takes on a value greater than 1.

Of note, the market share interpretation makes it very clear that CIS's rapid market share growth in downstream worked products versus upstream ores directly implies that RCA in downstream products has been falling faster over time relative to upstream products. As shown in the left panel of Figure 21, the average decline in RCA was much larger in stage 1 products than stage 3 products, a pattern consistent with LAC over the same period. Interestingly, while LAC and EU10 maintained similar trajectories of specialization throughout the sample period, CIS de-specialization effectively halted in between 2001 and 2008, shown in the right panel, with even a slight re-specialization in stage 1 products. Again, the fact that CIS changes in specialization were muted in the later period reflects the slowdown in market share growth in that period relative to the earlier one.

The fact that aggregate changes in RCA in a given stage closely follow changes in CIS market share in that stage *need not imply* that a large contribution of downstream products to the level of CIS metal market share translates into high specialization in downstream products. To be concrete, consider the ratio of a stage's contribution to CIS regional market share relative to the region's RCA in that stage:

$$\frac{s_{l,CIS}}{RCA_{CIS}^l} = \frac{\frac{X_{CIS}^l}{X^{metal}}}{\left(\frac{\frac{X_{CIS}^l}{X^l}}{\frac{X_{CIS}^{all}}{X^{all}}}\right)} = \frac{X^l}{X^{metal}} \frac{X^{all}}{X_{CIS}^{all}}$$

Notice that the regional market share in a given stage completely cancels out in the numerator and denominator, leaving only the relative size of the stage in global metal exports multiplied by the inverse of the region's share of global trade. Since downstream worked products have a higher share of global metal exports than upstream ores (in 2008, worked products had a global trade value approximately three times that of ores), there is no inherent contradiction to CIS having a high contribution of downstream products to its metal market share and a relatively high level of upstream specialization.

Indeed, looking at the levels of CIS metal specialization by stage, that is what we find. Table 1 uses the value-added stages defined in the previous section to measure the level of regional specialization in each stage and metal sector. As of 2008, it is evident that CIS had an overall level of specialization in metals comparable to LAC and above EU10, though an intermediate distribution across stages relative to the other regions. CIS had average specialization levels that were five or six times higher in ores and unwrought metals than in downstream worked products. This pattern is amplified in LAC, in which ore specialization was over fifty times higher than specialization in worked products. In EU10, the export intensity levels for all stages are not substantially different from those in the rest of the world. CIS specialization in ores and unwrought products was also more heterogeneous by sector, primarily accounted for by copper, iron/steel and zinc, versus a more uniform distribution of high and low specialization across products in LAC and EU10, respectively.

This heterogeneity among sectors and countries is illustrated in Table 2. Russia participates in almost all stage/sector combinations and is most specialized in unwrought aluminum and nickel as well as iron ore. Ukraine's matrix is slightly more sparse, with higher levels of specialization in iron/steel ores and unwrought products, and aluminum ore. Kazakhstan is more deeply specialized in the unwrought products of zinc, lead, copper and iron/steel. In terms of changes over time, at the country level the scope and even direction of changes in specialization vary substantially. Russia de-specialized in a wide array of sectors and stages; in some sectors, such as tin and copper, export intensity declined to levels at or below those of the rest of the world. Likewise, Kazakhstan specialization declined substantially in several sectors. In contrast, Ukraine de-specialization in metals was highly concentrated in iron/steel.

In summary, in spite of a period of rapid de-specialization in low value-added products in the 1990s, CIS remains relatively specialized in upstream products. The relatively high current levels of specialization in upstream products, as well as the unevenness of the de-specialization trends across metal types and countries, suggests further room for improvement.

3 Competitiveness as a driver of CIS market share

3.1 *Fact 6: CIS market share is not substantially driven by changing product composition*

In this section, I distinguish changes in the CIS market share that are related to the changing composition of the global set of traded metal goods versus those more closely related to competitiveness. The object of interest will be the change in market share for a given stage of production, which is both a function of exporter market share compared to competitors, as well as the size of each stage of production in the global basket of metal exports. For instance, if there is simply more demand for high value-added products, it would increase the contribution of downstream products to market share for all countries exporting those products. Such a change would not be closely related to the relative performance or competitiveness of worked product exporters. As such, below I compute measures of changing market share that purge such compositional, demand-driven effects. One established method of assessing the importance of composition for changes in trade shares is constant market share analysis. It involves separating the changes in aggregate market share into two components: a commodity effect and a non-commodity effect. These effects and are defined as the first and second terms on the right-hand side of the following expression:

$$\begin{aligned}\Delta\left(\frac{X_{CIS}}{X}\right) &= \sum_{s=1}^{3}\Delta\left(\frac{X_{s,CIS}}{X}\right)\\ &\approxeq \sum_{s=1}^{3}\frac{X_{s,CIS}}{X_s}\Delta\left(\frac{X_s}{X}\right)+\sum_{s=1}^{3}\Delta\left(\frac{X_{s,CIS}}{X_s}\right)\frac{X_s}{X}\end{aligned}$$

The first term is the commodity effect since it reflects the changing share of a given stage in overall metal exports, weighted by the region's share of exports of that stage. The intuition for this term is that if a given stage increases its share of total metal trade, a region's metal market share will increase in proportion to its share of that stage. The second terms is the non-commodity margin which reflects all factors that would affect an exporter's market share orthogonally to the size of the product. Since this non-commodity effect is a cleaner measure of an exporter's relative performance, it can be viewed as more directly related to an exporter's competitiveness than the overall market share.

The decomposition of regional market share changes into these margins is shown in Figure 22. The blue (left-most) column in each group is the contribution of that stage to the change in regional market share. In the case of CIS the columns for the three stages add up to the 3.4 percentage point increase in market share between 1994 and 2008 shown in Figure 1; the contribution of each stage is the same as that depicted in Figure 16. The next two columns show the contribution to the overall change of the commodity margin and non-commodity margin, respectively, for each stage. We see that the change in stage 3 market share, the dominant contributor to the overall share change, was driven entirely by the non-commodity margin. The fact that the commodity margin contribution is negative indicates that stage 3 products were shrinking as a share of world exports over that period. A similar pattern holds for CIS market share of unwrought products. In contrast, stage 1 products were growing as a share of world exports and were primarily responsible for the CIS market share gains in those products. Figure 23 confirms that these dynamics (i.e., changes in stage 2 and 3 products driven predominantly by the commodity margin) are consistent across CIS countries. LAC market share dynamics were markedly different. Most LAC growth over the period was in stage 1 products and a majority of that share increase was driven by the commodity margin. LAC lost market share in stage 3 products, primarily driven by the non-commodity margin.

In summary, it was not simply a shift in global demand towards stage 2 and 3 products which drove CIS market share expansion in those stages of production. Rather, the non-commodity margin, which is more an indicator of competitiveness, was the key driver.

4 Sources of growth for CIS metal exports

In this section, the trends in CIS metal trade over the past 15 years are extrapolated into views about the potential for CIS countries to continue growing their market share and to specialize in higher value-added products or higher quality varieties. At the regional level, recent trade patterns support the notion that CIS exporters have competed successfully in an array of products and markets. This is evidenced by: (i) overall market share increasing substantially, (ii) an expansion in the number and volume of core metal products, (iii) entry into many new destination markets, (iv) brisk growth of overall regional exports (including non-metal exports), (v) strong growth of higher value-added types of metal, and (vi) expanding market share along the non-commodity margin.

Are these trends likely to continue? Let us consider some factors affecting each one in turn. The first factor is that relatively small exporters are catching up to Russia along several margins. Metal exports from most non-Russian CIS countries grew rapidly. Ukraine and Kazakhstan accounted for almost all of the growth in the region's market share with smaller exporters playing a relevant, albeit less quantitatively important, role. These emerging exporters were behind the proliferation of core products and, in part, the rapid proliferation of destinations. Russia, on the other hand, was a key driver of entry into new destinations and declining regional specialization in metal, but less so for expanding smaller products or adding to the region's overall market share. Insofar as this catch-up trend is driven by technological innovation of non-Russian metal exporters and, further, since catching-up of this sort is likely to be fairly persistent, this trend may continue for some time.

However, two caveats are in order. First, the emerging exporters have only partially caught up to Russia and Ukraine in terms of the number of destination countries that they serve, implying significant scope for augmenting their volume of international sales. Second, it should also be noted that this constellation of CIS trade patterns may have been brought about, in part, by evolving demand conditions as well. The increasing volume of exports to China may have caused a shift in the sourcing strategy of other large importers, which may have contributed to the increased share and destination diversification of the non-Russia CIS exporters.

The second factor is hinted at by timing of several of the changes to CIS metal trade, namely that they took place in the late 1990s and were less pronounced thereafter. This pattern is suggestive of a structural transformation that took place in the region at that time which saw an increase in the overall exports of many countries. This is most evident from: (i) the region's decreasing specialization in metals, (ii) the overall change in market share, and (iii) the increase in export destinations, all of which evolved predominantly in the late 1990s. To the extent that this transformation has stabilized in more recent years, it may cease to be a significant driver of CIS metal exports in the future. That said, the data are somewhat ambiguous on whether certain sources of growth were exhausted by the end of the 1990s. As mentioned above, while the number of Russia and Ukraine export destinations caught up to LAC and EU10 in the late 1990s, indicating limited scope for further increases in destinations in the future, the other CIS exporters continue to have much room to grow. Additionally, despite rapid de-specialization in upstream metals in the 1990s the continuing high level of upstream specialization implies much room for increasing the average value added of the region's exports.

This brings us to our third factor, which is the capacity of CIS exporters to climb the value added chain and upgrade the quality of metal exports. Regarding the former, the region has been quite successful at expanding sales of downstream, higher value-added products and decreasing specialization in upstream products. This pattern suggests an underlying production infrastructure that has increased its level of sophistication; to the extent it is, in fact, a reflection of technical capability, it will buttress the level and potential growth of future export sales of downstream products. However, this trend stalled in the 2000s leaving the region much more specialized in upstream products. Under the assumption that downstream specialization is a desirable objective, Table 2 highlights significant room for improvement in a multitude of countries and metal types.

Another possible limiting factor to growth is the disproportionate amount of export share accounted for by relatively less differentiated products. In spite of the fact that metals, on average, are highly differentiated, implying significant scope for quality upgrading, the types of metals that CIS exports tend to be relatively less so. This implies more difficulty in gaining future share by augmenting output quality. The potential for improvement is illustrated in Figure 24, where each country's market share in a product is plotted against its level of differentiation (as measured by the extent of IIT). The size of each bubble is scaled by the global export sales of each product. Perhaps the sharpest examples are Kazakhstan and Uzbekistan, where relatively high market share products are almost exclusively in the 2nd quartile of differentiation, with all others hovering around zero. The large number of big, highly differentiated products in which these countries have zero or close to zero market share is a gauge of potential future sales growth from entry into more highly differentiated products. Russia and Ukraine have a higher incidence of non-zero market share in large, highly differentiated products, but are still most successful in less differentiated products. These patterns are not particularly sensitive to including smaller exporters such as Armenia or Georgia, or to using an alternative definition of differentiation (as in Figure 25).

The final factor is that the diversification of CIS metal exporters across CIS countries and foreign destinations has improved markedly over time, ending with persistently high levels of concentration across CIS exporters and relatively low concentration across destinations. As alluded to above, high source concentration indicates continuing room for improvement as smaller exporters catch up to larger ones. Greater diversification of source countries would diminish the relative market power of the largest exporters, potentially to the benefit of the smaller ones. Also, the relative market power of any given country will depend on the global configuration of exporters, which has been declining over time.

The high degree of destination diversification may be viewed as both an opportunity and a threat to prospective future export growth. On one hand, it likely means that CIS is less vulnerable to the idiosyncratic behavior of any given destination. Evidence on this type of diversification is suggested by Kurz and Senses (2012) for employment volatility in US manufacturing plants, with more export destinations corresponding to lower volatility at the plant-level. On the other hand, CIS's prolific entry into new markets also suggests that many of the region's countries have a relatively small, more fragile, foothold in a multitude of destination markets. Figure 26 illustrates this statement for a selection of the largest CIS metal exporters in 2008. Each panel shows the estimated kernel density of that exporter's market share distribution across all of the destination and product markets it serves. For instance, one observation would be Russia's market share of France's copper ore imports; each panel shows the distribution of these observations across all destination-product pairs having non-zero share. Across all countries, it is evident that there is a high degree of skewness in the distribution, with the bulk of destination-products characterized by very low market share and a much lower density of observations with high market share. Interestingly, the extent of skewness in the market share distribution is systematically related to the product's stage of production, with CIS exporters having a higher incidence of high market share in relatively low value-added products. Conversely, higher value-added products are characterized by greater skewness and higher numbers of destination-product pairs with very low market share. This observation highlights the tenuous position that CIS metal exporters have in a large number of high value-added products. Figure 27 shows an analogous set of figures, only pooling over stages and showing the kernel density for both 1994 and 2008. For Russia, the skewness of the distribution did not change much over time, if anything it became slightly more dense at low levels of market share. For the other exporters, the trend was very much the opposite, with skewness decreasing over time and the level of market share becoming more evenly distributed across destination-products. Overall, the density of product-destinations in which CIS has a very low market share has remained persistently high.

