Office Memorandum

To: Members of the Executive Board July 3, 2013

From: The Acting Secretary

Subject: **German-Central European Supply Chain—Cluster Report**

The attached cluster report on the German-Central European Supply Chain (GCESC) is being circulated as background for the **informal session to brief** Executive Directors that is tentatively scheduled for **Thursday, July 11, 2013.**

Unless an objection from the authorities of the Czech Republic, Germany, Hungary, the Republic of Poland, or the Slovak Republic is received prior to the conclusion of the informal session, the document will be published. Any requests for modifications for publication are expected to be received two days before the conclusion of the informal session.

Questions may be referred to Mr. Lall (ext. 36113), Mr. Aiyar (ext. 35973), and Mr. Elekdag (ext. 34835) in EUR.

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INTERNATIONAL MONETARY FUND

July 1, 2013

GERMAN-CENTRAL EUROPEAN SUPPLY CHAIN—CLUSTER REPORT

EXECUTIVE SUMMARY

Since the 1990s a German-Central European supply chain (GCESC) has evolved, manufacturing goods for export to the rest of the world. Reflecting this, bilateral trade linkages between Germany and the Czech Republic, Hungary, Poland and the Slovak Republic (henceforth CE4) have expanded rapidly.

Supply chain production in CE4 countries has been supported by large inflows of FDI. FDI comprised a much larger share of overall capital inflows to the CE4 than to some comparator European countries. FDI was directed to the manufacturing sectors, in particular, motor vehicles and other transport equipment. Portfolio investment and cross-border bank flows were relatively less important.

Participation in the GCESC has led to technology transfers to CE4 countries and accelerated income convergence. Export growth in knowledge-intensive sectors has been particularly rapid in the CE4. The sophistication of domestic value added embodied in overall exports has also increased rapidly. Complementarities between supply chain activities and domestic production have led to greater synchronization of the business cycle among GCESC countries.

CE4 policymakers stressed the importance of safeguarding enhanced competitiveness in knowledge-intensive sectors. As unit labor cost differentials with Germany narrow, the CE4 countries may struggle to sustain their current role in the supply chain. In order to remain part of the GCESC—or branch out into more specialized export production activities, as some countries in Asia have done—the CE4 countries will need to continually upgrade labor force skills.

The growth of the supply chain has increased the exposure of Germany and the CE4 to final demand outside Europe, to an extent not captured by bilateral trade statistics. Spillovers from aggregate demand and policy actions in the rest of the world are now much larger than before. Conversely, German domestic demand spillovers to the CE4 remain relatively small. Much bilateral trade between Germany and the CE4 is in intermediate goods: final demand in Germany is not the main determinant of CE4 exports to Germany. Correspondingly, German fiscal policies to stimulate or contract domestic demand have a relatively limited impact on CE4 economies.

Balance sheet fundamentals in Germany are a key determinant of the magnitude of shock spillovers to CE4 countries and beyond. Currently, sound fundamentals act as a shock absorber; more leveraged balance sheets and greater sovereign risk in Germany would considerably magnify the regional impact of external shocks.

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INTRODUCTION

1. In recent decades supply chains—production spread across several countries within a particular region—have arisen in many different parts of the world. The distribution of the manufacturing process over more than one country, with different countries specializing in different stages of production, owes to both a favorable policy environment and technological developments. Global and regional trade agreements have resulted in significant tariff reduction and removal of non-trade barriers, while increased financial liberalization has encouraged foreign direct investment (FDI) supporting the offshoring of production. Technological developments have also played a vital role: falling transportation costs and improvements in communication technologies have significantly reduced the costs of information exchange and made it easier for firms to coordinate and monitor production in diverse locations.

2. In Europe the German-Central European Supply Chain (GCESC) has expanded rapidly since the mid-1990s and assumed global importance. Large labor cost differentials together with geographical proximity and cultural similarities have led many German firms to shift large parts of their production to central European countries, most notably the Czech Republic, Hungary, Poland and Slovakia (CE4, hereafter) either by directly investing there or by purchasing intermediate inputs from local firms. The pattern is exemplified by the automobile industry, where increasing competition in both domestic and foreign markets has triggered a sustained process of outsourcing of manufacturing activities.

3. This report examines the evolution and economic implications of the GCESC. Several questions of policy relevance are discussed. What have been the chief benefits of membership in the GCESC, and how should these best be safeguarded? Have vulnerabilities to external shocks risen as a result of the supply chain? Have demand or policy spillovers within the cluster become more important over time? To answer these questions, the study first documents the pattern of vertical trade integration in the GCESC, and the pattern of international capital flows supporting this integration. The benefits and costs of GCESC membership are then examined empirically along several dimensions. Model simulations are used to examine policy actions and spillovers.

