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TARGET Balances

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TARGET Balances— An Anchor of Stability

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The debate about TARGET2, the payment system of the European System of Central Banks (ESCB), has resulted in controversial discussions in Germany in recent years. The present study by DIW Berlin concludes that fears often expressed in this context of the risks to Germany are largely unfounded. Germany is—in contrast to what is often claimed—one the beneficiaries of the Target system. In particular, the fact that in the course of the crisis, financial risks could easily be reduced thanks to TARGET2 was beneficial for both the German government and private investors. Since the outbreak of the crisis, German investors pulled almost €400 billion euros from the crisis countries and they continue to hold around €740 billion in assets there.

TARGET2 (T2) is the payment system of the Eurosystem, the European Central Bank (ECB), and the national central banks of the euro area countries. Payments via T2 are processed in central bank money (synonymous for central bank liquidity). The accounts of the financial institutions participating in the payment system are held by the national central bank of the country where these institutions are licensed.[1] The national central bank records a T2 asset on its balance sheet when a bank receives payments in euros from other European countries. Conversely, a T2 liability is recorded at the central bank whenever the commercial bank makes a transfer abroad. At the end of the day, all assets and liabilities of this kind are consolidated into a single position against the ECB which acts as the central counterparty.

If the T2 position eventually booked is an asset against the ECB, then the country is a net recipient of central bank money. In the case of a liability owed to the ECB, the country's banks transferred more central bank money abroad than they have received.

What Happens When a Country Leaves the Monetary Union?

T2 positions are a mirror image of the cross-border use of liquidity previously borrowed from the central bank; consequently, they are initially without additional risk that extends beyond that of providing central bank liquidity.[2]

However, in the case of a member country, whose national central bank has a balance of T2 liabilities, exiting the currency union, it is possible that the remaining Eurosystem looses its T2 claims.

1 For the sake of simplicity, financial institutions participating in the target payments scheme will simply be referred to as banks.

2 See also "Liquiditätsmanagement des Eurosystems im Zeichen der Krise," Wochenbericht des DIW Berlin, no. 44 (2013).

In case of exit, the right of the national bank of the exiting country to issue central bank money denominated in euro is terminated. But previously incurred euro liabilities owed to the ECB are not terminated. As a result, when a country leaves the system, its T2 liabilities turn into foreign currency debt, which may no longer be serviced.

The Eurosystem would then split up the resulting losses in accordance with the ECB's capital key[3] (which would then be recalculated) among the remaining national central banks.

For example, the German Central Bank and/or the Federal Republic of Germany would have to bear at least 27 percent (current capital share) of such losses. If , say, Greece exited, then this amount would currently be around 14.5 billion euros (T2 positions only).[4]

At the current point in time, it is completely unclear as to how a member country would exit the Monetary Union and how high the recovery values of individual claims would be if this were to happen. The cost of exiting is therefore difficult to assess. However, the frequently made assumption that all claims would be wiped out is—given the historical experiences of managing sovereign debt crises—hardly plausible.[5]

TARGET2 Payment System ...

In the context of the crisis in the euro area, the debate about TARGET2 positions has received unexpected attention and, in recent years, has become a subject of interest not only to professionals but also to the general public. However, while alleged risks have been extensively discussed, many important aspects have been ignored.

... has Allowed German Investors to Reduce Risks in Crisis Countries

German banks and investors have reduced their claims against Greece, Italy, Ireland, Portugal, Spain, and Cyprus since 2007 to around €400 billion (see Tables 1 to 3).[6] Since 2007, German banks have withdrawn around €360 billion, in particular bank loans, from the entire euro area. This includes €312 billion from the crisis countries. Furthermore, German investors also reduced their securities holdings in the six crisis countries by approximately €90 billion. Yet, remaining German foreign investment is still significantly high—approximately €2.4 trillion in the euro area, plus an additional €2.4 trillion in the rest of the world. In total, German foreign asset holdings are almost twice the annual economic output of Germany in 2012.