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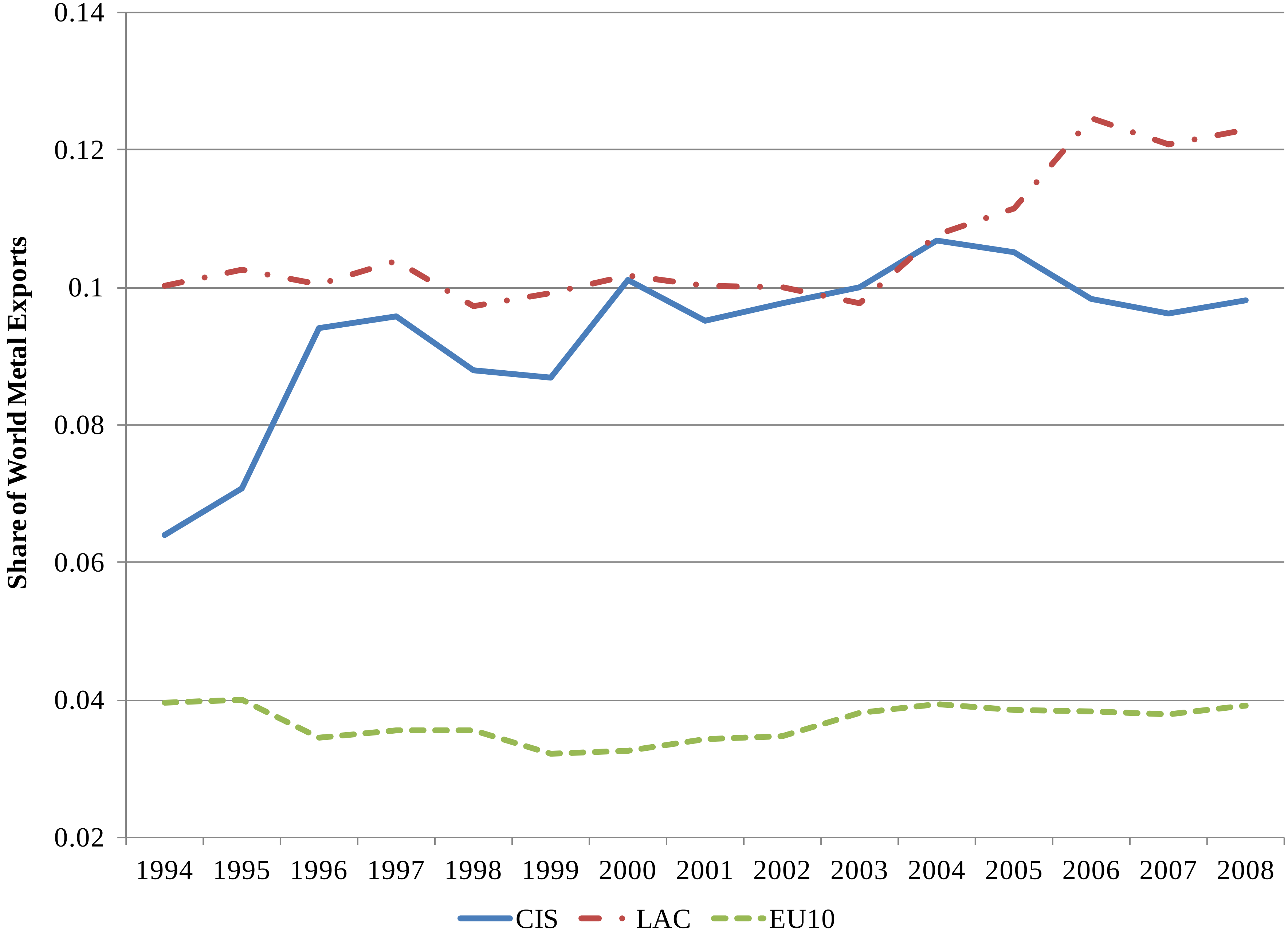
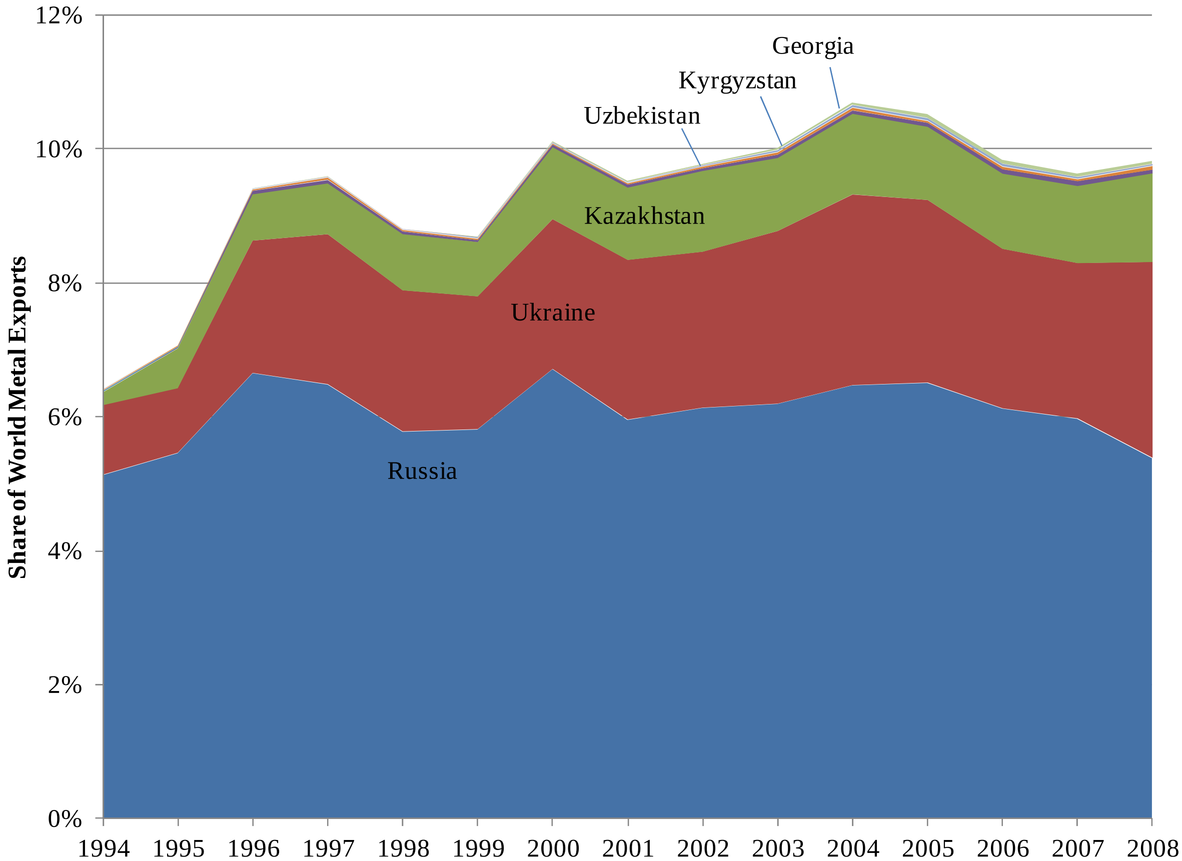
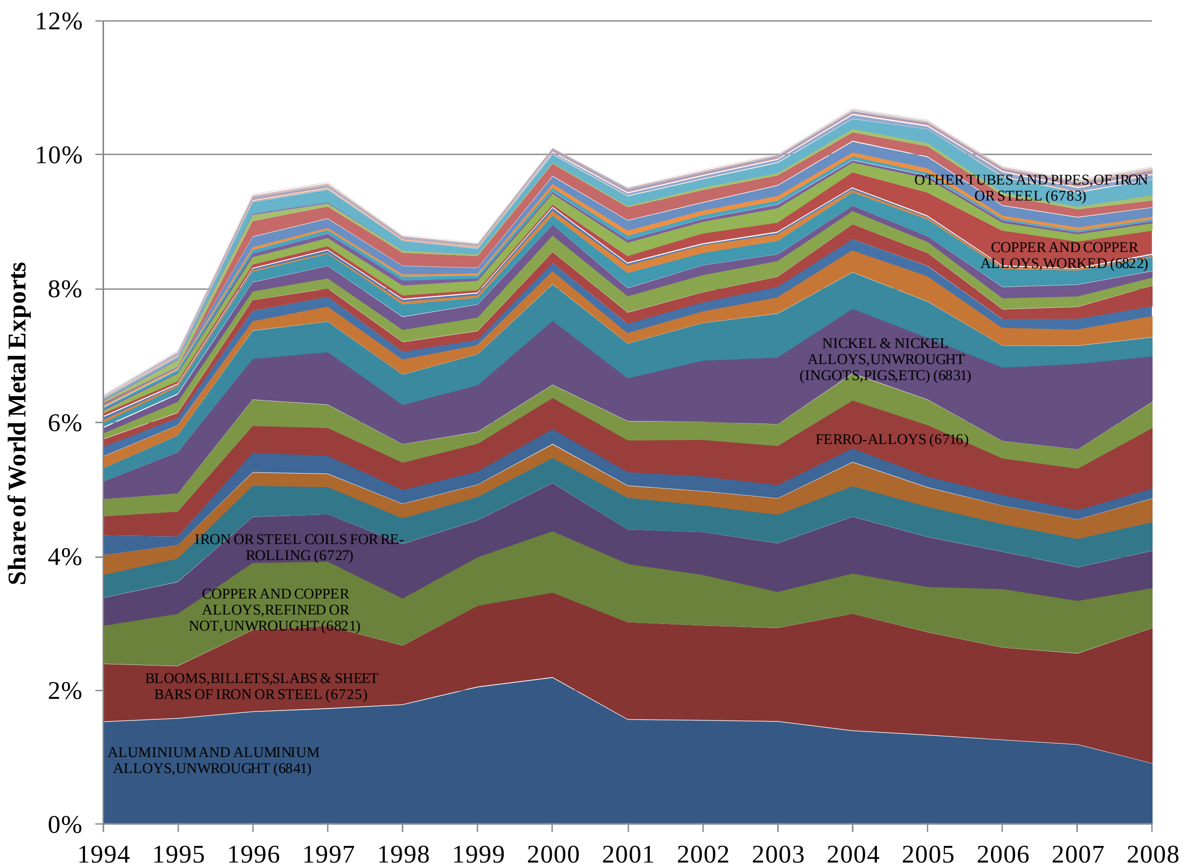


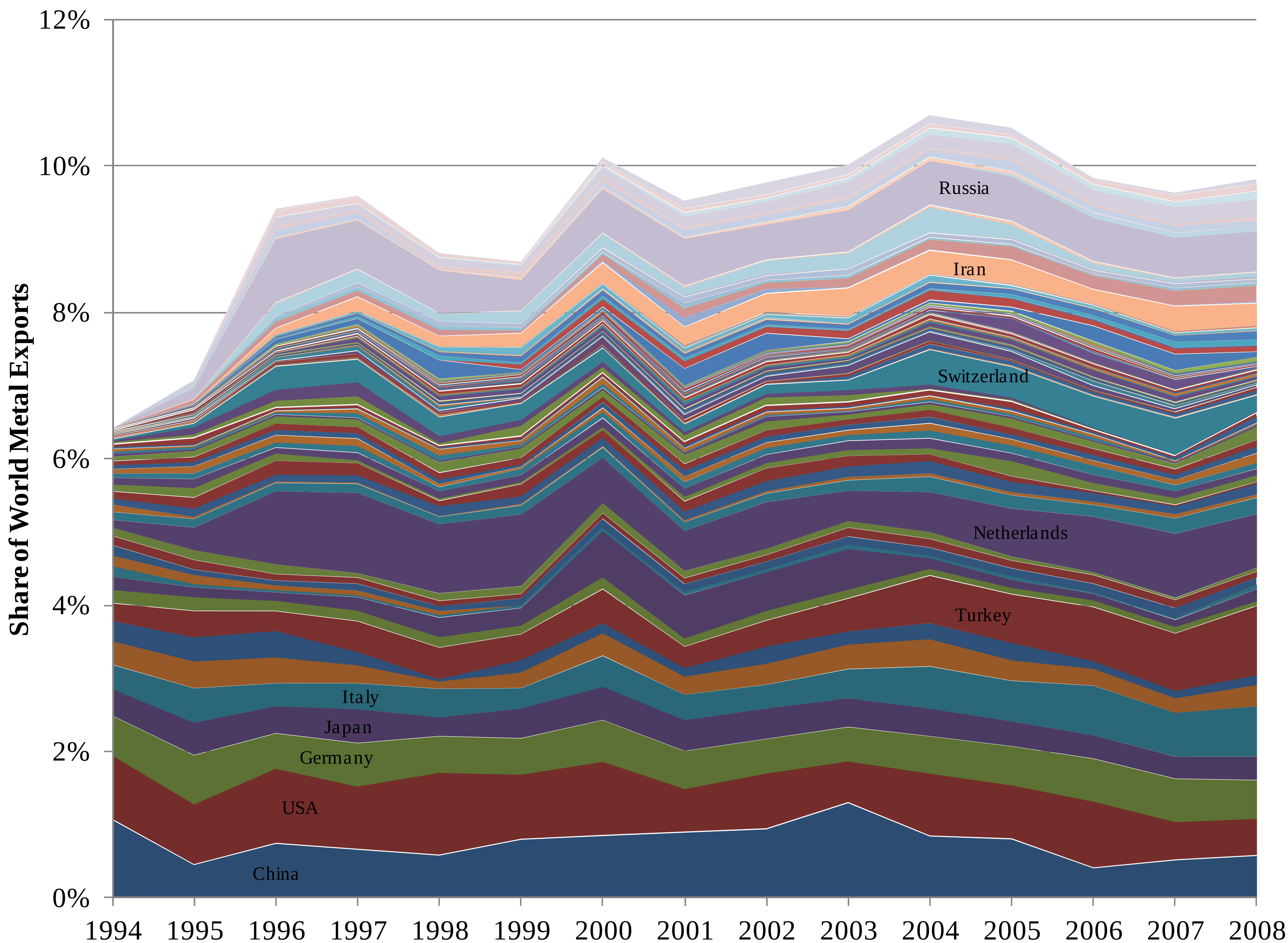
<u>Figure 1</u>: CIS, LAC and EU10 market share of global metal exports



<u>Figure 2</u>: CIS market share of global metal exports by source country



<u>Figure 3</u>: CIS market share of global metal exports by product



<u>Figure 4</u>: CIS market share of global metal exports by destination country

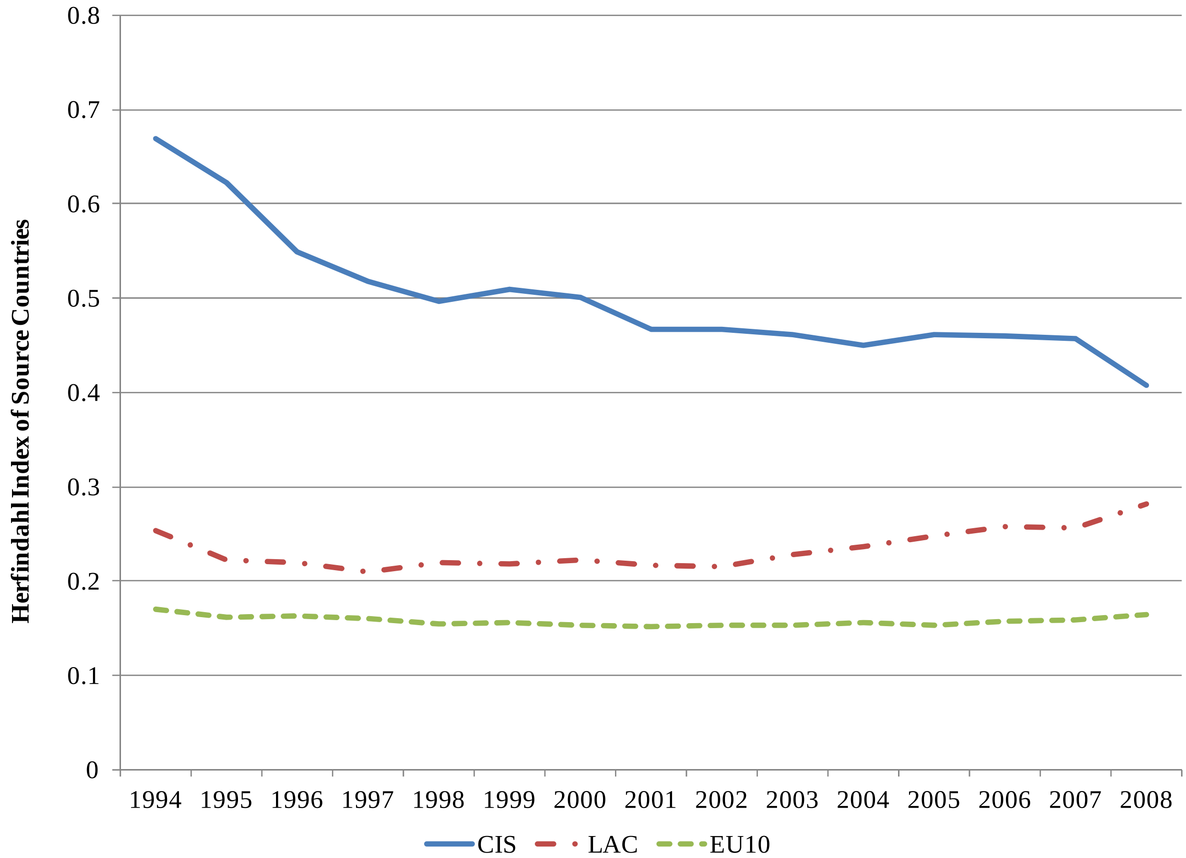


Figure 5: **Source country concentration of metal exports, normalized by regional market share**