THE EVOLUTION OF TRADE AND FINANCIAL LINKAGES

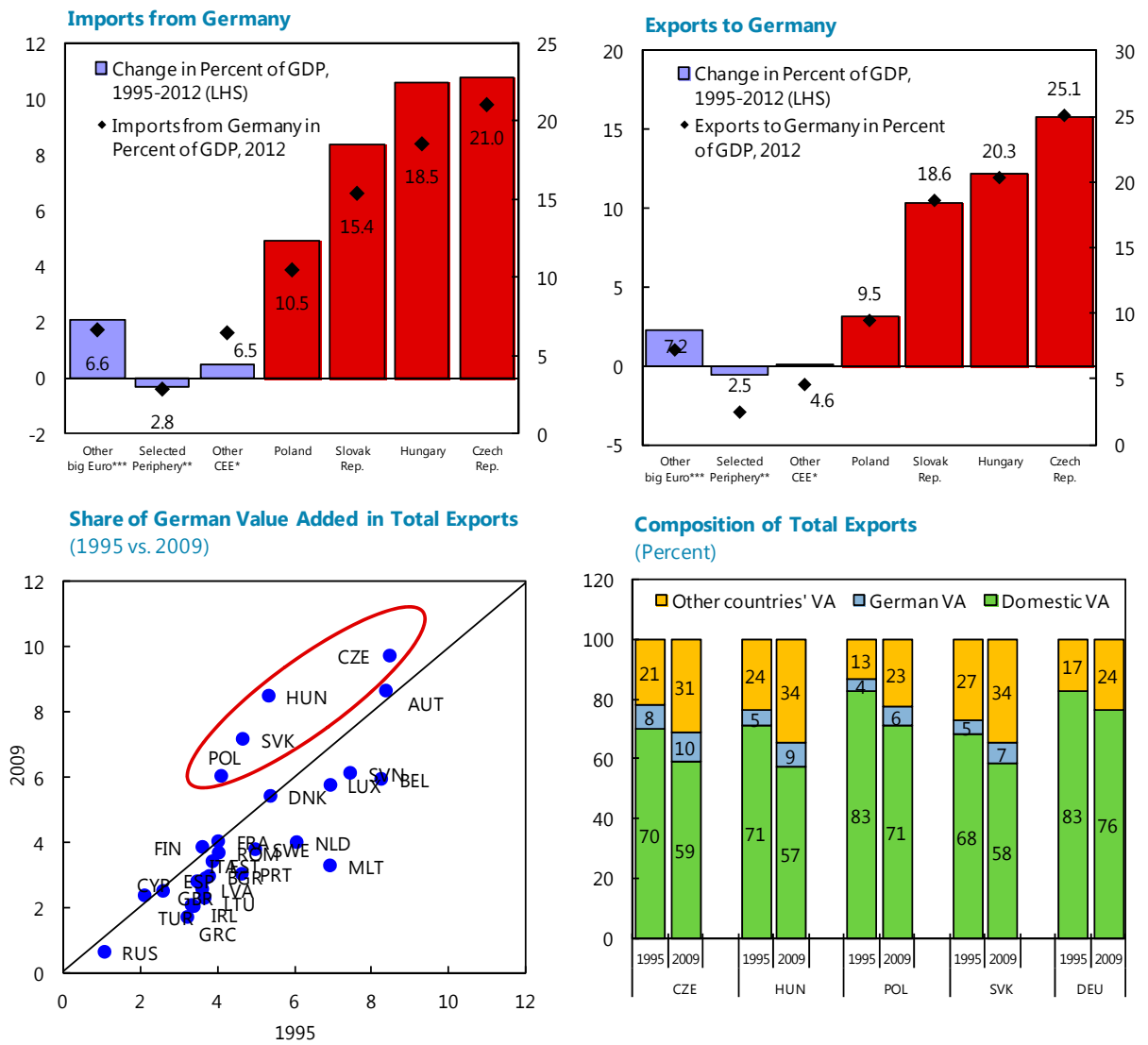
A. Trade Linkages

4. The CE4's trade links with Germany have strengthened considerably since the mid-1990s, largely reflecting their increased integration into the GCESC. Bilateral trade with Germany grew much faster in CE4 countries than in other European countries (Figure 1). However, there is heterogeneity among the CE4 countries. In particular, Poland, which accounts for more than half of CE4 GDP, is a relatively less open economy than the others, and its trade with Germany has grown more slowly. Similarly the share of German value added embodied in CE4 exports expanded much more rapidly than in comparator countries. Apart from large unit labor cost differentials and

adequate labor skills to support supply chain activities, the CE4's integration into the GCESC reflects several bilateral advantages vis-à-vis Germany: geographic proximity, cultural similarities, and a similar sectoral structure. Rahman and Zhao (2013) compute an "industrial similarity index" relative to Germany, and show that the CE4 countries had strong similarities with Germany even before they integrated into the GCESC.

5. The growth of the supply chain has substantially increased the exposure of both Germany and the CE4 to final demand outside Europe, to an extent not captured by bilateral

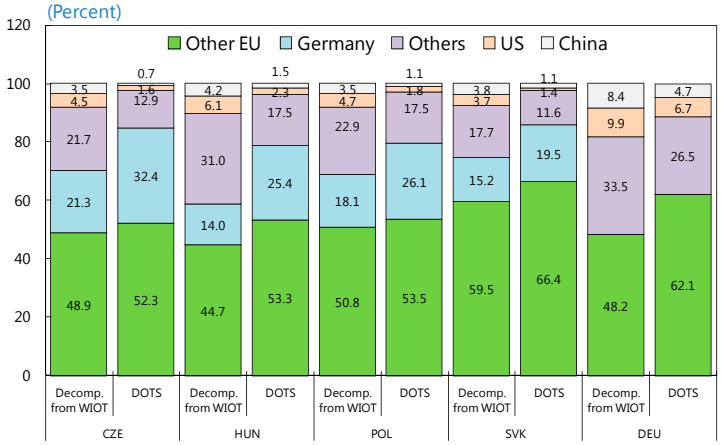
Figure 1. Bilateral Trade with Germany



Sources: DOTS; IMF staff calculations based on the WIOT.
* Other CEE includes BiH, Bulgaria, Croatia, Estonia, Latvia, Lithuania, Macedonia, Romania, Slovenia and Ukraine.
** Selected periphery includes Greece, Ireland, Portugal, and Spain.
*** Other big Euro includes Austria, Belgium, France, Italy and the Netherlands.

trade statistics. Conventional trade statistics tend to overestimate exposures within a supply chain due to the high prevalence of trade in intermediate goods. The recently released World Input-Output Table (WIOT) permits a detailed decomposition by origin of the value added (VA) embodied in total exports (Background Note 1). Figure 2 compares exposures to countries of final demand (from WIOTS) against more conventional gross exposures computed using the IMF's Direction of Trade statistics (DOTS). Germany's exposure to the EU under the WIOT (48 percent) is significantly below the implied exposure under DOTS (62 percent) while its exposure to the rest of the world is much higher (33 percent vs. 26 percent). Similarly, the CE4's exposure to Germany is significantly lower than implied by gross bilateral trade statistics; a substantial fraction of CE4 exports pass through Germany before export outside the EU.