Four important conclusions can be derived from the available data:

- German investors have reduced their investments in virtually all regions of the world; bank loans in particular were affected, while portfolio investments declined predominantly in the crisis countries. A substantial share of the pre-crisis capital inflows into these countries was repatriated.
- Not only German investors repatriated their capital, but, at the same time, foreign investors have also significantly reduced their investments in Germany. This reflects the growing fragmentation of financial and capital markets in the euro area.
- The volume of these capital flows is considerable. The flow of capital from the rest of the euro area to Germany amounts to approximately €400 billion which corresponds to around 15 percent of German output in 2012. A more severe crisis in the euro area would therefore result in potentially high costs for German investors, should borrowers go bankrupt or should the access to assets be limited.
- Germany would not only have to bear these losses but its exports would also be severely affected by a worsening of the crisis. Between 2009 and 2012, Germany exported goods valued at €428 billion (see Table 4) to the crisis countries of the euro area.

The fact that German investors were able to reduce their investments in these countries on a large scale without causing more serious distortions in financial markets is mainly due to the provision of unlimited liquidity as part of the full allotment procedure of the Eurosystem and the smoothly functioning TARGET2 payment system. This prevented widespread fire sales of assets below their fundamental value in the crisis countries. At the same time, the liquidity support strengthened financial stability in Germany: without it and the T2 payment system, some of the assets would have defaulted. In the

3 The capital key quantifies the share of equity that was paid in by the respective member states when the ECB was founded.

4 If the entire Monetary Union were to collapse, then the German Central Bank would still have claims denominated in euros against the ECB , an institution which would no longer exist. As a result, all countries with net claims would probably share the liquidation value of the ECB. This, however, would (at the current juncture) not suffice to redeem all T2 claims.

5 See F. Sturzenegger and J. Zettelmeyer, Debt Defaults and Lessons from a Decade of Crises (Cambridge, Massachusetts: 2006).

6 See also H.-W. Sinn and T. Wollmershäuser, „Target-Salden und die deutsche Kapitalbilanz im Zeichen der europäischen Schuldenkrise," Kredit und Kapital 45 (4), (2012): 465–487.

Table 1

Other Investments from and in Germany

In billions of euros

	Claims			Liabilities			Net assets		
	2008	2013	Change	2008	2013	Change	2008	2013	Change
Euro area	**1,125.76**	**764.96**	**–360.79**	**788.86**	**572.06**	**–216.79**	**336.90**	**192.90**	**–144.00**
GIIPS & Cyprus	590.48	277.84	–312.64	346.75	226.65	–120.10	243.73	51.19	–192.53
Non-GIIPS & Cyprus	535.28	487.12	–48.16	442.11	345.42	–96.69	93.17	141.71	48.53
EU	**1,759.14**	**1,189.73**	**–569.41**	**970.46**	**787.38**	**–183.08**	**788.68**	**402.36**	**–386.32**
Non-euro area	633.38	424.77	–208.61	181.60	215.31	33.71	451.78	209.46	–242.32
World	**2,823.90**	**2,008.69**	**–815.21**	**1,281.20**	**1,153.12**	**–128.08**	**1,542.70**	**855.57**	**–687.13**

Sources: BIS consolidated banking statistics; calculations by DIW Berlin.

German investors have significantly reduced their receivables from the crisis countries.

Table 2

Portfolio investments from and in Germany

In billions of euros

	Claims			Liabilities			Net claims		
	2007	2011	Change	2007	2011	Change	2007	2011	Change
Euro area	**1,207**	**1,222**	**15**	**1,052**	**973**	**–79**	**156**	**249**	**94**
GIIPS & Cyprus	474	385	–89	261	221	–40	213	164	–48
Non-GIIPS & Cyprus	734	837	103	791	752	–39	–57	85	142
EU	**1,407**	**1,459**	**52**	**1,239**	**1,167**	**–73**	**168**	**292**	**124**
Non-euro area	200	237	37	188	194	6	12	43	30
World	**1,783**	**1,840**	**57**	**2,193**	**2,179**	**–14**	**–410**	**–339**	**71**

Sources: IMF; CPIS; calculations by DIW Berlin.

German investors have reduced their securities investments in the crisis countries; at the same time, investors from the crisis countries also reduced their investment in Germany.

Table 3

Foreign Direct Investments from and in Germany

In billions of euros

	Claims			Liabilities			Net claims		
	2009	2011	Change	2009	2011	Change	2009	2011	Change
Euro area	**327**	**385**	**59**	**402**	**437**	**35**	**–75**	**–51**	**24**
GIIPS & Cyprus	70	72	2	54	54	0	16	18	2
Non-GIIPS & Cyprus	257	314	57	348	383	35	–91	–69	22
EU	**483**	**556**	**73**	**471**	**522**	**52**	**12**	**33**	**21**
Non-euro area	156	171	15	69	86	17	87	85	–2
World	**778**	**932**	**154**	**638**	**707**	**70**	**140**	**225**	**84**

Sources: IMF; CDIS; calculations by DIW Berlin.