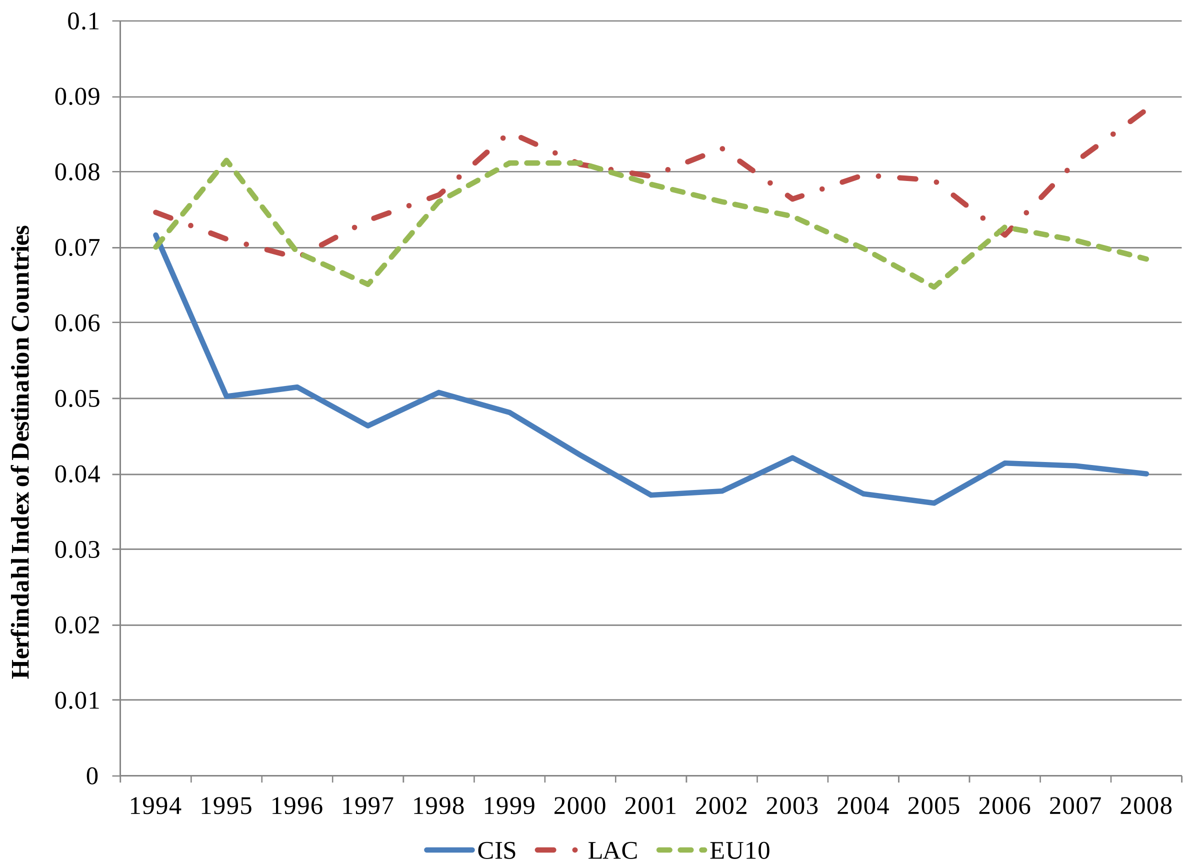
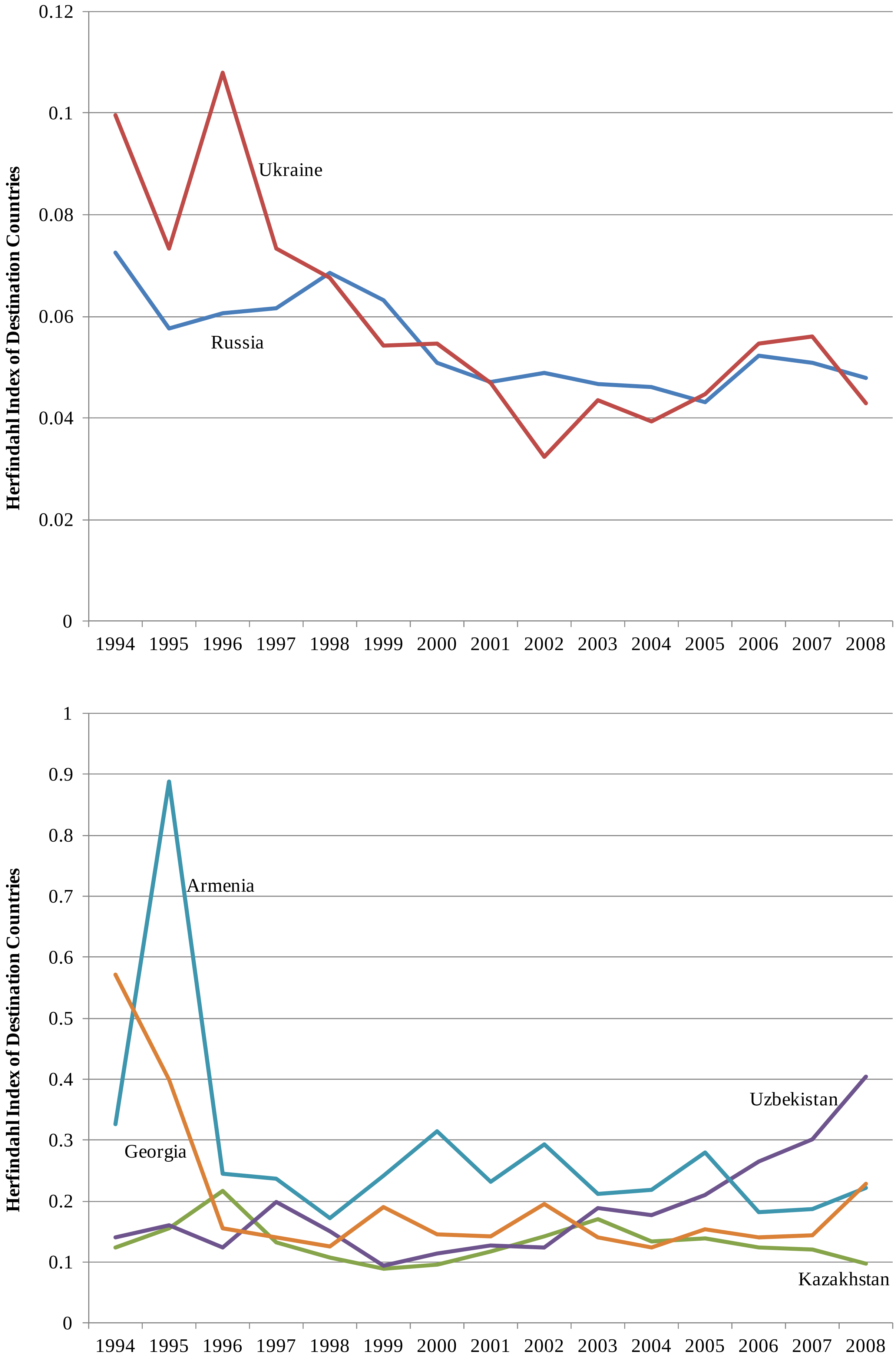
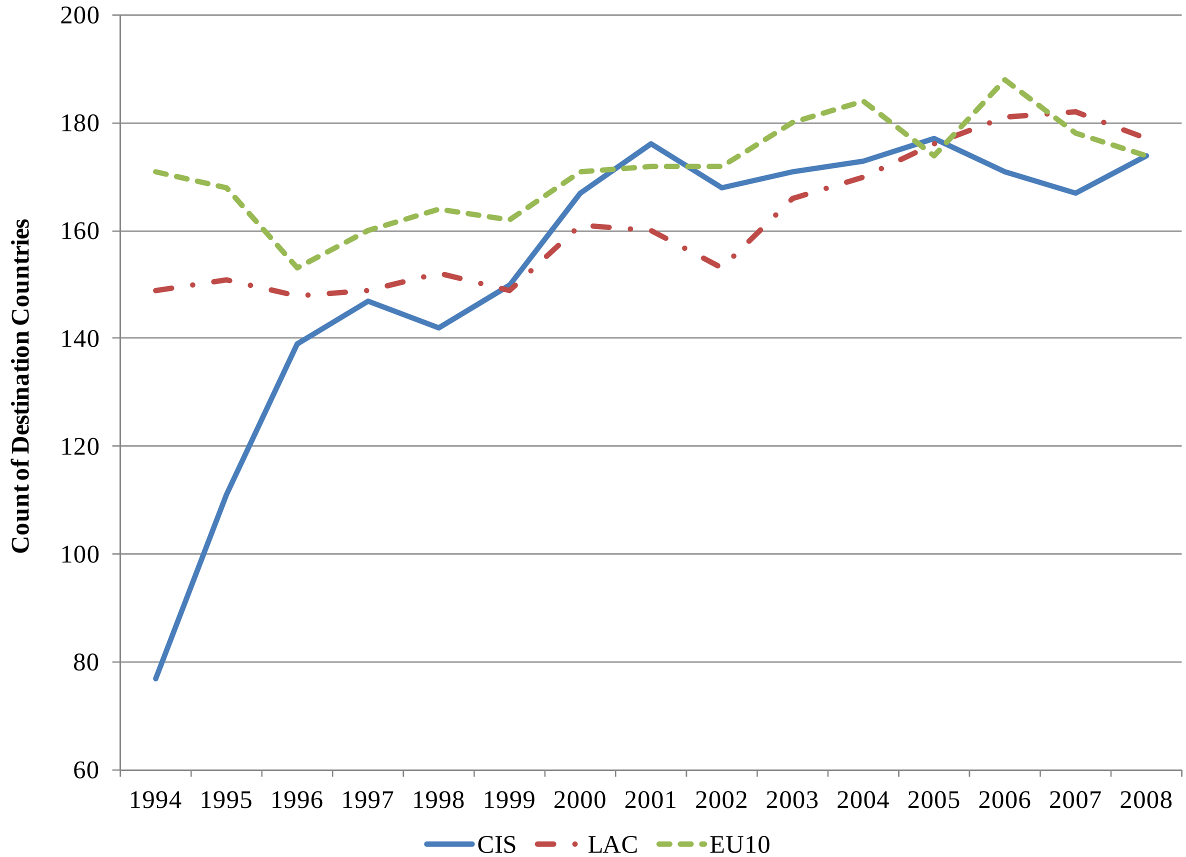


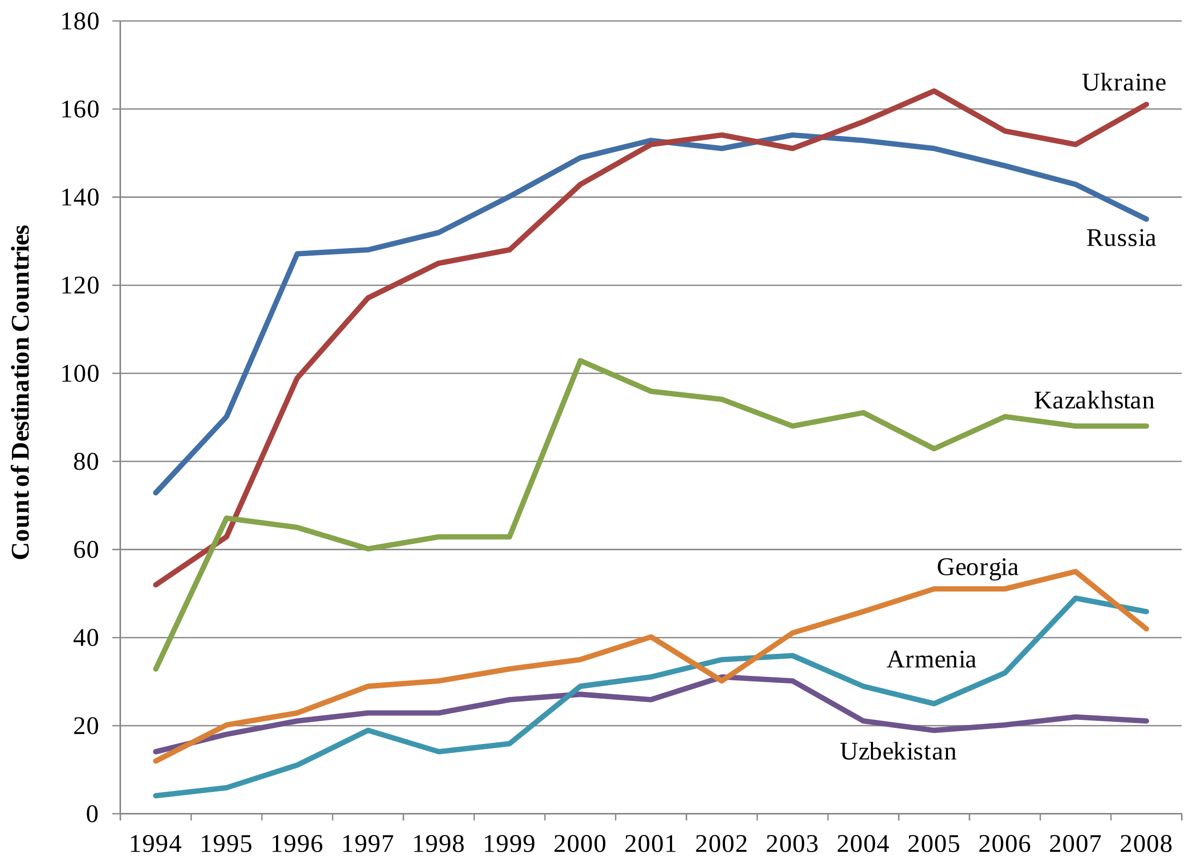
Figure 6: **Destination country concentration of regional metal exports**



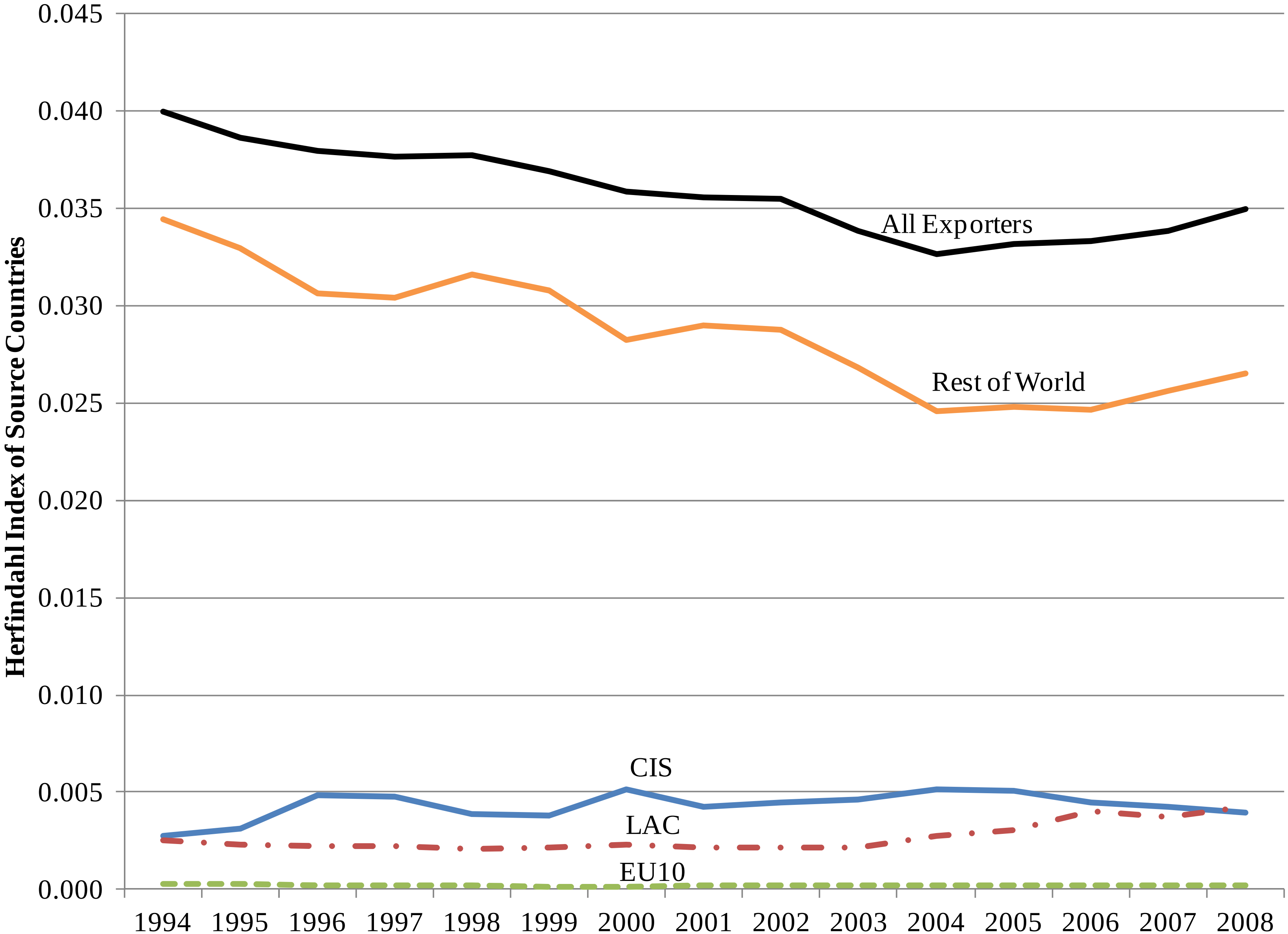
<u>Figure 7</u>: Destination country concentration of CIS metal exports