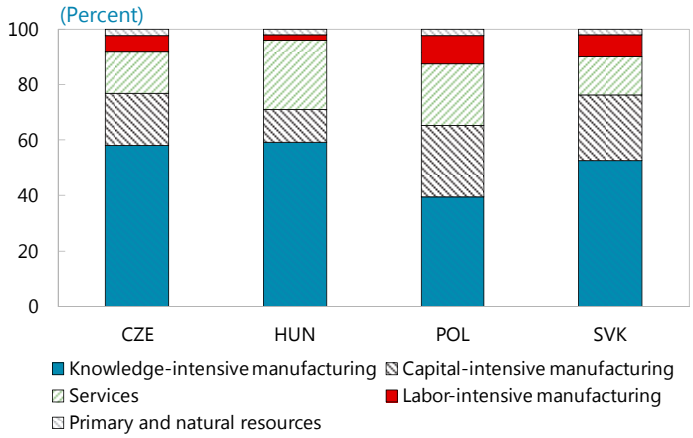
Figure 2. Actual Exposure of the CE4 Countries Based on the Recipients' Final Demand, 2009
(Percent)



Source: IMF staff calculations based on the WIOT.

6. CE4 exports grew most rapidly in knowledge-intensive sectors (Figure 3).[1] In Czech Rep., Hungary and Slovakia, these sectors—which include transport and electrical equipment, machinery and chemicals—contributed about 50-60 percent of total export growth in the period 1995-2009. In Poland, their contribution was somewhat lower (40 percent) but still the highest among sectors. Knowledge-intensive sectors also comprise the highest share in the countries' domestic VA exports (about 30-40 percent).

Figure 3. Sectoral Contribution to Exports Growth, 1995-2009
(Percent)