German direct investment in the crisis countries remained moderate with virtually no change; direct investment from the crisis countries remained unchanged.

Table 4

Cumulative Trade Flows for Germany between 2009 and 2012
In billions of euros

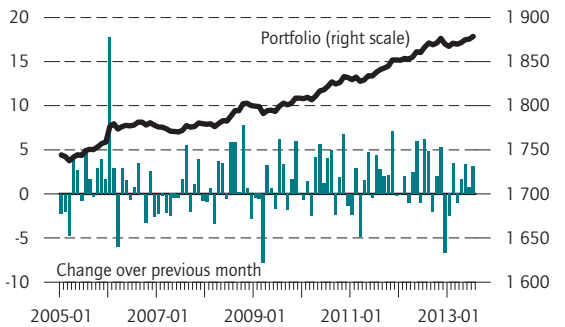
	Exports	Imports	Trade surplus
Euro area	1,560	1,462	97
GIIPS & Cyprus	428	314	114
Non-GIIPS & Cyprus	1,132	1,149	–16
EU	2,320	2 076	244
Non-euro area	760	613	147
World	3,728	3,231	498

Sources: IMF, Direction of Trade Statistics; calculations by DIW Berlin.

Germany exports more goods to the crisis countries than it imports.

Figure 1

Long-Term Loans from German Commercial Banks to German Companies and Private Households
In billions of euros



Source: German Central Bank.

Long-term lending to the private sector continued to grow in Germany, even during the crisis.

event of bankruptcy of foreign borrowers, German investors would have to accept massive depreciations; in turn, this would have reduced, among other things, the core capital[7] of German banks and probably necessitated additionalgovernment rescue packages.

... does Not Restrict Lending to Households and Businesses in Germany

Thanks to payment inflows from abroad, German banks were able to reduce their recourse to monetary policy refinancing operations during the crisis. Consequently, the Bundesbank recorded a reduction in claims against German banks. At the same time, it recorded additional T2 assets against the ECB resulting from payment inflows to Germany. This fact has raised fears that the German economy could be stripped of its loans because T2 receivables from the ECB were interpreted as foreign loans which are no longer available in Germany.[8]

However, based on the available data, this claim cannot be put to a test since the volume of loans not granted is not observable; hence, empirically, a corresponding relationship can neither be proved nor disproved.[9]

However, the Bundesbank statistics related to the development of lending to companies and households by German banks did not show a general decline (see Figures 1 to 3). Loans to the German private sector actually increased from the outbreak of the crisis to date. Only short-term lending declined between 2009 and 2011, but then increased again and has been moving sideways since the end of 2011.

In addition, economic theory suggests that there is no cause for the concern that higher T2 claims could reduce lending in Germany, since commercial bank lending is not controlled by the central bank but by the commercial banks themselves. The key determinants here include the creditworthiness of borrowers, the internal risk management of the commercial bank, the regulatory conditions, or the overall economic situation.[10]

7 Measured according to *Tier 1 capital*–relevant to, among other things, banking regulations–the equity capital ratio of German banks in 2012 was 11.9 percent. Measured according to the ratio of *tangible equity* to *tangible assets*, however, it was only 2.2 percent. See IMF, Global Financial Stability Report. October 2012 (International Monetary Fund, 2012).

8 See also H.-W. Sinn and T. Wollmershäuser, „Target-Kredite, Leistungsbilanzsalden und Kapitalverkehr: Der Rettungsschirm der EZB," ifo Working Paper, no. 105 (June 24, 2011): "Since the Bundesbank did not issue the credit to a German transportation company via a German commercial bank but via the European central banking system and a Greek commercial bank to a Greek transportation company, the truck is delivered to a Greek instead of a German transportation company. For jobs at the German truck manufacturer, both amount to the same thing, and also the amount of money that circulates in Germany after the transaction is the same. The only difference is that the truck now operates in Greece instead of Germany." 29. It should be noted here that Sinn and Wollmershäuser do not revisit this issue in later versions of this article without giving reasons. However, in connection with the facts outlined above, they used the term *crowding out of refinancing credit*, according to which liquidity inflows from the T2 system to banks in non-crisis countries mean that they can cover their liquidity needs without recourse to central bank facilities. A detailed description of this situation and the underlying balance-sheet mechanics were already available in U. Bindseil and P. King (2011).