<u>Figure 8</u>: Number of destination countries for metal exports



<u>Figure 9</u>: Number of destination countries for CIS metal exports



<u>Figure 10</u>: Source country concentration of metal exports

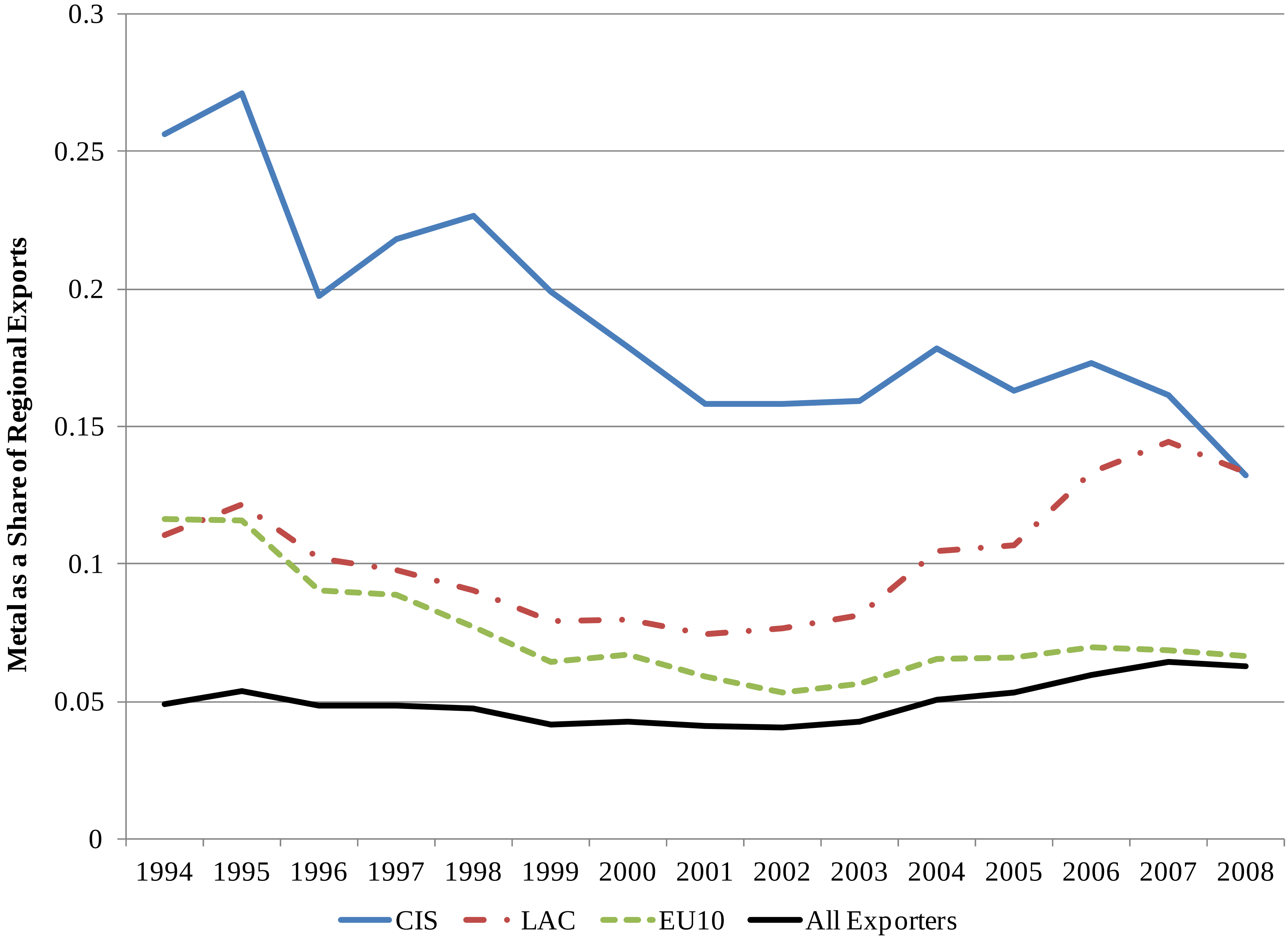
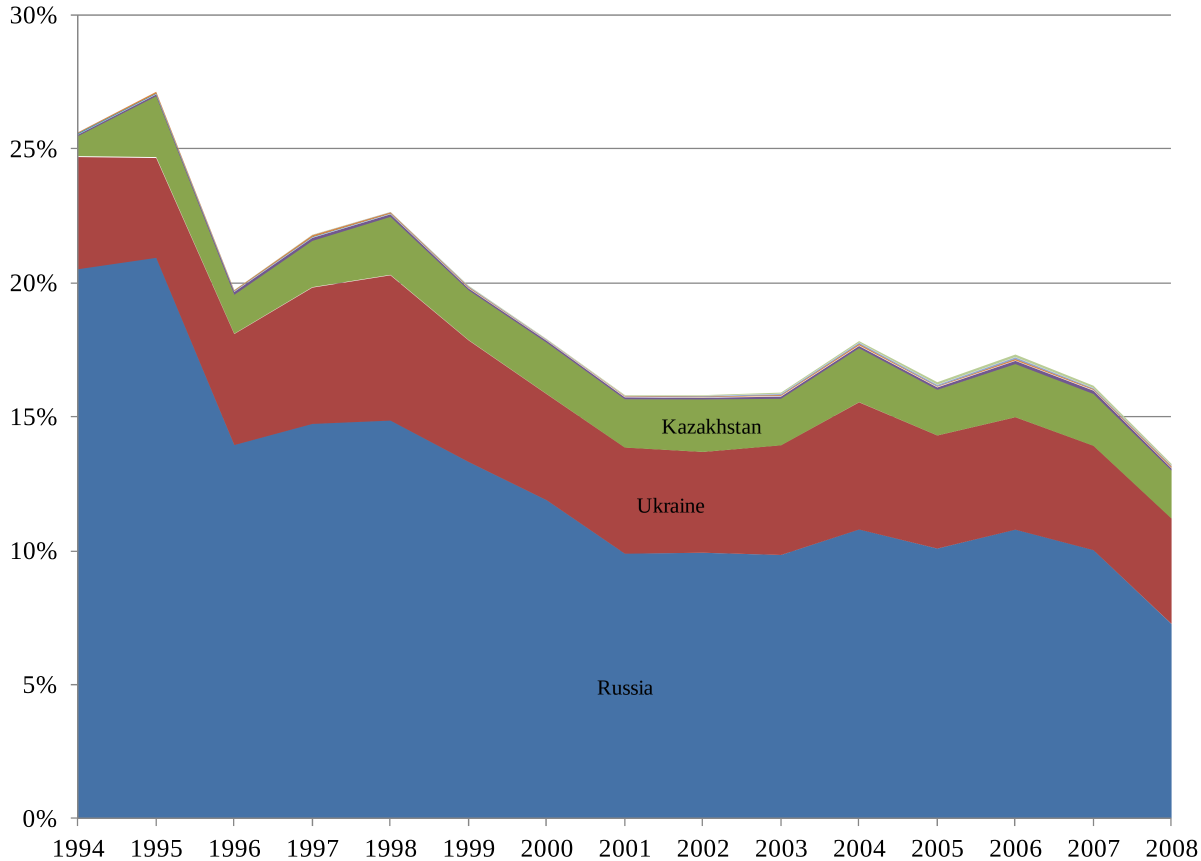
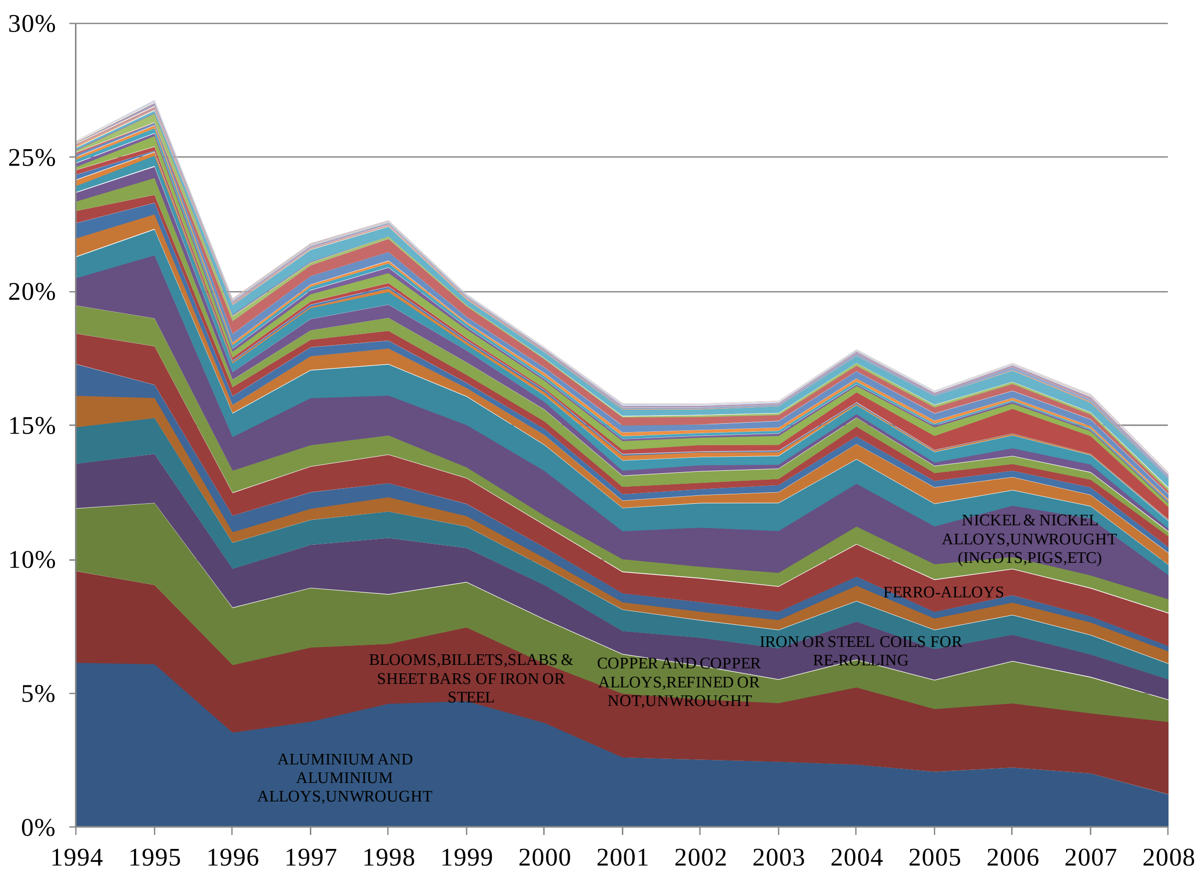


Figure 11: Metals as a share of the regional export basket for CIS, LAC and EU10



<u>Figure 12</u>: Metals as a share of the regional export basket, contributions by country



<u>Figure 13</u>: Metals as a share of the regional export basket, contributions by product

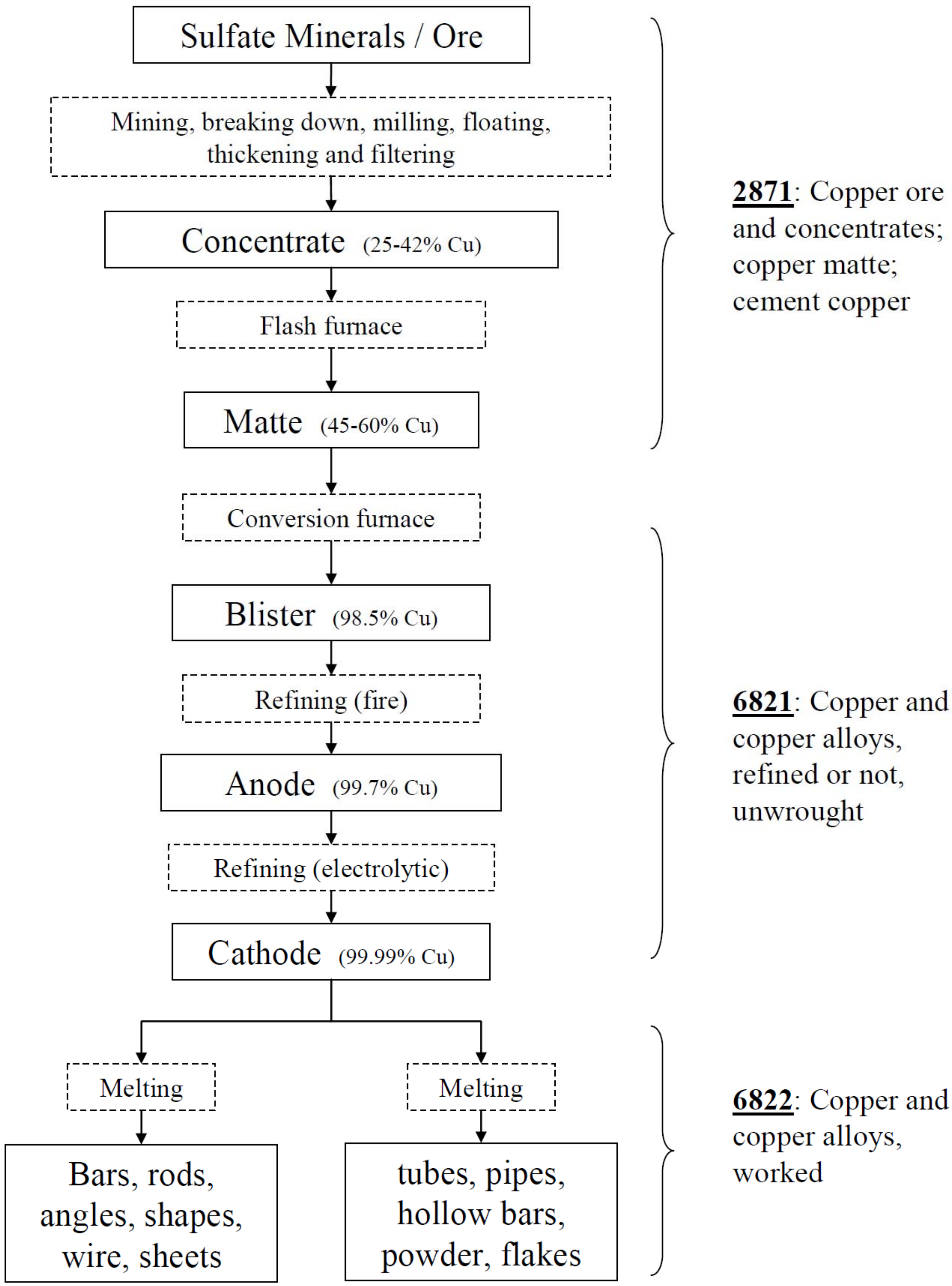
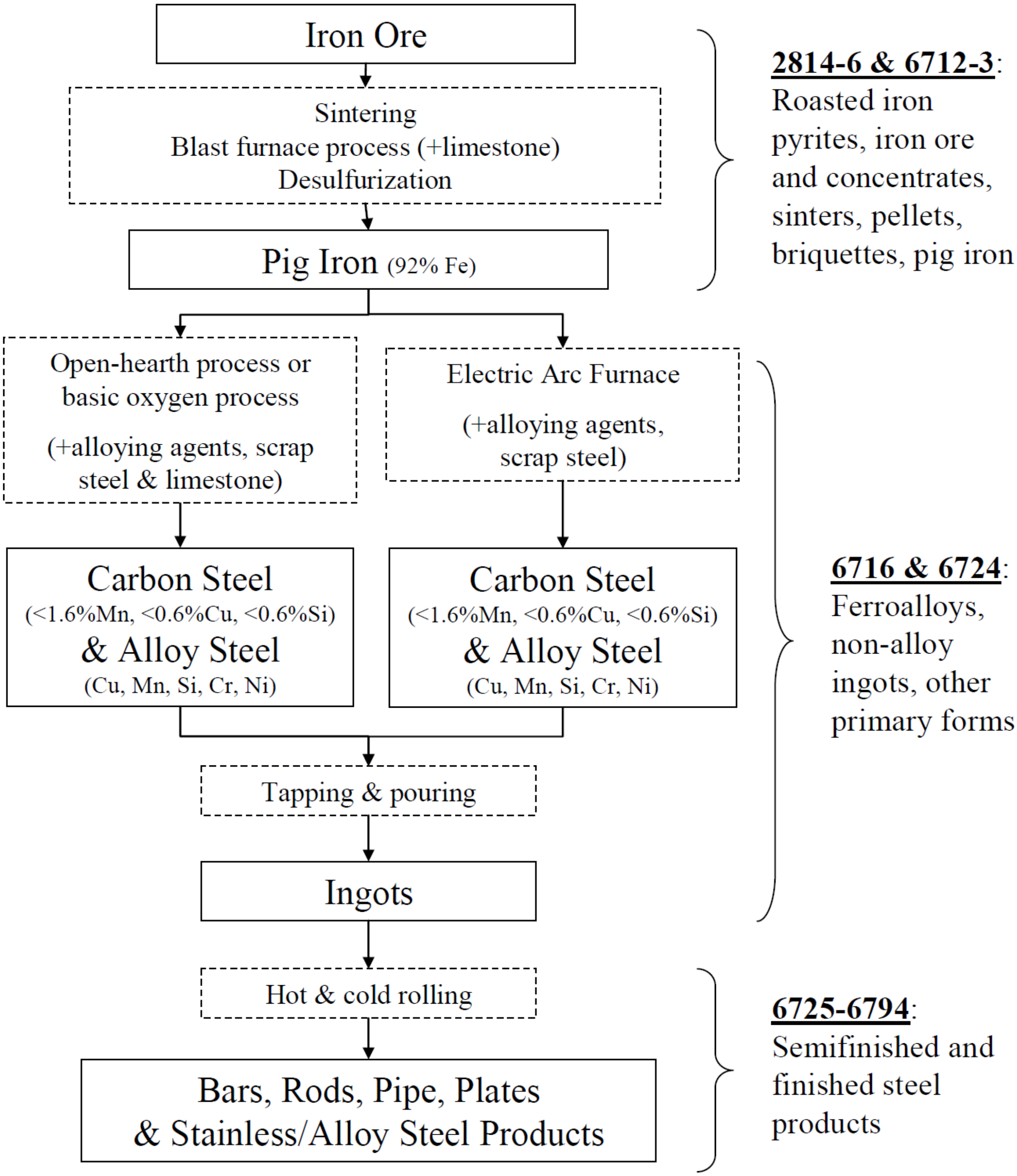


Figure 14: Stages of copper processing and corresponding SITC commodity codes



<u>Figure 15</u>: Stages of iron and steel processing and corresponding SITC commodity codes