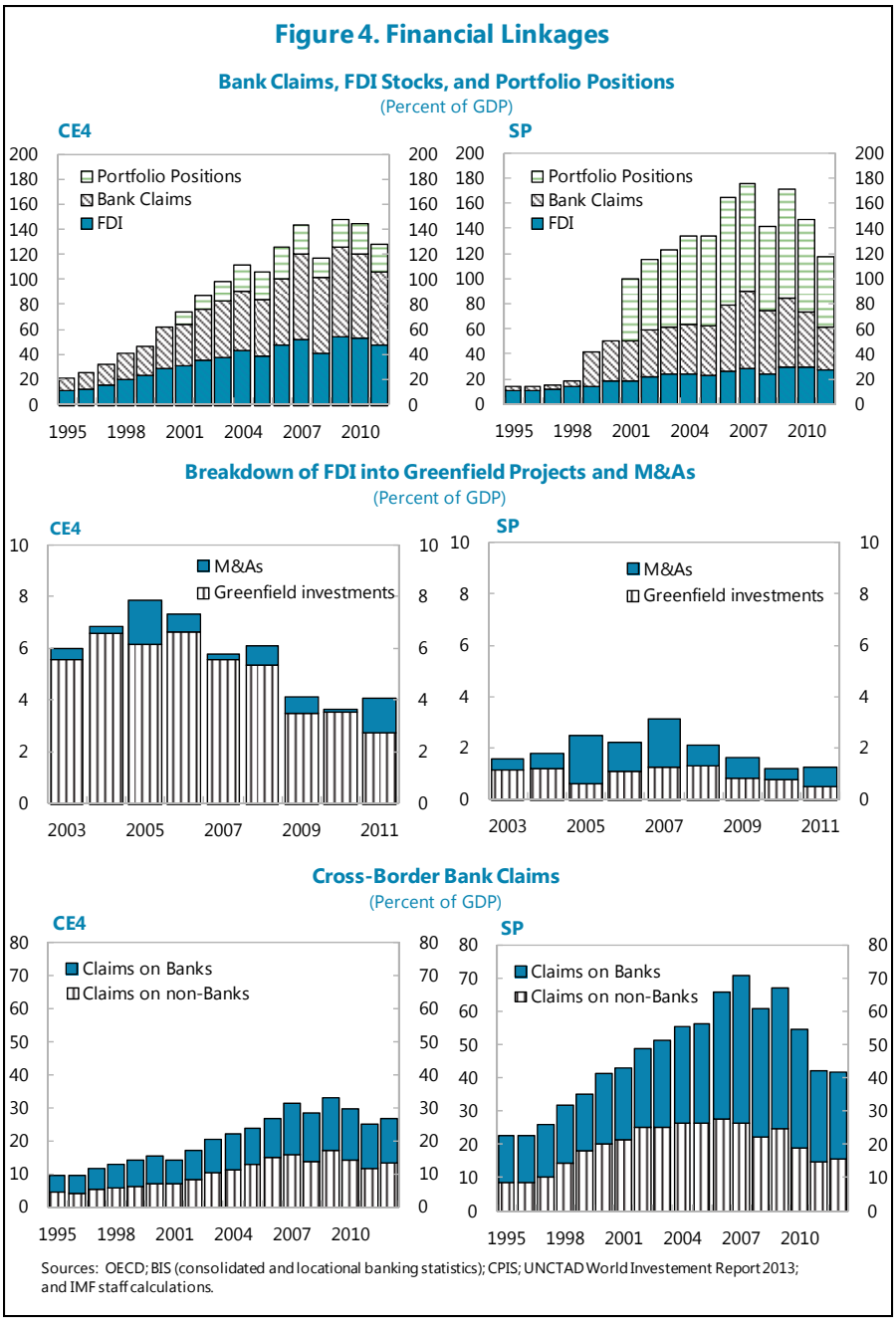


Source: IMF staff calculations based on the WIOT.

[1] The various sectors are grouped into five main categories: primary and natural resources, services, labor-intensive manufacturing, capital-intensive manufacturing and knowledge-intensive manufacturing.

B. Financial Linkages

7. The evolution of the GCESC has been supported by large inflows of foreign direct investment (FDI) to CE4 countries. Figure 4 decomposes the stock of inward capital flows into FDI, portfolio flows and other (mainly bank) flows.[2] All stocks are scaled by GDP, and for reference purposes, a comparison is made against selected periphery (SP) countries—comprising Greece,



[2] The time series of stock positions is very similar to the evolution of balance of payments flows, but the former comprises a much richer data source for *bilateral* positions between, say, Germany and other countries.

Ireland, Portugal and Spain—another group of European countries which globalized rapidly in the run-up to the 2007-08 crisis but have had very different recovery paths (Background Note 2). While FDI and bank flows were the main source of external financing for the CE4, portfolio and bank flows were the main types of external financing for the SP. The pattern of bilateral German claims on the CE4 and SP is broadly similar to the global exposures.

8. Moreover, the FDI inflows into CE4 countries have largely financed greenfield investments (Figure 4). Greenfield investment—as opposed to mergers and acquisitions (M&A) activity—is generally associated with an expansion in productive capacity and therefore growth. Moreover, it is a relatively stable source of external funding, and the least prone to sudden stops and reversals. Notably, much of the FDI directed to the CE4 countries was in the Motor Vehicles and Transport Equipment sectors (Background Note 2), supporting the offshoring of German passenger car production (Box, Background Note 1). 2009 marked the first year in which offshored production outstripped domestic German production of passenger cars.

9. While foreign bank finance has played a large role in the CE4, *cross-border* bank flows have been less pronounced (albeit still important). The CE4 countries have been reliant on foreign bank financing to roughly the same extent as the SP countries on a *consolidated* basis, which includes not just cross-border bank flows, but also local lending by resident foreign branches and subsidiaries. But cross-border bank flows to the CE4 countries have been far less pronounced than in the SP (Figure 4). In the run-up to the financial crisis, cross-border claims on the SP countries built-up to a much larger extent than in CE4 countries, and the corresponding deleveraging was also much sharper. Foreign bank lending to the CE4 contained a relatively larger share of local lending by resident banks, which tend to support their lending operations through local deposits and are thus more stable and less prone to sudden reversals. However, there are important differences between CE4 countries; in particular, the share of cross-border bank flows was much larger in Hungary (where the pattern more closely resembled the SP countries).

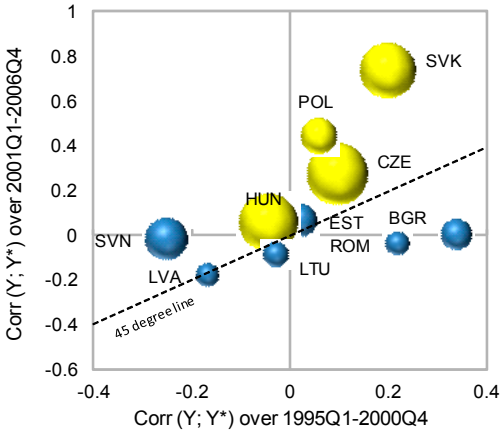
10. Overall, therefore, it would appear that the external financial linkages supporting the GCESC countries have developed in a sustainable fashion over time. The stock position indicates the predominance of FDI and lending by foreign-owned but locally resident banks. FDI is a relatively stable source of external funding, and holds up better during external crises, as documented by a well-established literature, most recently, Catao and Milesi-Ferretti (2013). FDI was directed to the manufacturing—and in particular, motor vehicles and other transport equipment—sectors, and a substantial amount of this FDI comprised greenfield investments. By way of contrast, the SP attracted a greater share of portfolio and cross-border banking flows, which—with the benefit of hindsight—exacerbated overheating pressures. In general, while FDI flows promoted durable growth in the CE4, non-FDI flows added to macroeconomic and financial imbalances across the SP.

MACROECONOMIC CONSEQUENCES AND POLICY IMPLICATIONS

A. Business Cycle Synchronization

11. The business cycles of the CE4 countries have become more synchronized with Germany. The CE4 countries stand out in a ranking of the bilateral conditional correlation of output gaps against Germany.[3] The conditional correlation has increased over time for all the CE4 countries except Hungary (Figure 5), and this is associated with the size of German VA embodied in the countries' exports. For other CEE countries, the output synchronization seems to have diminished over the time. This result—that greater vertical trade integration with Germany contributes to closer business cycle co-movement—is supported by a more formal econometric analysis that attempts to account for endogeneity concerns (see Background Note 1).