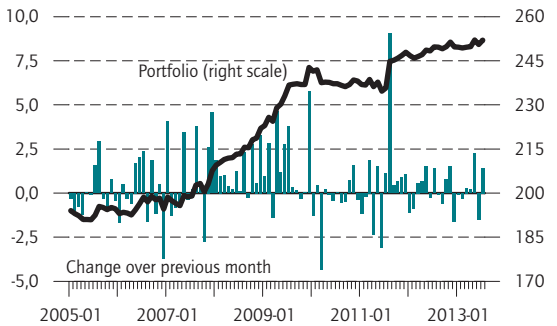
9 See also U. Bindseil, P. König, and P. Cour-Thimann, „Target2 and Cross-border Interbank Payments during the Financial Crisis" in: H.-W. Sinn, (pub.) „The European Balance of Payments Crisis," CESifo Forum, vol. 13 (2012).

10 See, for example, X. Freixas and J.C. Rochet, The Microeconomics of Banking (Cambridge, Massachusetts: 2008). J. Tobin, „Commercial Banks as

Figure 2

Medium-Term Loans from German Commercial Banks to German Companies and Private Households

In billions of euros



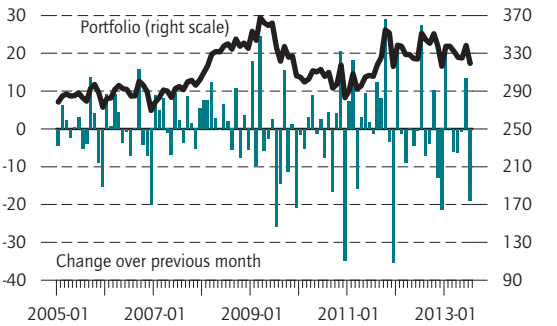
Source: German Central Bank.

Medium-term lending to the private sector continued to grow in Germany, even during the crisis.

Figure 3

Short-Term Loans from German Commercial Banks to German Companies and Private Households

In billions of euros



Source: German Central Bank.

Short-term loans declined between 2009 and 2010 but then rose again and are now largely moving sideways.

Commercial banks must keep a minimum of liquidity at the central bank, first, to be legally competent, settle financial transactions, and manage their liquidity, and second, to meet minimum reserve requirements. However, liquidity inflows from abroad do not negatively affect this mechanism. If conditions remain unchanged, an influx of liquidity from the crisis countries to Germany in fact increases German banks' ability to remain liquid without additional central bank credit.

... and Provision of Liquidity by Eurosystem Has Stabilizing Effect

According to some critics of the T2 system, it will prevent necessary economic adjustments such as reducing current account deficits.

For an economy with an independent monetary and exchange rate regime, a fast and effective way to partially adjust to a flight of capital is to devalue its currency, which would improve its international price competitiveness and its current account position.

Within a monetary union, however, the exchange rate mechanism is deactivated such that the corresponding adjustment has to be made in other ways, in particular, through economic reforms and by reducing prices of tradeable (transportable) goods and services. Certainly, the reform packages needed, from decision-making to implementation and development, will take a long time.

ECB liquidity support and the ability to use this liquidity within the euro area via the T2 system have helped overcome the flight of capital and facilitated the adjustment of current accounts in the crisis countries. Although consequences such as excessive indebtedness in the corporate and banking sector, unemployment, and a massive drop in production could not be prevented, they were at least minimized, because it became possible to make the adjustment gradually rather than abruptly.

However, the consequences of the alternative course of action—no liquidity provision resulting in a sudden enforced adjustment—would have been fatal both for the crisis countries themselves and for the euro area as a whole. The result would have been a much sharper decline in imports in the crisis countries which would also have severely affected German exports (see Table 4). Assets in the crisis countries would have been massively devalued, resulting in high private and corporate over-indebtedness. This would have led to bankruptcies and loan defaults which themselves would also have ultimately affected the other euro area countries and Germany. The risk that the crisis would have spread to other healthy countries in the euro area would have been considerable. Without the provision of additional liquidity, many banks and therefore national economies would probably start to waver and ultimately sail a course towards insolvency—not simply because the national economies would actually be insolvent but because mar-

Creators of Money," in: D. Carson (pub.) Banking and Monetary Studies (Homewood, Illinois: 1963), 408-419; C. A. E. Goodhart, „Money, Credit, and Banking Behavior: Need For A new approach," National Institute Economic Review 214 (2010) F73 – F82.

ket participants would become incapacitated due to a lack of liquidity.