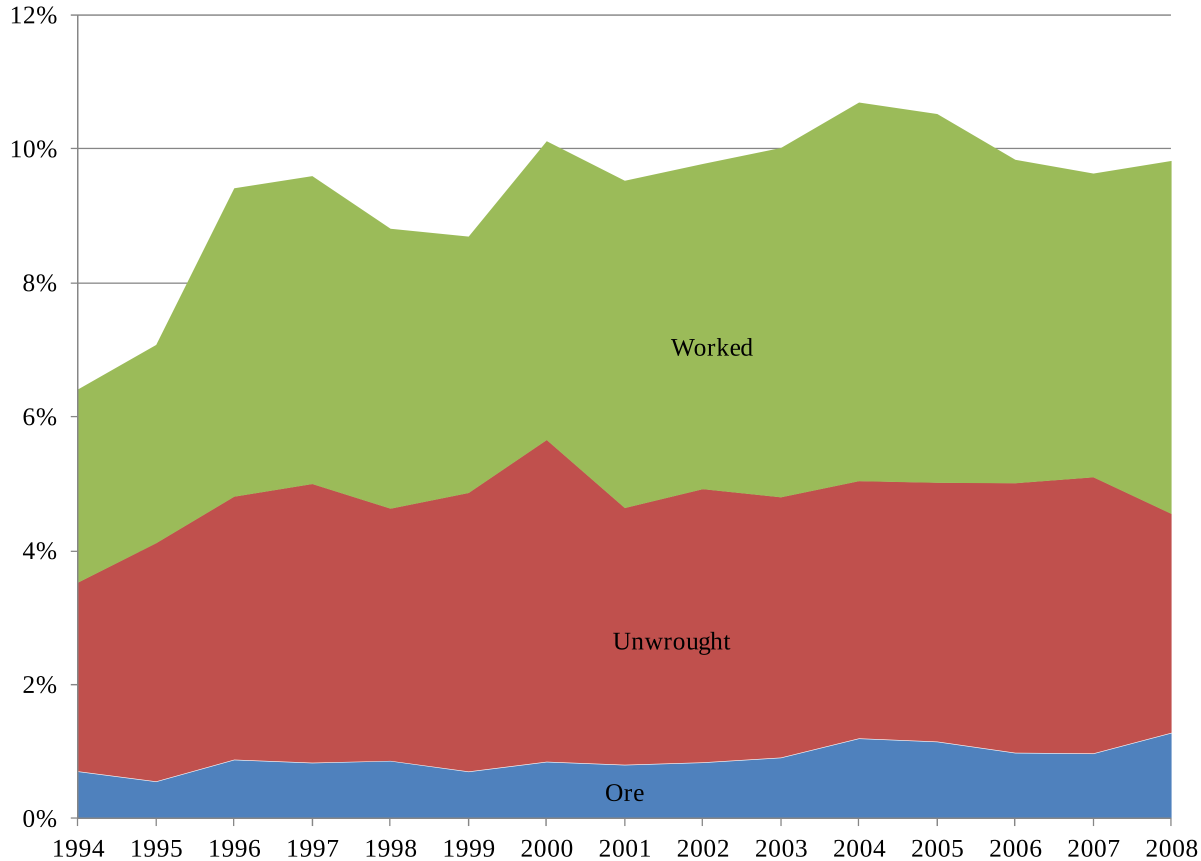


Figure 16: **CIS market share of global metal exports, contributions by stage of production**

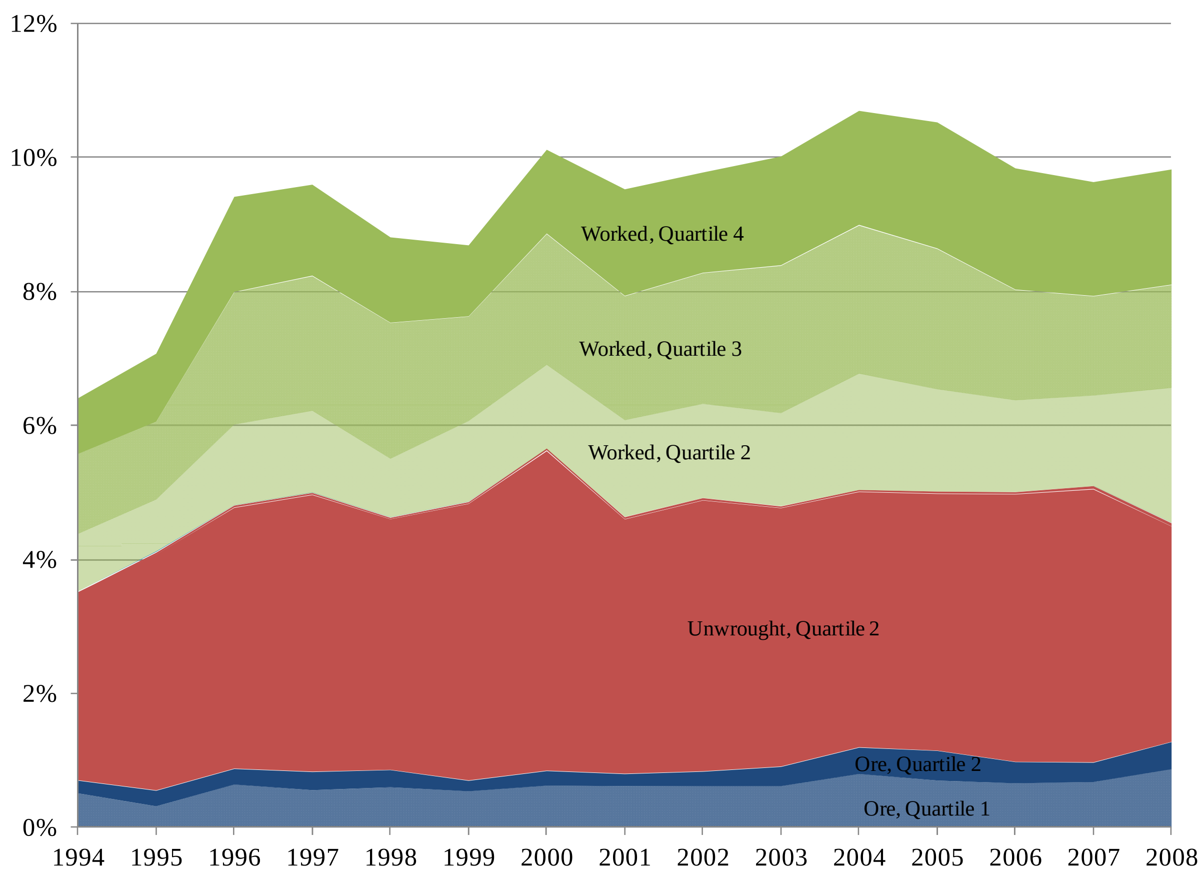
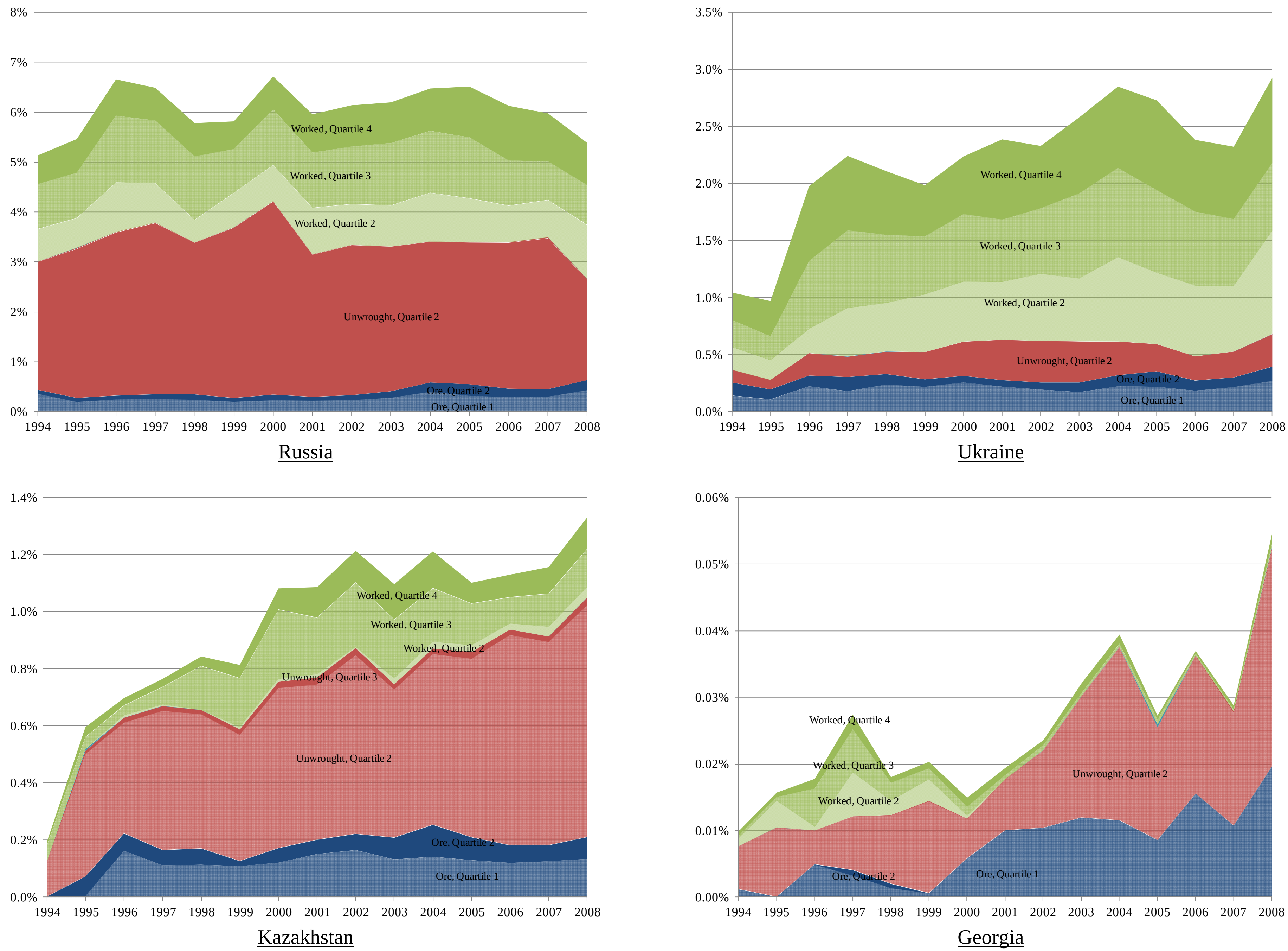


Figure 17: **CIS metal market share by stage and level of differentiation (IIT)**



<u>Figure 18</u>: Metal market share by stage and level of differentiation (IIT)

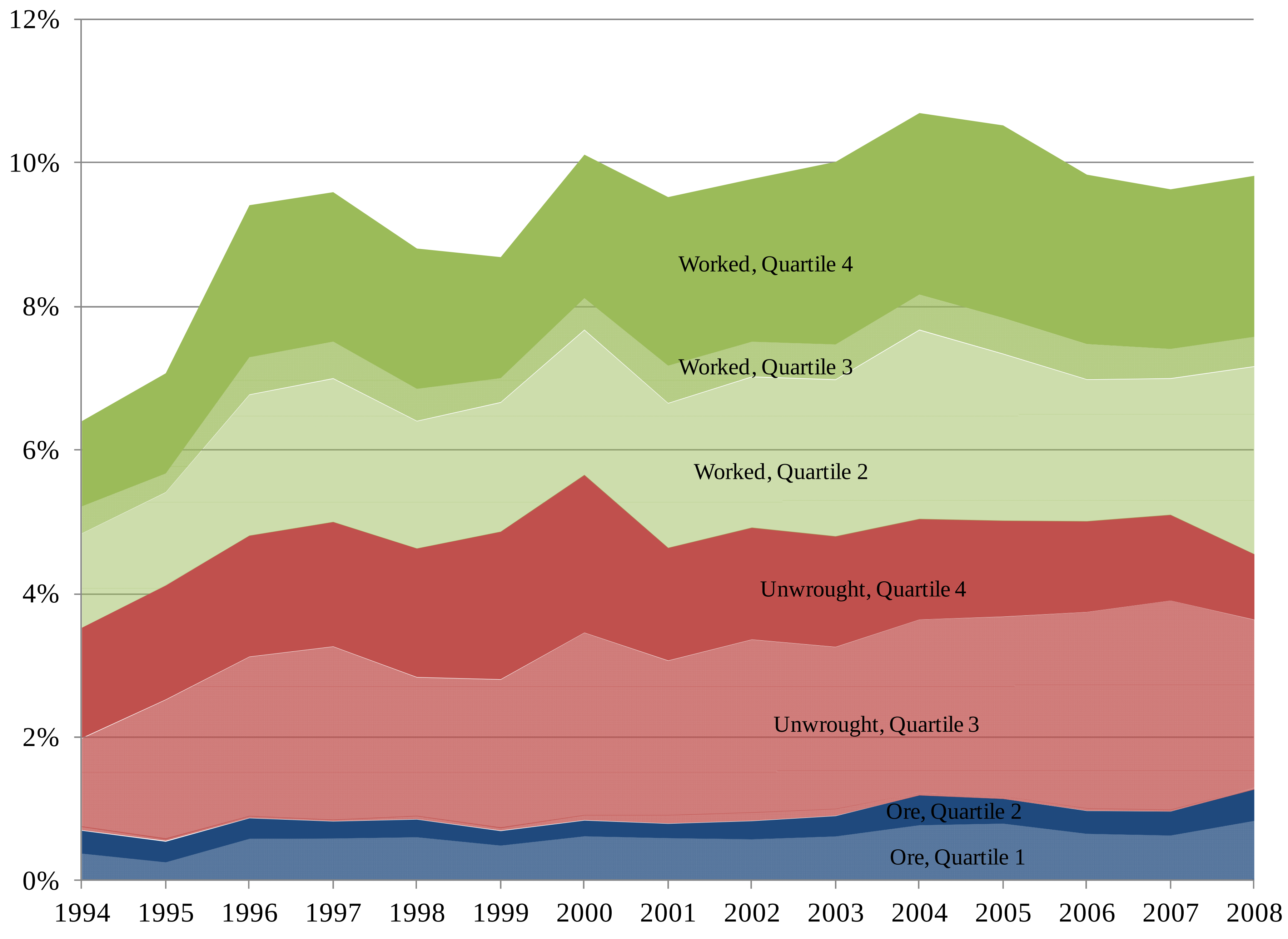


Figure 19: CIS metal market share by stage and level of differentiation (IIT price)