Figure 5. Conditional Correlation of Output Gap*



Source: WEO; and IMF staff estimates.
*Bubbles represent the size of German's Value-Added embodied in countries' i gross exports in 2009.

B. Technology Transfers

12. There is evidence that participation in the GCESC has led to considerable technology transfers to the CE4 countries. As documented in the previous section, export growth in knowledge-intensive sectors has been particularly rapid in the CE4 countries. Moreover, the share of these sectors in domestic value added exports has been increasing.

13. Revealed Comparative Advantage (RCA) patterns for the CE4 countries have evolved in line with such technology transfers.[4] Table 1 provides RCA calculations in the manufacturing sectors for the CE4 countries, Germany and some comparator countries. The manufacturing sectors are grouped into labor-intensive, capital-intensive, and knowledge-intensive sectors. The RCA calculations show that with the exception of Poland, all other CE4 countries have largely "caught up" with Germany's comparative advantage in the knowledge-intensive manufacturing sectors, which

[3] The correlation of output gaps is computed using output gaps (for each country and Germany) purged from the effect of global economic conditions. The resulting output gaps therefore represent idiosyncratic shocks observed in each country. See Background Note 1 for further details.

[4] Traditionally, RCA is defined as the proportion of a sector's exports in a country's total gross exports relative to the average share of the same sector's exports in the world's total exports. A value higher than one indicates that the country has a comparative advantage in that particular sector. Here RCA is calculated on the basis of domestic VA, as in Rahman and Zhao (2013). See Background Note 1 for further details.

are a significant part of the German supply chain. While there has been a concomitant loss of comparative advantage in the labor and capital-intensive sectors, even in these sectors the RCA index remains greater than one (except in Hungary). These trends differ from those in some euro area periphery countries, which have lost their comparative advantage in the knowledge-intensive sectors (Ireland and Spain) or retain their comparative disadvantage (Greece and Portugal).

Table 1. Revealed Comparative Advantage (RCA) in Manufacturing

	Manufacturing 1995			Manufacturing 2009		
	Labor-intensive	Capital-intensive	Knowledge-intensive	Labor-intensive	Capital-intensive	Knowledge-intensive
Czech	1.29	1.30	0.56	1.01	1.16	1.18
Hungary	0.68	1.06	0.50	0.37	0.77	1.18
Poland	1.95	1.39	0.59	1.52	1.39	0.93
Slovakia	1.05	1.61	0.60	1.16	1.41	1.11
Germany	0.64	1.07	1.48	0.64	1.20	1.49
Portugal	3.42	0.94	0.57	2.08	1.43	0.60
Spain	0.93	1.21	1.04	0.97	1.29	0.98
Ireland	0.34	1.79	1.01	0.11	0.72	0.89
Greece	1.56	1.26	0.03	0.33	0.72	0.20
China	3.55	1.03	0.64	2.52	0.66	1.27

Source: Rahman and Zhao (2013).

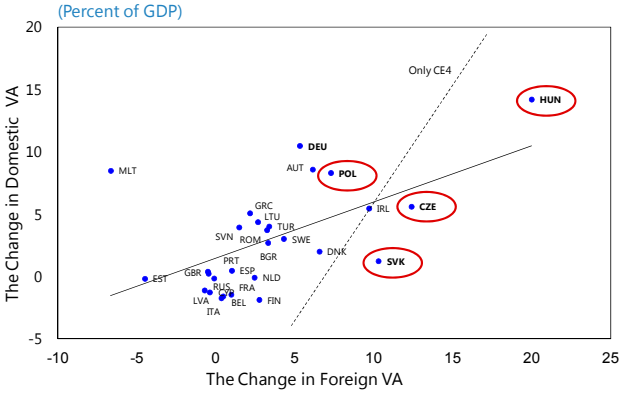
14. Integration into the GCESC has greatly enhanced CE4 competitiveness in knowledge-intensive sectors. With the progression of income convergence and narrowing of unit labor cost differentials with Germany, the CE4 countries may struggle to sustain their current role in the supply chain and further benefit from the vertical specialization. In addition, other CEE economies have made substantial progress in removing impediments to trade and improving the business environment, increasing their attractiveness as new potential links in the GCESC. In order to remain part of the GCESC—or indeed, to branch out into more specialized export production activities of their own—the CE4 countries will likely need to continue investing in human capital and upgrading labor skills to cement their comparative advantage in the region. This would facilitate moving up the value chain, as countries in Asia, notably China, are doing.[5]

[5] IMF (2011) documents that China is moving beyond its earlier predominant role as a downstream assembler of manufactured products, and accounts for a burgeoning share of intermediate inputs into advanced countries' high technology exports.

C. Spillovers to Domestic Production

15. The increase in foreign value added in CE4 exports appears to have spurred domestic value added (DVA). While the shares of DVA in gross exports have broadly declined, they have increased significantly in nominal terms and as a percentage of GDP (Figure 6). The increase in domestic VA was positively correlated with the increase in foreign value added (FVA). Importantly, Rahman and Zhao (2013), who examine the relationship between foreign and domestic VA growth across 40 countries during 1995-2008, find econometric evidence that causality runs from growth in FVA to DVA.

Figure 6. The Change in Foreign and Domestic Value Added in Total Exports, 1995-2009
(Percent of GDP)



Source: IMF staff calculations based on the WIOT.