In this context, the question that needs clarification is how the risk of default by governments and banks is linked to the respective T2 positions. On the one hand, one could argue that market participants would infer from high T2 positions the unwillingness of an ailing government or a bank to undertake reforms. In this case, a deterioration in the T2 position would lead to a higher risk of default. On the other hand, it is possible that the causality is reversed. Then, a higher risk of default would lead to increased capital flight abroad and thus higher T2 liabilities.

Indeed, there is only a significant correlation between changes in CDS premiums (credit default swaps as a measure of the default risk for governments and banks), and changes in T2 positions (see Table 5) for Spain, Italy, and Ireland. However, this still says nothing about the actual causal direction of this relationship. A common test of causality (Granger causality) for Ireland and Spain shows that a higher probability of default by the government leads to higher T2 positions; conversely, a higher T2 position does not lead to a greater default risk. In contrast, there is no significant causal relationship for the remaining crisis countries and Germany (see Table 6).

This result shows that an increased likelihood of insolvency led to outflows of capital abroad and thus exacerbated the liquidity situation of these countries. This is not to say that these countries were actually insolvent. Rather, it shows that the increased T2 positions were a result of the gloomy economic situation in these countries; yet, they did not further exacerbate it.

... is Not a Fiscal Bailout Program

In the course of the T2 debate, the question arose as to whether Target positions constituted refinancing loans to governments and therefore can be classified as monetary financing.[11] It is true that the stabilizing effects of the Target mechanism allow governments to delay necessary fiscal consolidation. This may, on the one hand, contribute to a lack of confidence in financial markets but, on the other hand, the liquidity provided by the Target system is preventing an even deeper recession and will ultimately prevent the collapse of domestic markets.

Table 5

Correlation between Changes in the Target Position and Default Risk[1]

	Target
Germany	
CDS government	0.0053
CDS bank	0.2115
Spain	
CDS government	−0.2824*
CDS bank	−0.3827***
Italy	
CDS government	−0.3556**
CDS bank	−0.4142***
Greece	
CDS government	−0.0440
CDS bank	−0.2675*
Ireland	
CDS government	−0.3775**
CDS bank	−0.3131**
Portugal	
CDS government	0.2254
CDS bank	0.0887

*1 Calculations for the period after 2009 from monthly data; positive target position = receivable, negative target position = liability; significant levels: *** 1 percent, ** 5 percent, * 10 percent.*

Sources: Reuters; Credit Market Analysis (CMA); calculations by DIW Berlin.

For many countries, there is a correlation between changes in target positions and CDS premiums.

It should also not be overlooked that increasing T2 positions (whilst simultaneously recourse to central bank facilities) is, initially, purely mechanical in nature. If, for example, in times of crisis, there are capital flows from crisis countries to more stable countries in the Monetary Union, by definition a build-up of T2 liabilities in crisis countries and T2 claims in more stable countries occurs. By providing an effective payment system, the Eurosystem is fulfilling its tasks as laid down in the Treaty on the Functioning of the European Union (TFEU).

Reducing the Risks from Target Positions ...

One proposal to limit the risks associated with the Target system is to introduce an explicit upper limit for T2 positions.[12] The problem is that such a limit would destabilize the Monetary Union and increase the risk of an

11 H.-W. Sinn and T. Wollmershäuser, „Target-Salden."

12 H.-W. Sinn, „The ECB's Secret Bailout Strategy," April 29, 2011, http://www.project-syndicate.org/commentary/the-ecb-s-secret-bailout-strategy.