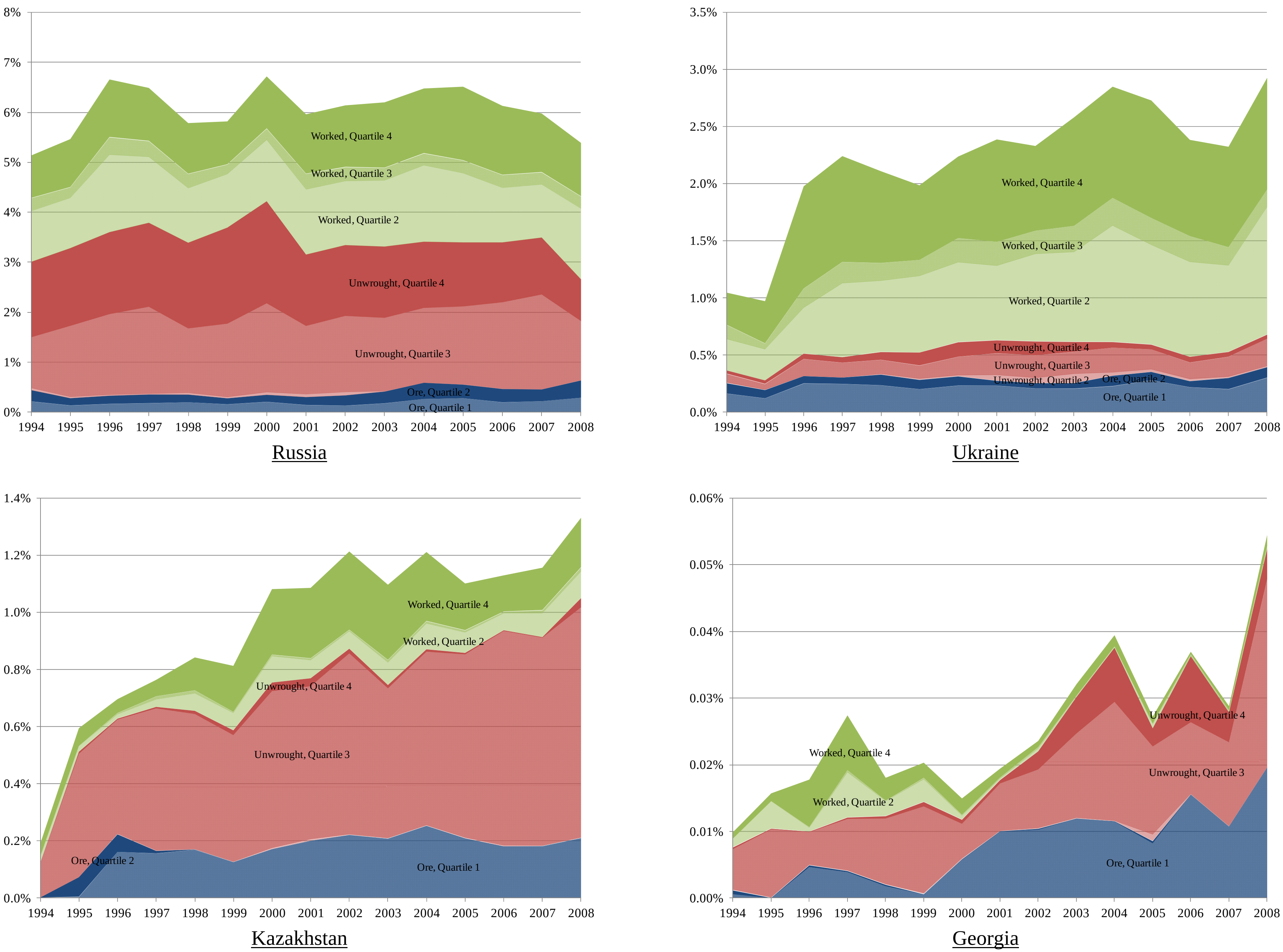
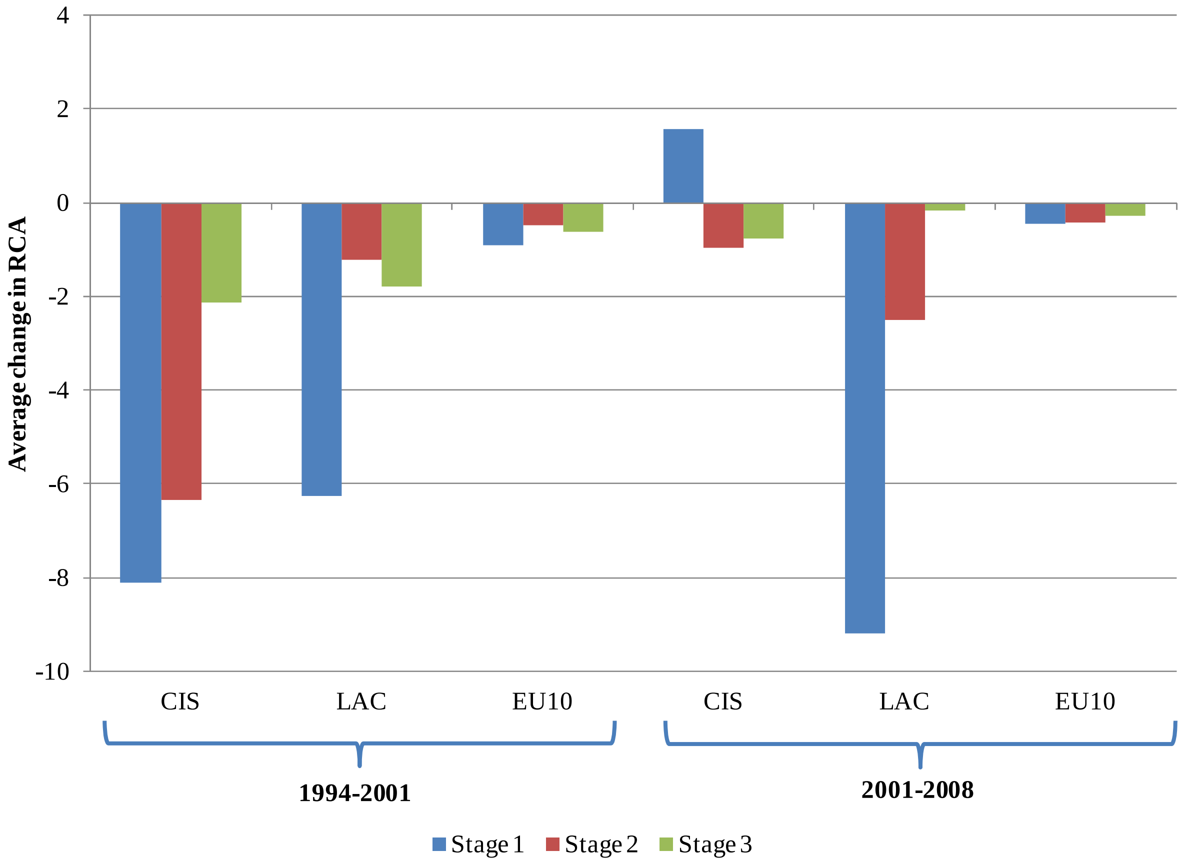
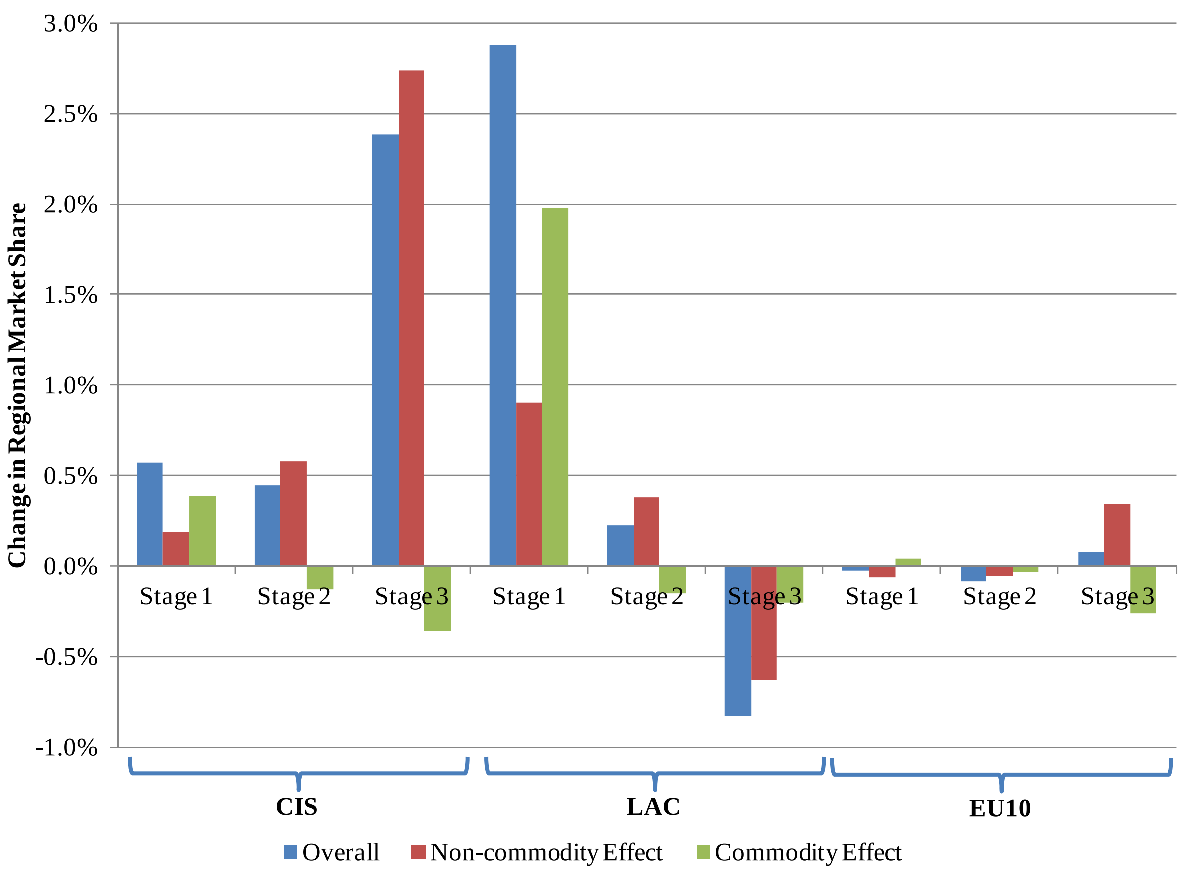


Figure 20: **Metal market share by stage and level of differentiation (IIT price)**



<u>Figure 21</u>: Change in metal RCA by stage of production



<u>Figure 22</u>: Change in metal market share (1994-2008) by commodity and non-commodity margin

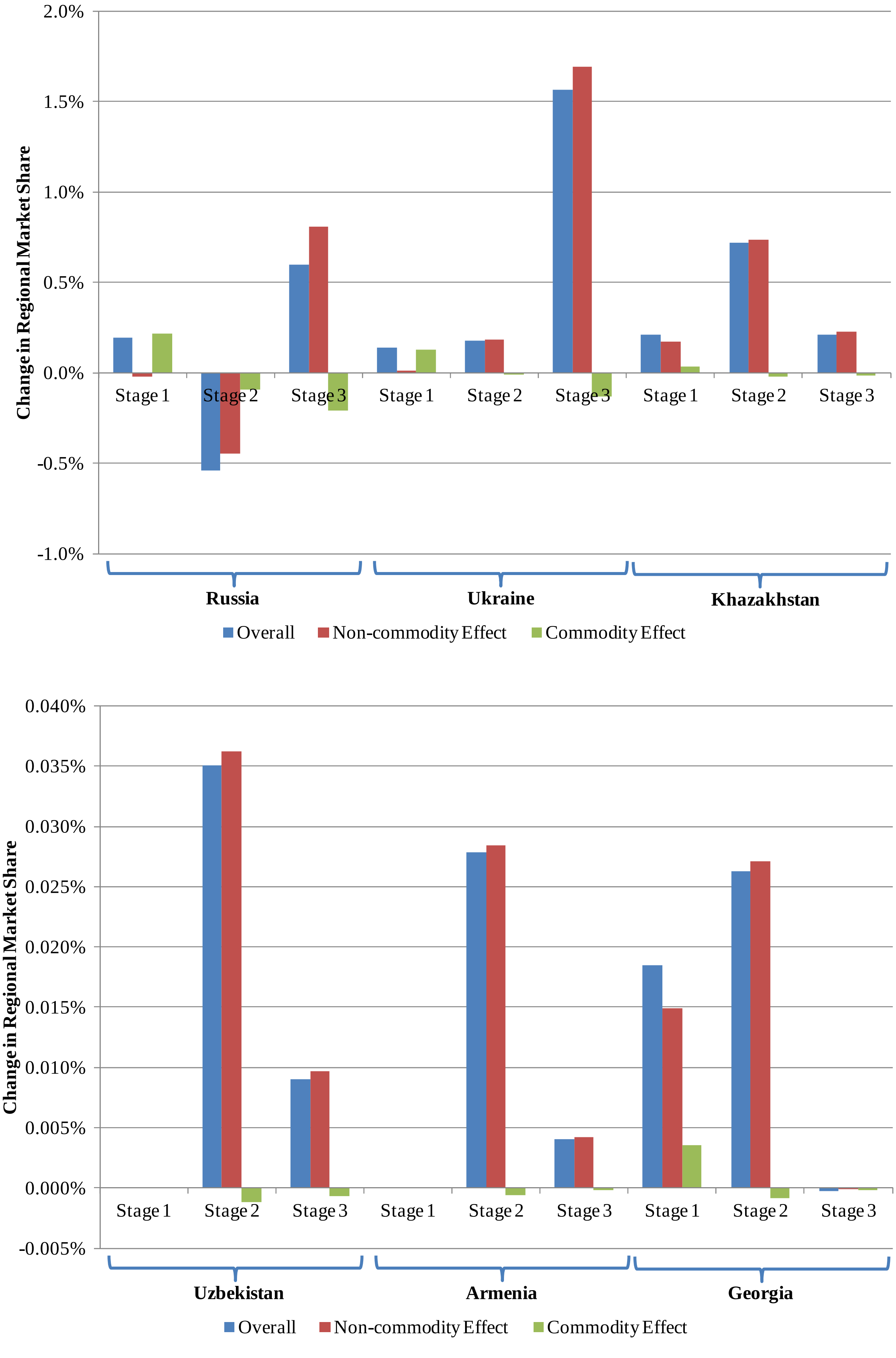


Figure 23: Change in CIS metal market share (1994-2008) by commodity and non-commodity margin

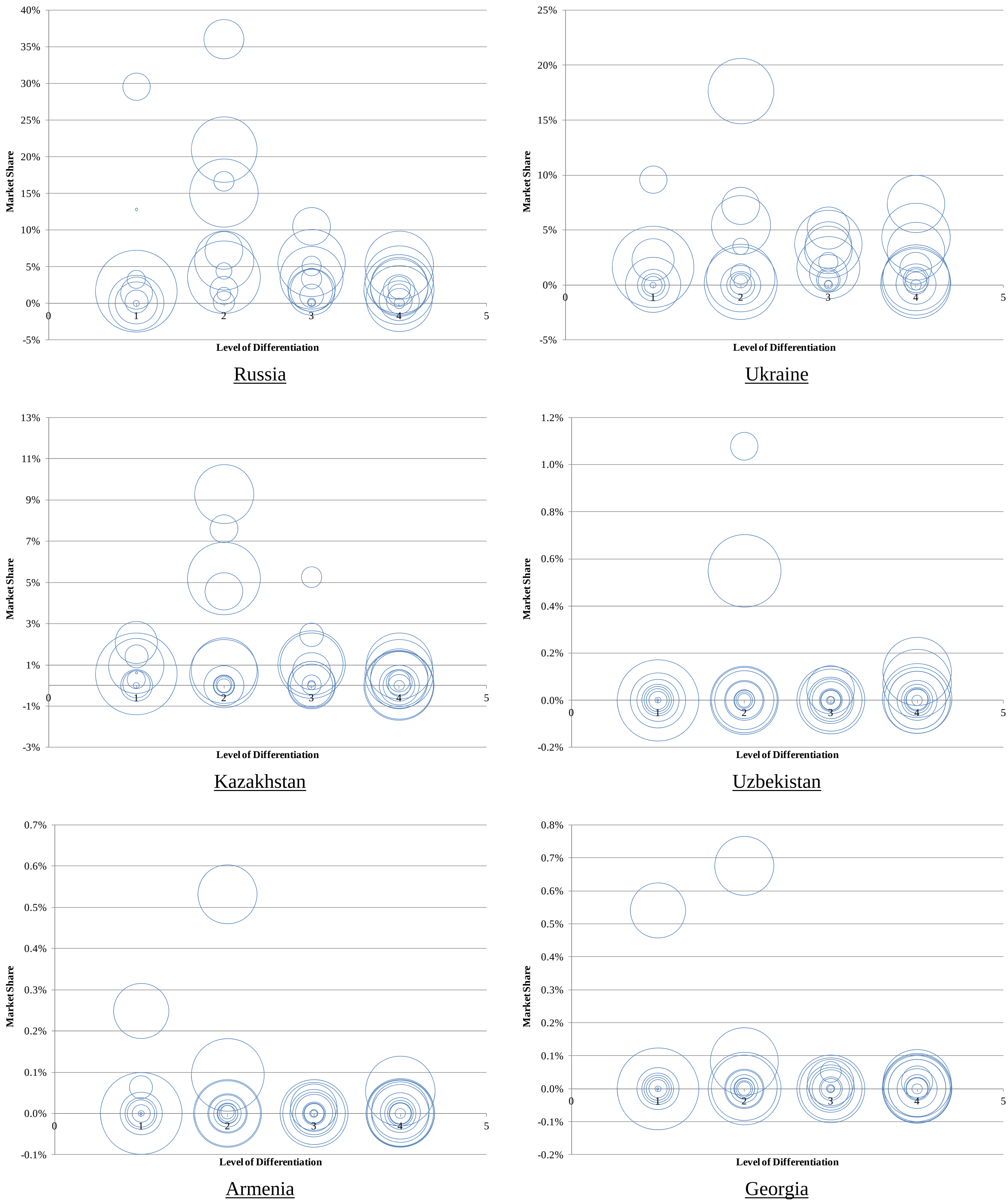
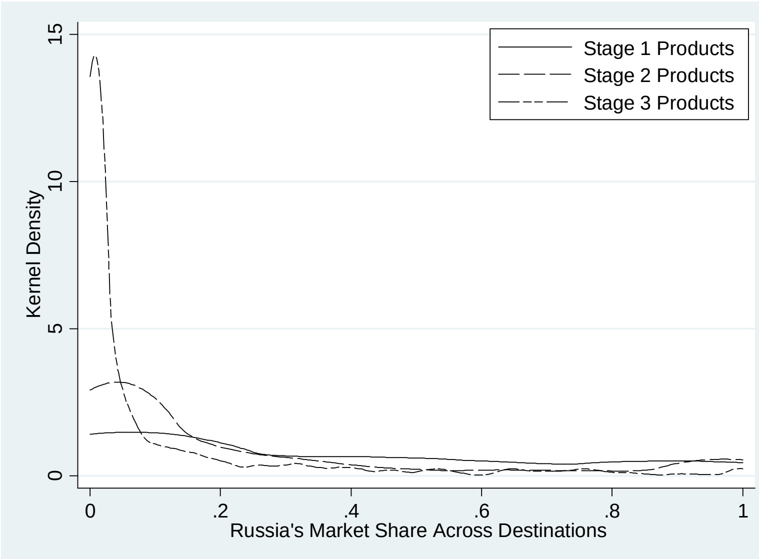
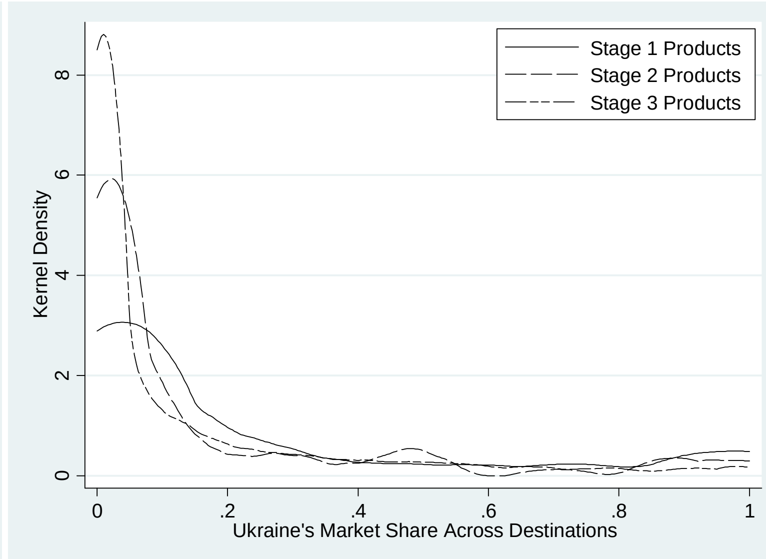