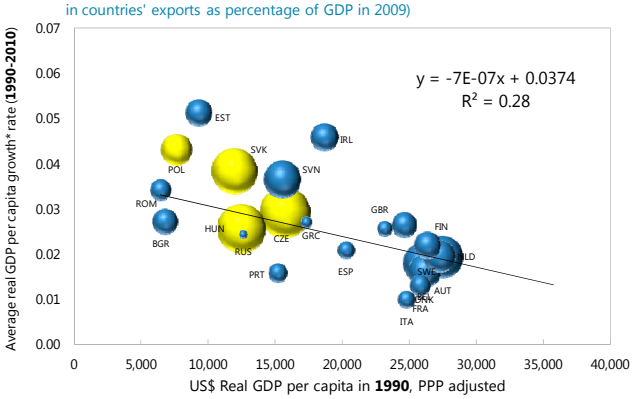
16. Thus attracting FVA—as part of integrating into the vertical supply chain—complements rather than substitutes for domestic production. The existence of the supply chain creates demand for ancillary products and services in host economies. This contributes to an expansion of the production possibility frontier and spurs overall employment and growth. So policies aimed at improving an economy's attractiveness for the supply chain are unlikely to come at the expense of domestic industries; instead the latter in general benefit from positive spillovers from supply chain activities.

D. Income Convergence

17. There are several channels through which trade—and supply chains in particular—may foster growth and income convergence. Trade can stimulate productivity gains, especially if supported by investment that embodies technological transfers with spillovers to other sectors in the economy. It could also foster financial deepening. Moreover, trade can contribute to specialization in highly productive sectors, which could generate efficiency gains for the economy as a whole.

18. The CE4 economies have generally grown more rapidly than can be explained simply by initial income, suggesting that membership in the GCESC accelerated income convergence. Figure 7 illustrates that over the last two decades income convergence was broadly prevalent in Europe. Greater technological catch-up, improved functioning of markets, greater market access, and better institutions have allowed

Figure 7. Income Convergence and the Role of Supply Chains
(Bubble size is proportional to the share of German foreign value added embodied in countries' exports as percentage of GDP in 2009)



Sources: Penn World Table 7.1.; WIOT; IMF Staff estimates. (*) Instantaneous growth rate.

developing countries, mostly from the CEE region, to grow faster than richer economies. But the CE4 countries, with the exception of Hungary, lie above the regression line, implying that, controlling for initial income, they grew faster than average. The importance of the supply chain is confirmed using a more formal econometric approach, in which the beta convergence co-efficient is allowed to vary according to the amount of foreign VA in a country's exports (see Background Note 1 for further details). Exposure to External Shocks

19. Greater trade openness has increased the vulnerability of both Germany and the individual CE4 countries to global shocks. A six-region version of the IMF's Global Integrated Monetary and Fiscal (GIMF) model is calibrated to capture the way in which the evolution of the GCESC has changed the transmission of shocks (Background Note 3). Each region exports and imports both final (consumption and investment) and intermediate goods; thus capturing the changing trade relationship between Germany, the CE4, and other key trading partners. Figure 8 summarizes the peak impact of a 1 percent aggregate demand (private consumption and investment) shock originating either in Germany, or in the non-European blocks of the model (Emerging Asia, the U.S., and remaining countries). This shock is motivated by the collapse of world trade during the global financial crisis of 2008-09. It shows the percent deviation of real GDP from the baseline in Germany and in the CE4 region.

Figure 8. Aggregate Demand Shock
(Real GDP, percent deviation from baseline)

Source: IMF staff calculations.

20. German domestic demand spillovers to the CE4 have increased over time but remain relatively small, while greater openness has lessened the domestic impact of a pure domestic demand shock originating in Germany. The CE4 is only slightly more vulnerable to domestic demand shocks in Germany in 2011 than in 1996 (similar to other euro area countries), despite far more developed trade links. This is explained by the supply chain nature of the trade integration: final demand in Germany is *not* the main determinant of CE4 exports to Germany. Meanwhile, the impact on German GDP of an aggregate demand shock originating within Germany has *declined* substantially between 1996 and 2011. Germany's openness has greatly increased over the period, with the export-to-GDP ratio doubling from 24 percent to around 48 percent. Because Germany is more open in 2011, the economy is characterized by more "leakage", and therefore a lower domestic impact multiplier. Note that this simulation of an aggregate shock to domestic demand in Germany is virtually identical to modeling the impact of German *policy action*—for example fiscal contraction (or stimulus) —on the domestic economy and the CE4 countries. German fiscal policy has less domestic impact now than in the 1990s, due to greater openness, and the impact on the CE4 economies is relatively limited because of the nature of trade linkages. To a much larger extent than before, spillovers from German domestic demand are directed towards trade partners outside Europe, including emerging Asia.

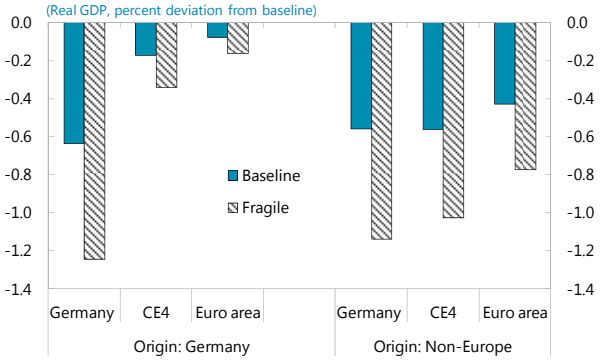
21. Because the GCESC has become more open, spillovers from the rest of the world are now much larger. In response to non-European demand shocks, real GDP in both Germany and the CE4 dips below baseline by considerably more in 2011 than in 1996. This is because both economies have become more open, and are thus more susceptible to fluctuations in global economic activity. The larger downturns are compounded by indirect effects because intra-European economic activity slows down, acting as an additional drag on growth. Also, the size of the "rest of the world" (especially emerging Asia) has increased disproportionately over time, and the impact of shocks originating here has increased correspondingly.[6] Again, simulating a shock to aggregate demand in the rest of the world is akin to considering co-ordinated *policy action* in the rest of the world. Thus a fully co-ordinated non-European fiscal action of a given magnitude (in percent of GDP) would have a much greater impact on both the German and CE4 economies than a purely German fiscal action of the same magnitude.