Table 6

Correlation between Target Positions and Default Probabilities
Granger causality test

	CDS government	CDS bank	Target
Germany			
CDS government, Granger causality for			–
CDS bank, Granger causality for			–
Target, Granger causality for	–	–	
Spain			
CDS government, Granger causality for			+
CDS bank, Granger causality for			–
Target, Granger causality for	–	–	
Italy			
CDS government, Granger causality for			–
CDS bank, Granger causality for			–
Target, Granger causality for	–	–	
Greece			
CDS government, Granger causality for			–
CDS bank, Granger causality for			–
Target, Granger causality for	–	–	
Ireland			
CDS government, Granger causality for			+
CDS bank, Granger causality for			–
Target, Granger causality for	–	–	
Portugal			
CDS government, Granger causality for			–
CDS bank, Granger causality for			–
Target, Granger causality for	–	–	

Sources: Reuters; Credit Market Analysis (CMA); calculations by DIW Berlin.

There is no Granger causality relationship between changes in target positions and those of CDS premiums for most countries.

exit. Firstly, it would trigger costly circumvention measures in which previously cashless cross-border transactions would then be made partly in cash. Secondly, there would be a real threat from speculative attacks and the return of crises through self-fulfilling prophecies, which—just think of the crisis of the European exchange-rate mechanism in the 1990s— would induce the risk of exit from the Monetary Union, and therefore the possibility of suffering losses on T2 claims.

… using the American Solution?

More recently, it has been proposed that the »American system« be applied to the Monetary Union.[13] Even within the American central bank system, there are positions similar to the T2 positions (known as ISA positions) on the balance sheets of the individual district reserve banks resulting from processing cashless payments between the reserve districts. These positions are partly offset annually, whereby district banks with ISA assets receive an additional share of the securities portfolio of the central bank system, while reducing the share of district banks with liabilities. This procedure is sometimes interpreted as a hard budget constraint for the relevant districts so that their introduction to the euro area could pave the way for a system of "fair and free exchange" with "budget restrictions which reflect the real scarcity of resources."[14]

The opinion that the annual settlement procedure in the US would be tantamount to a budget constraint is, however, doubtful. The annual settlement historically dates back to the time of the gold standard and is implemented to adjust the ratio of banknotes to gold certificates on the balance sheets of the district banks. Here, the average ISA position of the previous year is compensated for by adjusting the district banks' shares in the securities portfolio of the Federal Reserve System. This is purely an accounting procedure.[15] The district central bank receives no assets it can sell at its own discretion. The securities portfolio is managed centrally by a portfolio manager appointed by the New York Fed, not decentrally at the level of the individual district central banks.[16]

The reallocation of the portfolio shares within the settlement leads only to a reallocation of profits from the portfolio. This has no consequence in the US, as the largest share of central bank profits is already transferred to the US Treasury Department.[17]

It is also worth noting that the Federal Reserve has no explicit rules on how to proceed if a district central bank no longer owns sufficient shares in the portfolio to settle its average position.[18] If the American system were to introduce a binding restriction, then it would also need to specify a consequence of what would happen if the

13 See H.-W. Sinn, Die Target-Falle: Gefahren für unser Geld und unsere Kinder (Munich: 2012).

14 See H.-W. Sinn, „Die Target-Verluste im Fall des Auseinanderbrechens des Euro—Eine Replik auf DeGrauwe und Ji," ifo Schnelldienst 66 (01) (2013): 23.

15 See J. Klose and B. Weigert, „Das Verrechnungssystem der Federal Reserve und seine Übertragbarkeit auf den Euroraum," Wirtschaftsdienst 92 (4), (2012): 243–250.

16 P. Cour-Thimann, „Target Balances and the Crisis in the Euro Area," Cesifo Forum, no. 14, (2013).

17 The remaining share of the profits from the district central banks is transferred to the *member banks*.

18 See Financial Accounting Manual for Federal Reserve Banks, last modified September 3, 2013, www.federalreserve.gov/monetarypolicy/files/BSTfinaccountingmanual.pdf.

settlement could not be carried out. However, it is not plausible to assume that in such a case, the respective reserve district would be declared insolvent and no further payments could be processed from this district.

Furthermore, the introduction of the American system to the euro area is simply not possible because of lack of a suitable portfolio. The Federal Reserve system as a whole always has a sufficiently large portfolio of securities for the settlement because the Federal Reserve implements its monetary policy through outright purchases of securities. In contrast, the Eurosystem undertakes credit transactions, hence a corresponding portfolio could not be built up in the first place.