Figure 24: Metal market share and product differentiation (IIT)

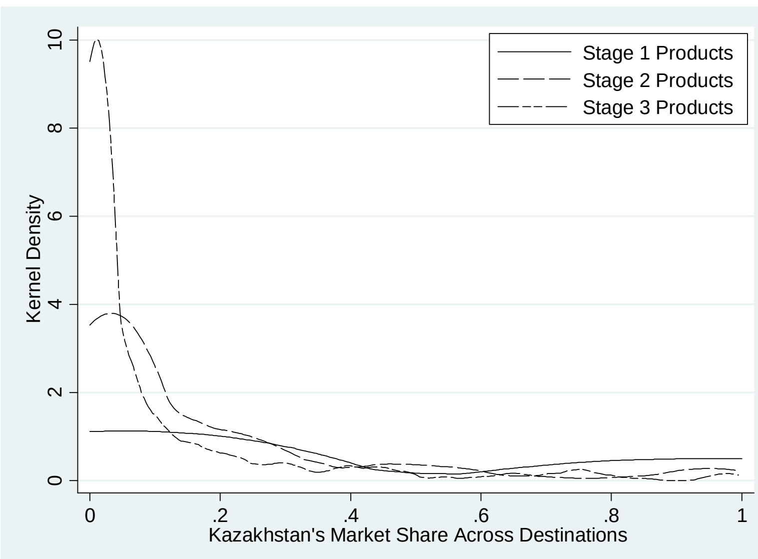
<u>Figure 25</u>: Metal market share and product differentiation (IIT price)



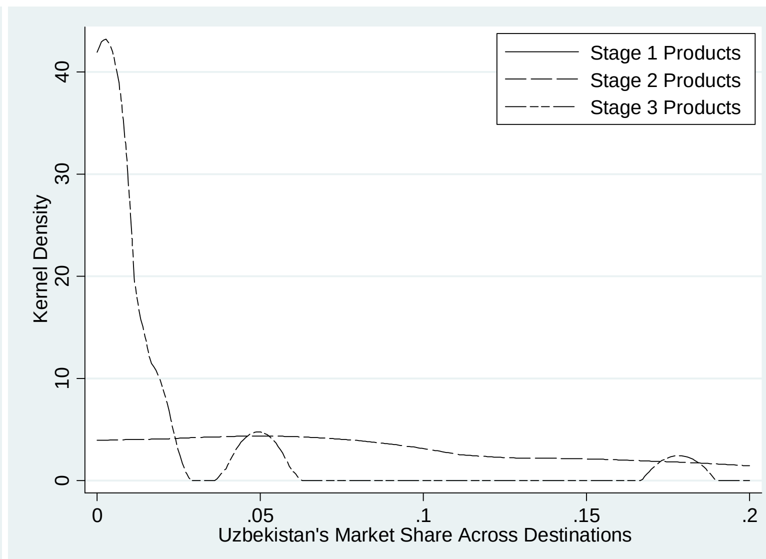
Russia



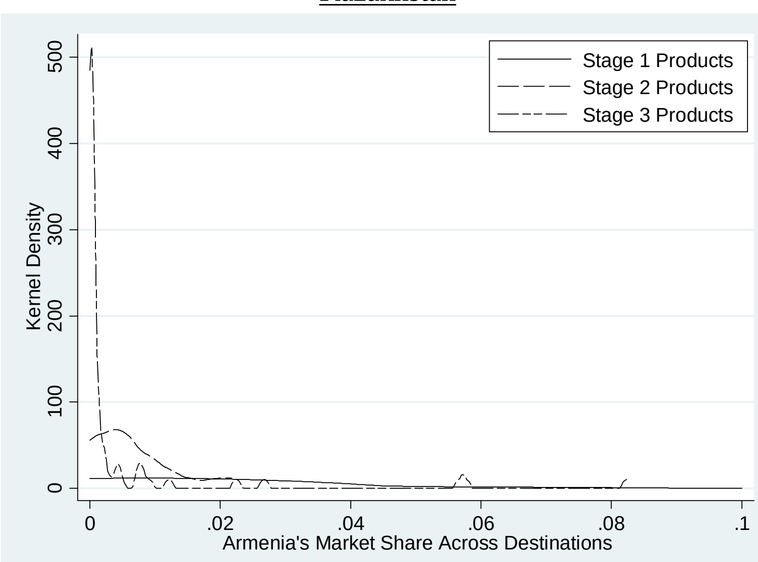
Ukraine



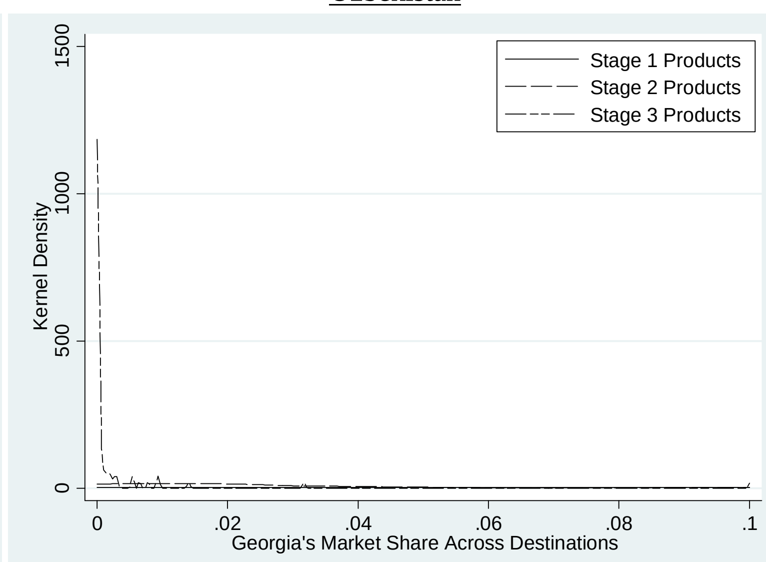
Kazakhstan



Uzbekistan

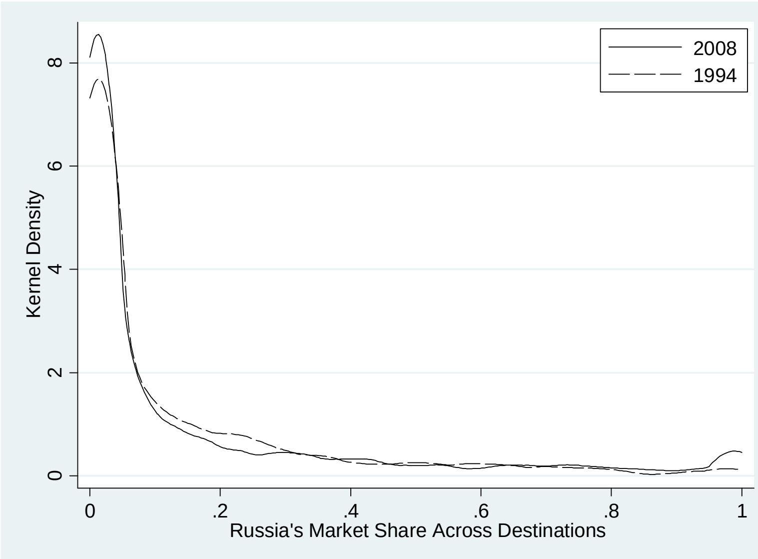


Armenia

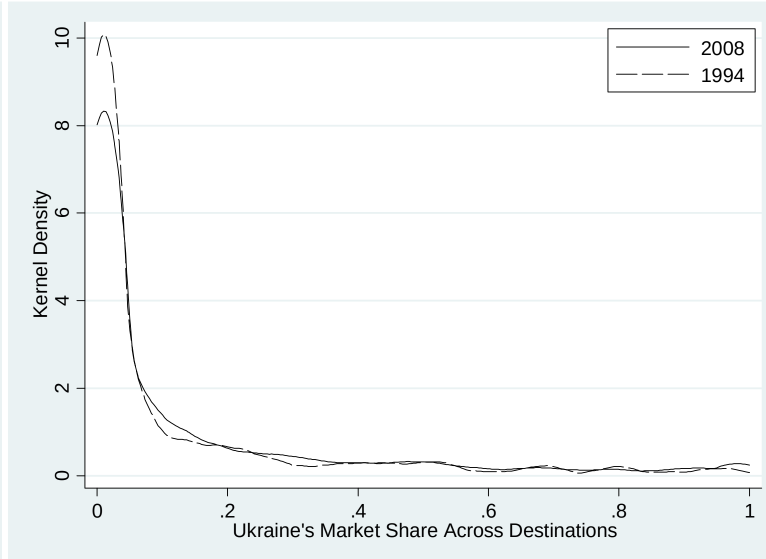


Georgia

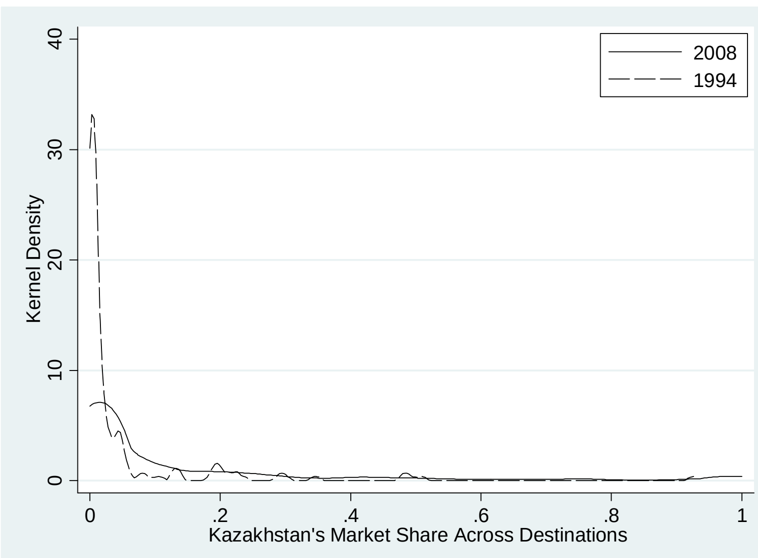
Figure 26: The distribution of CIS market share across destinations (by stage of production)



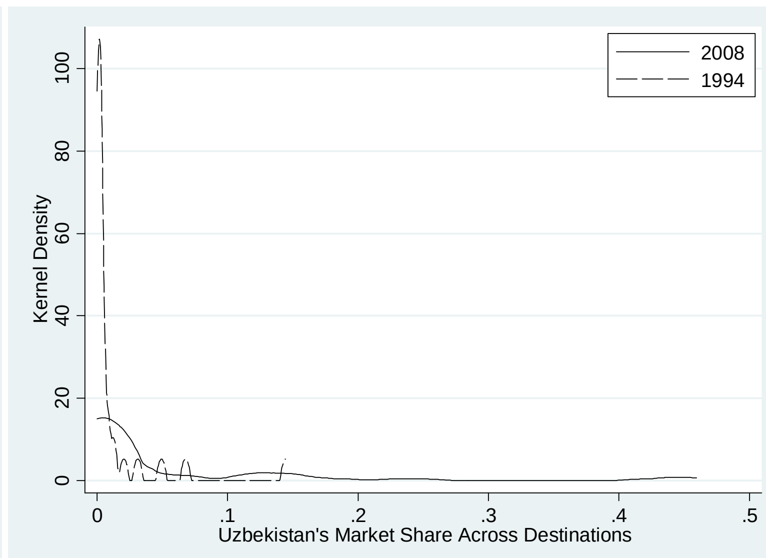
Russia



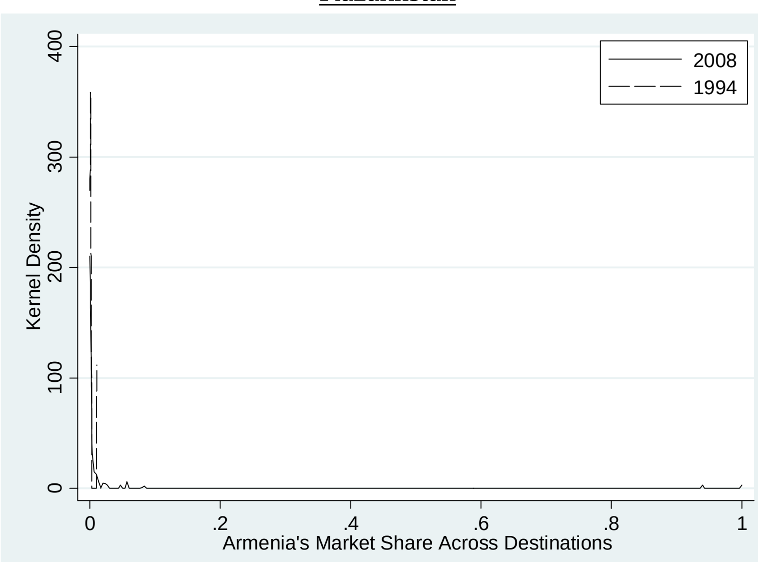
Ukraine



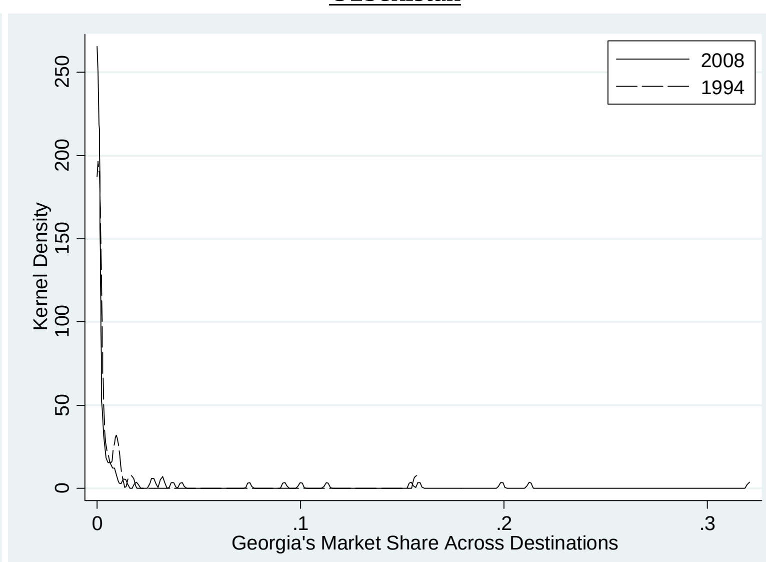
Kazakhstan



Uzbekistan



Armenia



Georgia

Figure 27: The distribution of CIS market share across destinations (over time)

Region		Aluminum	Copper	Lead	Nickel	Tin	Zinc	Iron and Steel	
CIS	Stage 1	2.1	**14.2**	0.8	0.2	2.8	**4.1**	**10.9**	**7.9**
	Stage 2	1.7	**5.7**	**3.2**	**3.6**	0.2	**6.3**	**14.7**	**6.5**
	Stage 3	1.1	0.7	0.3	0.3	0.0	0.0	1.5	1.3
		1.6	**5.8**	1.8	1.3	0.8	**4.0**	**3.5**	**3.3**

Region		Aluminum	Copper	Lead	Nickel	Tin	Zinc	Iron and Steel	
LAC	Stage 1	**63.4**	**15.8**	**44.1**	0.2	**62.5**	**39.3**	**3.3**	**22.5**
	Stage 2	0.6	**6.0**	1.9	0.1	**17.3**	1.1	2.0	**3.4**
	Stage 3	0.4	0.4	0.8	0.1	1.0	2.2	0.3	0.4
		16.2	**5.6**	**8.7**	0.1	**16.7**	**10.2**	0.8	**4.1**

Region		Aluminum	Copper	Lead	Nickel	Tin	Zinc	Iron and Steel	
EU10	Stage 1	0.6	0.8	1.6	0.2	0.0	0.3	0.4	0.5
	Stage 2	0.9	2.3	3.6	0.1	0.1	2.3	1.1	1.5
	Stage 3	1.4	1.1	0.5	0.2	1.2	1.4	1.4	1.3
		1.0	1.5	2.0	0.2	0.6	1.7	1.2	1.2

Table 1: Regional revealed comparative advantage (2008)

Notes: Shown are RCA measures for each region, stage of production and metal sector. Column and row averages are unweighted. Values of greater than 3 or less than -3 are shown in bold typeface.