E. The Importance of German Balance Sheets

22. At present balance sheets in Germany are generally healthy. Low debt-to-GDP ratios prevail in the household, corporate and government sectors (Background Note 3). The country's safe haven status is reflected in the growing and persistent divergence in yields between Germany and other countries in the region.

23. Model simulations suggest that fundamentals in Germany are an important determinant of the magnitude of shock spillovers to CE4 countries. To assess these linkages, the GIMF model was calibrated to an alternative scenario under which Germany has weaker household, corporate, and sovereign balance sheets (see Background Note 3 for details). As before an aggregate demand shock originating in either Germany or the rest of the world (non-European blocks) is shown in Figure 9. The negative impact on real GDP triggered by the domestic shock is much larger when balance sheets are more fragile in Germany. A key reason is the stronger financial accelerator.[7] This makes the German economy much more

Figure 9. Role of German Balance Sheets in Mediating an Aggregate Demand Shock
(Real GDP, percent deviation from baseline)



Source: IMF staff calculations.

[6] Although not captured by the model, increasing exposure to the outside world has been accompanied by concentration risk in certain sectors such as automobiles. An external shock that had a large differential impact on the automobile sector (such as an energy shock), could have a disproportionately large impact on GCESC countries.

[7] Weaker corporate balance sheets, for example, would be associated with a larger increase in spreads, and a more severe decline in investment. The decline in economic activity would in turn further impair balance sheets, thereby triggering a vicious cycle.

sensitive to shocks, a situation which is further exacerbated by corporate credit spreads, the higher stock of government debt and greater share of liquidity constrained households. The larger economic contraction in German is also transmitted across borders, causing more pronounced declines in real GDP in CE4 countries and the rest of the euro area. This wider European slowdown then has feedback effects on the GCESC countries. Relatedly, sensitivity to global shocks in CE4 countries (and other euro area countries) increases very considerably under a scenario of fragile German balance sheets. The implication is that healthy German balance sheets have the characteristics of a public good: they generate positive spillovers that extend well beyond Germany, serving as a buffer against external shocks for the whole GCESC (and beyond).

KEY CONCLUSIONS

This section summarizes the key conclusions and policy dialogue with GCESC country authorities at a conference in Prague on June 14.

24. Conventional trade statistics are a poor guide to bilateral export exposures for supply chain countries. A value added decomposition shows that CE4 countries' bilateral exposure to final demand in Germany is much less than that implied by the IMF's DOT statistics, and its exposure to the rest of the world much greater. For Germany, the exposure to European countries (including the CE4) is substantially lower, and exposure to non-European countries higher. *Authorities agreed that the value added decomposition was more useful in examining final exposures than bilateral trade statistics. More generally, for analytical purposes they saw merit in examining the consolidated external position of the supply chain countries vis-à-vis the rest of the world, since this would net out supply chain-related intermediate goods trade..*

25. The evolution of the GCESC has been supported by large inflows of foreign direct investment (FDI) to CE4 countries. The pattern of capital inflows differs considerably from many other European comparators—such as SP countries—for whom FDI was less important and portfolio inflows more so. In the CE4 countries greenfield investment—which most directly expands productive capacity—comprised a much larger share of FDI than mergers and acquisitions. Much of the FDI directed to the CE4 countries was in the transport sector, consistent with the rapid offshoring of the German automobile industry. *The Hungarian authorities noted that FDI inflows to their country not only proved more stable during the global crisis, but tended to finance production, whereas portfolio inflows in the pre-crisis period created an unsustainable consumption boom. There was general acknowledgement that the GCESC had been accompanied by substantial FDI inflows, and that such inflows represented the "best" form of external financing.*

26. While foreign bank finance has been important in the CE4, *cross-border* bank flows have been less pronounced. On a consolidated basis**,** foreign bank financing in the CE4 since 1995 has been at broadly comparable levels to SP countries. But this includes not just cross-border bank flows but also local lending by foreign-owned but domestically resident subsidiaries. The cross-border component—which tends to be the most prone to sudden stops and reversals—was much larger for the SP, whereas local lending, supported by local deposits, was more pronounced in the

CE4. *Participants felt that the distinction between cross-border and locally-supported foreign bank financing was a crucial one. Several authorities also noted that penetration by German banks in the CE4 countries was not commensurate with GCESC activities. They pointed to the "first-mover" advantage enjoyed by Austrian banks in the region, and observed that parent company rather than bank funding was used by at least some large supply chain companies.*

27. Participation in the GCESC has led to considerable technology transfers to the CE4 countries. Export growth in knowledge-intensive sectors has been particularly rapid in the CE4 countries. The sophistication of domestic VA embodied in overall exports also appears to have increased rapidly. With the exception of Poland, all other CE4 countries have largely "caught up" with Germany's comparative advantage in knowledge-intensive manufacturing sectors. *There was a lively debate about whether export growth in knowledge intensive sectors – especially automobile production – really represented technology transfer and human capital development, or simply entailed low-skilled assembly jobs within a high tech industry. Publically available data are insufficiently granular to illuminate this distinction. CE4 participants emphasized that while overall the GCESC has undoubtedly created knowledge spillovers, there is heterogeneity across firms in terms of fostering skills. The Czech representatives pointed to Skoda (owned by Volkswagen) as a good example of a company that develops workers' technical skills: the firm has its own University. Skoda's Czech operations have evolved towards producing relatively high value added components. The company now owns subsidiary plants in countries such as China, India and Russia, where final assembly is undertaken for several markets. By contrast, other foreign-owned car plants in the Czech Republic specialize in downstream activities.*