Although this argument is countered by the proposal to introduce a new national security to the euro area that can be used to compensate for T2 positions,[19] it is unclear how the national central banks would receive the securities needed for compensation. A purchase on the primary market of the respective home governments could be interpreted as monetary financing which is prohibited in the euro area.[20] In addition, this settlement procedure creates a direct link between banking and sovereign debt. A run on the banks in one country would immediately increase its sovereign debt. This runs counter to current efforts to decouple the already close links between banking and sovereign risks in the euro area. Ultimately, it is still unclear as to why this new security should be more valuable and less risky than other bonds issued by the respective governments.[21]

The introduction of the American system in the euro area would generally be problematic and fraught with many difficulties. In addition, it also induces, at least in the United States, no hard budget constraints. While the introduction of such restrictions in the euro area may make sense under certain circumstances, their introduction indirectly via the payment system that serves as the backbone of the Monetary Union would only contribute to its destabilization.

... Using the European Solution!

Losses from Target positions arising due to a member state leaving the Monetary Union could be reduced by implementing monetary policy centrally rather than by the national central banks.

In order for payments to be implemented through T2 at all, a central bank must provide the banking sector with appropriate liquidity as part of its monetary operations. To achieve this, it enters into corresponding collateralized credit agreements with the banks in its country; if a bank defaults on its liabilities, the national central bank can access the collateral to make good any potential losses.

What happens if a member state with T2 liabilities leaves the Monetary Union? The counter position to its T2 liabilities are recorded on the asset side of the balance sheet (either claims against banks in the country or securities outright holdings by the national central bank). These assets cover the T2 positions in principle, but the rest of the Eurosystem has no access to them after the country exits and only has the T2 claims from the national central bank. If monetary policy were fully centralized, for example, at the ECB in Frankfurt, the ECB could enter the credit contracts and receive access rights to the collateral on behalf of the entire Eurosystem.[22] In the event of a country leaving the Monetary Union, the remaining Eurosystem would have a claim against the banks (and not against a national central bank or government). If these banks became insolvent, the remaining Eurosystem could access the collateral to cover any losses.

If this procedure were introduced, the T2 positions would disappear from the balance sheets because payments would only be transacted through one simple balance sheet. Capital flows would continue and the possibility of capital flight would also remain. However, potential losses due to the exit of a member state would—at least partially—be covered.

However, it is possible that, in the event of a member state exiting the Monetary Union and a new national currency being introduced, the securities would also be re-denominated, so that, in certain cases, claims might no longer be covered completely.

These two objections, however, apply equally to the newly introduced compensation securities mentioned in the American solution above.

19 See H.-W. Sinn, „Die Target-Verluste im Fall des Auseinanderbrechens des Euro." ifo Schnelldienst 66 (01): 14-24.

20 See article 123 (1) of the Treaty on the Functioning of the European Union. For a more detailed discussion, in particular the problem of purchases in the secondary market, see S. Burgold and P. Voll, „Begrenzung von Target2 Risiken – ein kritischer Überblick," Perspektiven der Wirtschaftspolitik, special issue, no. 13 (2012): 103–121.

21 J. Klose and B. Weigert, „Das Verrechnungssystem."

22 At the same time, this would also mean that the national central banks would not be obliged to make final purchases of assets for monetary policy reasons or for investment or risk-control reasons.

Conclusion and Outlook

There is no alternative to the current structure of payments in the euro area via the Target system for the stability of the Monetary Union in its current state. To protect the Eurosystem against risks arising from the possibility of exit of individual members, a more centralized monetary system, as envisaged by the »European solution«, may effectively reduce the exposure to exit risks, insofar as the contractual structure of this proposal can minimize any legal uncertainties. The introduction of the »American system« and thus a regular settlement, however, does not seem to be a viable means of ensuring a stable monetary union, in particular due to the resulting close link between banking and sovereign risks.

Increasing imbalances in T2 positions between the countries have ultimately occurred by three mechanisms: the flight of capital from the crisis countries—also by German investors—the inactivity in the interbank market, through which the commercial banks lend virtually no money, and the resulting liquidity support from the ECB.

The build-up of excess liquidity, the T2 imbalances, and the rising demand for liquidity by banks from the crisis countries at the Central Bank are a consequence of the crisis and stem from changes in the behavior of market participants. In this situation, the Eurosystem replaces the interbank market to prevent liquidity-induced bankruptcies and provide the crisis countries time to make necessary adjustments through economic reforms.