		Aluminum	Copper	Lead	Nickel	Tin	Zinc	Iron and Steel	
Armenia	Stage 1		**36.5**				**9.3**		**22.9**
	Stage 2	0.0	**13.7**				0.0	**78.1**	**23.0**
	Stage 3	**7.9**	0.4					0.4	0.9
		4.0	**16.9**				**4.7**	**6.4**	**7.5**
Azerbaijan	Stage 1	0.8						0.0	0.4
	Stage 2	0.5	0.1	0.1			0.0	0.1	0.2
	Stage 3	0.0	0.0		0.0		0.0	0.0	0.0
	Total	0.4	0.1	0.1	0.0		0.0	0.0	0.1
Georgia	Stage 1	0.0	**32.7**					0.0	**10.9**
	Stage 2	**5.0**		**3.1**				**40.8**	**16.3**
	Stage 3	0.0	0.0	0.0	0.1	0.0		0.3	0.2
	Total	1.7	**16.4**	1.6	0.1	0.0		2.6	**3.3**
Kazakhstan	Stage 1	**4.3**	2.0	0.6	0.0	0.0	2.9	3.0	2.2
	Stage 2	1.2	**10.7**	**10.8**			**15.6**	**9.6**	**9.6**
	Stage 3	0.0	1.2	0.2		0.0	0.0	0.9	0.8
	Total	1.8	**4.6**	**3.9**	0.0	0.0	**6.2**	2.0	2.5
Kyrgyzstan	Stage 1					**5.7**			**5.7**
	Stage 2	0.6	0.0	**6.6**	0.0		0.4	0.2	1.3
	Stage 3		0.0	0.9	0.2			0.1	0.1
	Total	0.6	0.0	**3.7**	0.1	**5.7**	0.4	0.1	0.7
Russia	Stage 1	0.0	0.0	1.0	0.4		0.1	**4.1**	2.2
	Stage 2	**4.6**	1.1	1.0	**10.9**	0.1	0.5	1.6	2.7
	Stage 3	0.6	1.6	0.0	0.7	0.0	0.0	1.1	0.9
	Total	1.7	0.9	0.7	**4.0**	0.1	0.2	1.7	1.6
Turkmenistan	Stage 1								
	Stage 2								
	Stage 3	0.0						0.0	0.0
	Total	0.0						0.0	0.0
Ukraine	Stage 1	**5.1**	0.0					**28.4**	**21.0**
	Stage 2	1.4	0.4	1.0	0.0	0.3	0.0	**10.0**	2.9
	Stage 3	0.3	0.8	0.3	0.4	0.0	0.0	7.1	**5.4**
	Total	2.3	0.4	0.6	0.2	0.2	0.0	**11.6**	**7.7**
Uzbekistan	Stage 1								
	Stage 2	0.0	**13.9**	0.0			**27.3**		**10.3**
	Stage 3	0.2	1.8					0.5	0.6
	Total	0.1	**7.9**	0.0			**27.3**	0.5	**3.4**

Table 2: Revealed comparative advantage by country, sector and stage (2008)

		Aluminum	Copper	Lead	Nickel	Tin	Zinc	Iron and Steel	
	Stage 1		**36.5**				**9.3**		**22.9**
Armenia	Stage 2	0.0	**13.0**				0.0	**78.1**	**22.3**
	Stage 3	**7.9**	0.4					-0.2	0.4
		3.9	**16.2**				**4.7**	**5.8**	**7.0**
	Stage 1	0.8						-0.2	0.2
Azerbaijan	Stage 2	**-6.4**	**-3.8**	0.1			**-4.8**	0.1	**-5.0**
	Stage 3	-0.4	-0.3		0.0		0.0	-0.2	-0.3
	Total	**-3.3**	-2.1	0.1	0.0		**-4.8**	-0.2	-1.7
	Stage 1	0.0	**6.7**					**-60.4**	**-32.3**
Georgia	Stage 2	2.3	-0.6	**3.1**	**-17.9**		-0.2	**-56.4**	**-19.6**
	Stage 3	-0.6	-0.5	0.0	0.1	0.0		**-5.0**	**-4.4**
	Total	0.0	**7.3**	1.6	**-17.8**	0.0	-0.2	**-18.5**	**-13.3**
	Stage 1	**4.3**	2.0	0.6	0.0	0.0	2.9	-0.3	-1.1
Kazakhstan	Stage 2	0.1	**-47.3**	**-15.7**	-0.3		**-42.4**	**-20.4**	**-19.6**
	Stage 3	-0.2	0.4	0.2	-0.1	0.0	-0.9	**-3.6**	-2.8
	Total	1.2	**-24.8**	**-9.4**	-0.2	0.0	**-23.3**	**-5.0**	**-7.0**
	Stage 1	**-13.2**				**5.7**			**-7.5**
Kyrgyzstan	Stage 2	0.0	**-6.0**	**6.6**	0.0		0.4	0.2	-0.9
	Stage 3	-0.4	-0.6	0.9	0.2		**-5.5**	**-7.3**	**-6.4**
	Total	**-4.2**	**-3.3**	**3.7**	0.1	**5.7**	**-5.1**	**-6.8**	**-5.5**
	Stage 1	-0.6	-0.4	-0.9	**-5.4**	**-5.4**	-1.7	-2.7	-2.3
Russia	Stage 2	**-12.7**	**-7.6**	0.5	**-7.1**	-2.2	-2.8	**-8.8**	**-6.2**
	Stage 3	-0.5	1.1	0.0	-1.1	-1.0	-0.2	-1.7	-1.4
	Total	**-4.6**	-2.3	-0.1	**-4.5**	-2.8	-1.6	-2.4	-2.5
	Stage 1								
Turkmenistan	Stage 2	-0.1		-0.3				-0.4	-0.2
	Stage 3	0.0	-0.1	**-5.4**				-0.4	-1.2
	Total	-0.1	-0.1	-2.8				-0.4	-0.8
	Stage 1	**5.1**	0.0					**-9.6**	**-6.1**
Ukraine	Stage 2	-1.6	-1.2	0.9	-0.1	0.1	-1.8	**-10.4**	**-3.1**
	Stage 3	0.0	0.0	0.3	0.4	0.0	-0.8	**-3.4**	**-3.7**
	Total	1.2	-0.4	0.5	0.1	-0.1	-1.3	**-5.2**	**-4.2**
	Stage 1								
Uzbekistan	Stage 2	0.0	**11.6**	0.0			**11.4**	0.0	**4.2**
	Stage 3	0.2	0.6					0.2	0.2
	Total	0.1	**6.1**	0.0			**11.4**	0.2	1.6

Table 3: Change in revealed comparative advantage (1994-2008)

Appendix

List of included CIS countries
Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Russia, Turkmenistan, Uzbekistan, Ukraine

List of included LAC countries
Antigua, Argentina, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, St. Kitts-Nevis-Anguilla, St. Lucia, St. Vincent, Suriname, Trinidad & Tobago, Turks And Calicos Islands, Uruguay, US Virgin Islands, Venezuela.

List of EU10 transition countries
Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Poland, Romania, Slovakia, Slovenia, Latvia, Lithuania, Malta

Metal Commodity Classifications in the NBER-UN Trade Flows Data
<u>Aluminum SITC rev.2 categories</u>
1. 2873: Aluminium ores and concentrates (including alumina)
    a. 28731 Aluminium ore and concentrate
    b. 28732 Alumina (aluminium oxide)
2. 6841 Aluminium and aluminium alloys, unwrought
3. 6842 Aluminium and aluminium alloys, worked
    a. 68421 Aluminium bars, rods, angles, shapes, etc, wrought; wire
    b. 68422 Aluminium plates, sheets and strips, wrought
    c. 68423 Aluminium foil, of a thickness not exceeding 0.20 mm
    d. 68424 Aluminium powders and flakes
    e. 68425 Aluminium tubes, pipes and blanks; hollow bars of aluminium
    f. 68426 Aluminium tubes and pipes fittings

<u>Copper SITC rev.2 categories</u>
1. 2871: Copper ore and concentrates; copper matte; cement copper
2. 6821: Copper and copper alloys, refined or not, unwrought
    a. 68211 Unrefined copper (blister copper but excluding cement copper)
    b. 68212 Refined copper, (including alloys except master alloys), unwrought
    c. 68213 Master alloy of copper
3. 6822: Copper and copper alloys, worked
    a. 68221 Copper bars, rods, angles, shapes, sections, wrought; copper wire
    b. 68222 Copper plates, sheets and strips, wrought
    c. 68223 Copper foil not exceeding 0.15 mm
    d. 68224 Copper powders and flakes
    e. 68225 Copper tubes, pipes, and blanks thereof; hollow bars of cooper
    f. 68226 Copper tubes and pipes fittings

Lead SITC rev.2 categories
1. 2874 Lead ores and concentrates
2. 6851 Name: Lead, and lead alloys, unwrought
3. 6852 Name: Lead and lead alloys, worked

Nickel SITC rev.2 categories
1. 2872 Nickel ores and concentrates; nickel mattes, etc
    a. 28721 Nickel ores and concentrates
    b. 28722 Nickel matte, sinters, etc
2. 6831 Nickel and nickel alloys, unwrought
3. 6832 Nickel and nickel alloys, worked
    a. 68321 Nickel bars, rods, angles, shapes, sections, wrought; nickel wire
    b. 68322 Nickel sheet, plates, strip, wrought; nickel foil, powders, flakes
    c. 68323 Nickel tube, pipe, blanks; hollow bars; tube and pipe fittings
    d. 68324 Electro-plating anodes, of nickel

Tin SITC rev.2 categories
1. 2876 Lead ores and concentrates
2. 6871 Tin and tin alloys, unwrought
3. 6872 Tin and tin alloys worked

Zinc SITC rev.2 categories
1. 2875 Lead ores and concentrates
2. 6861 Zinc and zinc alloys, unwrought
3. 6863 Zinc and zinc alloys worked

Iron and Steel SITC rev.2 categories
1. 2814 Roasted iron pyrites
2. 2815 Iron ore and concentrates, not agglomerated
3. 2816 Iron ore agglomerates
4. 6712 Pig iron, cast iron, spiegeleisen, in pigs, blocks, lumps, etc
5. 6713 Iron and steel powders, shot or sponge
6. 6716 Ferro-alloys
7. 6724 Puddled bars, pilings; ingots, blocks, lumps, etc, of iron or steel
8. 6725 Blooms, billets, slabs and sheet bars, of iron or steel
9. 6727 Iron or steel coils for re-rolling
10. 6731 Wire rod of iron or steel
11. 6732 Bars, rods (not wire rod), from iron or steel; hollow mining drill
12. 6733 Angles, shapes, sections and sheet piling, of iron or steel
13. 6741 Universal plates of iron or steel
14. 6744 Sheet, plates, rolled of thickness 4,75mm plus, of iron or steel
15. 6745 Sheet, plates, rolled of thickness 3mm to 4,75mm, of iron or steel
16. 6746 Sheet, plates, rolled of thickness less 3mm, of iron or steel
17. 6747 Tinned sheets, plates of steel (not of high carbon or alloy steel)
18. 6749 Other sheet and plates, of iron or steel, worked

19. 6750 Hoop and strip of iron or steel, hot-rolled or cold-rolled
20. 6760 Rails and railway track construction materials, of iron or steel
21. 6770 Iron or steel wire (excluding wire rod), not insulated
22. 6781 Tubes and pipes, of cast iron
23. 6782 Seamless tubes, pipes; blanks for tubes and pipes, of iron or steel
24. 6783 Other tubes and pipes, of iron or steel
25. 6784 High-pressure hydro-electric conduit of steel
26. 6785 Tube and pipes fittings, of iron or steel
27. 6793 Steel and iron forging and stampings, in the rough state
28. 6794 Castings of iron or steel, in rough state

		Value - Added Stage	IIT quartile	IIT Price quartile
Aluminum	2873 Aluminium ores and concentrates (including alumina)	1	1	1
	6841 Aluminium and aluminium alloys, unwrought	2	2	4
	6842 Aluminium and aluminium alloys, worked	3	4	4
Copper	2871 Copper ore and concentrates; copper matte; cement copper	1	1	1
	6821 Copper and copper alloys, refined or not, unwrought	2	2	3
	6822 Copper and copper alloys, worked	3	4	4
Lead	2874 Lead ores and concentrates	1	1	1
	6851 Name Lead, and lead alloys, unwrought	2	3	3
	6852 Name Lead and lead alloys, worked	3	3	2
Nickel	2872 Nickel ores and concentrates; nickel mattes, etc	1	1	1
	6831 Nickel and nickel alloys, unwrought	2	2	3
	6832 Nickel and nickel alloys, worked	3	4	2
Tin	2876 Tin ores and concentrates	1	1	1
	6871 Tin and tin alloys, unwrought	2	2	3
	6872 Tin and tin alloys worked	3	3	2
Zinc	2875 Zinc ores and concentrates	1	1	1
	6861 Zinc and zinc alloys, unwrought	2	2	3
	6863 Zinc and zinc alloys worked	3	4	2
Iron and Steel	2814 Roasted iron pyrites	1	1	1
	2815 Iron ore and concentrates, not agglomerated	1	1	1
	2816 Iron ore agglomerates	1	2	1
	6712 Pig iron, cast iron, spiegeleisen, in pigs, blocks, lumps, etc	1	1	2
	6713 Iron and steel powders, shot or sponge	1	2	2
	6716 Ferro-alloys	2	2	3
	6724 Puddled bars, pilings; ingots, blocks, lumps, etc, of iron or steel	2	2	2
	6725 Blooms, billets, slabs and sheet bars, of iron or steel	3	2	2
	6727 Iron or steel coils for re-rolling	3	3	2
	6731 Wire rod of iron or steel	3	3	3
	6732 Bars, rods (not wire rod), from iron or steel; hollow mining drill	3	4	4
	6733 Angles, shapes, sections and sheet piling, of iron or steel	3	3	4
	6741 Universal plates of iron or steel	3	1	1
	6744 Sheet, plates, rolled of thickness 4,75mm plus, of iron or steel	3	4	4
	6745 Sheet, plates, rolled of thickness 3mm to 4,75mm, of iron or steel	3	3	3
	6746 Sheet, plates, rolled of thickness less 3mm, of iron or steel	3	3	4
	6747 Tinned sheets, plates of steel (not of high carbon or alloy steel)	3	3	4
	6749 Other sheet and plates, of iron or steel, worked	3	4	4
	6750 Hoop and strip of iron or steel, hot-rolled or cold-rolled	3	1	1
	6760 Rails and railway track construction materials, of iron or steel	3	3	2
	6770 Iron or steel wire (excluding wire rod), not insulated	3	4	3
	6781 Tubes and pipes, of cast iron	3	2	2
	6782 Seamless tubes, pipes; blanks for tubes and pipes, of iron or steel	3	3	4
	6783 Other tubes and pipes, of iron or steel	3	4	4
	6784 High-pressure hydro-electric conduit of steel	3	1	1
	6785 Tube and pipes fittings, of iron or steel	3	4	4
	6793 Steel and iron forging and stampings, in the rough state	3	4	3
	6794 Castings of iron or steel, in rough state	3	4	3