28. The increase in foreign value added in CE4 exports appears to have spurred domestic value added. The existence of the supply chain creates demand for ancillary products and services in host economies. This contributes to an expansion of the production possibility frontier and spurs overall employment and growth. The complementarity between supply chain activities and domestic production has led overall to greater synchronization of the business cycle among GCESC countries. *The German authorities in particular emphasized the importance of this finding. Production within a vertically specialized chain is not a "zero sum game". The potential gains in employment as a result of production spillovers should be kept in mind when considering labor market reforms or during negotiations between industry and labor unions.*

29. Integration into the GCESC has accelerated income convergence. Within a sample of European countries, the CE4 economies have generally grown more rapidly over the last two decades than can be explained simply by initial income levels. This is consistent with the evidence regarding technology transfers, enhanced competitiveness in skill-intensive sectors, and positive spillovers from supply chain activities to domestic production. *The authorities agreed that GCESC investment and production activities had played a key role in fostering income convergence.*

30. The issue of safeguarding enhanced competitiveness in knowledge-intensive sectors received considerable attention. With the progression of income convergence and narrowing of unit labor cost differentials with Germany, the CE4 countries may struggle to sustain their current role in the supply chain and further benefit from the vertical specialization. In order to remain part of

the GCESC—or indeed, to branch out into more specialized export production activities of their own—the CE4 countries will likely need to continue investing in human capital and upgrading labor skills to cement their comparative advantage in the region. The aspiration should be to move up the value chain, as countries in Asia, notably China, have done. *All the authorities agreed that it was important for downstream countries to gradually move towards more sophisticated activities, although the German authorities pointed out that there was no imminent threat to the position of CE4 countries in the value chain despite narrowing cost differentials. German business surveys show that the CE4 countries remain favored destinations of supply chain investment, due to their skilled labor forces and track record in the relevant industries. As noted above, the Czech authorities highlighted Skoda as a successful example of upstream evolution over time. Participants agreed on the importance of technical training to upgrade labor force skills, and felt that much could be learned from the German model of combining vocational education with business apprenticeships. The Czech authorities are considering a scheme offering tax breaks to companies that provide technical education. The Hungarian and Polish authorities pointed out that skills shortages were linked to the wider demographic problem of ageing populations, which will require policy action across several dimensions.*

31. German domestic demand spillovers to the CE4 have increased over time but remain relatively small. This is explained by the supply chain nature of the trade integration: final demand in Germany is not the main determinant of CE4 exports to Germany. As a corollary, German fiscal policies to stimulate or contract domestic demand have a relatively limited impact on CE4 economies. Meanwhile, the impact on German GDP of an aggregate demand shock originating within Germany has *declined* substantially, due to Germany's increasing openness. *The Slovak authorities noted that there is potentially some tension between the findings of greater business cycle synchronization, and limited domestic demand spillovers from Germany to the CE4. The ensuing discussion clarified the difference between* domestic *demand spillovers from Germany (which are relatively small), and demand spillovers from Germany related to the production chain (which are large, but originate in countries to which goods are finally exported). The latter can increase business cycle synchronization between Germany and the CE4.*

32. Because the GCESC countries have become more open, spillovers from the rest of the world are now much larger. In response to non-European demand shocks, real GDP in both Germany and the CE4 dips below baseline by considerably more in 2011 than in 1996. The larger downturns are compounded by indirect effects because intra-European economic activity slows down, acting as an additional drag on growth. A fully co-ordinated non-European fiscal action of a given magnitude (in percent of GDP) would have a much greater impact on both the German and CE4 economies than a purely German fiscal action of the same magnitude. *Authorities agreed that exposure to external shocks had increased substantially with the evolution of the GCESC, and that this represents a key policy challenge going forward. The Hungarian authorities furthermore pointed out that the small size of some of the CE4 countries relative to supply chain firms can be a concern in this context: Nokia's loss of market share after the financial crisis had a large impact on Hungary's exports. Participants agreed that diversification of export markets and product lines could help reduce vulnerability to external shocks. There was also a lively discussion on the merits of a flexible exchange*

rate in adjusting to external shocks. Polish, Hungarian and Czech authorities held that a flexible exchange rate provided an important buffer against volatile external demand. But the Slovak authorities argued that flexible exchange rates were not very helpful in 2008-09, against a background of collapsing external demand. They also noted that a fixed exchange rate reduces currency risk within *the supply chain. Slovakia has enjoyed vigorous growth in exports and GDP under the euro.*

33. Balance sheet fundamentals in Germany are an important determinant of the magnitude of shock spillovers to CE4 countries. At present balance sheets in Germany are generally healthy. Low debt-to-GDP ratios prevail in the household, corporate and government sectors, and the country is regarded by investors as a safe haven. Simulations suggest more leveraged balance sheets and greater sovereign risk in Germany would considerably magnify the impact of external shocks. Thus healthy German balance sheets have the characteristics of a public good: they generate positive spillovers that extend well beyond Germany, serving as a buffer against external shocks for the whole GCESC (and beyond). *CE4 participants broadly agreed on the advantages of the supply chain being anchored by a country with strong fundamentals and low sovereign risk.*