Although the euro area has taken some steps to overcome the crisis; the willingness of the banks to lend to each other is, however, still not fully restored. There still remains a lack of confidence; banks from non-crisis countries with ample liquidity prefer to deposit their money with their national central bank rather than lend it to other institutions.

Once confidence has been restored, the European Central Bank will be in a position to curtail the provision of unlimited liquidity. Only then will Target balances be reduced again.

The return of confidence also goes hand in hand with a fundamental decision for Europe. The Target debate is a discussion about the pros and cons of the idea of European unity. It should be clear that certain decisions could result in the collapse of the European currency area with all the negative consequences that would bring in its wake.

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JEL: E44, E58, F34, G01, G15
Keywords: TARGET2, central bank liquidity, euro area crisis, capital flight

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SEVEN QUESTIONS TO CLAUDIA LAMBERT AND PHILIPP KÖNIG

»Settling TARGET Balances after the Euro Crisis«

1. TARGET2 is the electronic payment system of the Eurosystem. What's the basic principle of TARGET2? Philipp König: The national central banks and the ECB process payments within the Monetary Union via TARGET2. Here, a national central bank records a TARGET asset if more liquidity flows into the banks in its country via the payment system than they transfer abroad. Conversely, the national central bank records a TARGET2 liability if less central bank liquidity flows into the banks in its country than they transfer abroad.

2. How high are the Bundesbank's TARGET2 claims against the European Central Bank? Philipp König: These claims currently amount to around 570 billion euros. Before the crisis, they were very moderate and frequently fluctuated around zero. Since 2008, they have steadily risen in the course of the crisis and reached their highest level of around 750 billion euros in July 2012. They have fallen again since.

3. What impact does the level of these TARGET claims have on German commercial banks and their liquidity? Claudia Lambert: We estimate that German commercial banks are currently holding excess reserves of approximately 78 billion euros. New regulations, approved under Basel III, intended to encourage banks to secure their short- and long-term liquidity. These surplus reserves help to achieve this goal.

4. What are the risks associated with this? Philipp König: Currently, there are no direct risks resulting from holding excess reserves. But since there is virtually no interest on excess reserves, it is not profitable for banks to hold them. The banks will try to find a better way of investing them, which may lead to asset price upsurges. This could lead to asset price inflation. But there is no evidence of this at the moment.

5. How high are the current TARGET liabilities of the European crisis countries? Philipp König: The current TARGET liabilities of the European crisis countries amount to around 220 billion euros for Italy, around 58 billion for Greece, around 56 billion for Ireland, approximately 60 billion for Portugal, and around 280 billion euros for Spain.

6. What are the chances that these TARGET balances will be reduced again? Philipp König: The moment the crisis is overcome through structural measures in the crisis countries and the ECB reverts to the mode of liquidity provision it used prior to the crisis, the TARGET balances will also decrease again. But TARGET balances may remain. This is due in particular to a structural change within the demand for liquidity and the liquidity deficit in the euro area.
Claudia Lambert: A decisive factor for repayment of TARGET balances is also that banks begin to trust each other again and the interbank market is active again. That would help to settle these balances.

7. What happens if a crisis country leaves the EMU? Claudia Lambert: The TARGET balances would become foreign currency loans, meaning that a liability would have to be settled in a different currency. At this point in time, however, it is not possible to accurately assess what institutional processes would come into play. It can be assumed that a share of the claims that, for example, Germany now has would also still be recoverable in those circumstances. Therefore, it would not mean that everything would be written off.

Interview by Erich Wittenberg.

Structural Shift in Global Natural Gas Markets—Demand Boom in Asia, Supply Shock in the US

by Franziska Holz, Philipp M. Richter, and Christian von Hirschhausen

The significance of natural gas is on the rise due to the restructuring and decarbonization of energy systems worldwide. Natural gas is widely available and flexible as it can be used in electricity generation, manufacturing, transport, and private households. Compared to other fossil fuels, natural gas produces relatively low carbon dioxide emissions during combustion. For this reason, the natural gas sector also has an important supportive role to play when it comes to the European energy transition towards renewable energies. Against this backdrop, DIW Berlin has examined the potential of the global natural gas market and carried out model-based analyses of possible scenarios for meeting different climate change targets.

The structural shift in the international natural gas market that has been observed for some years now is also set to continue in the medium and long term. While the Arab states of the Persian Gulf, particularly Qatar, will remain swing suppliers due to their geographical location, Russia's significance in supplying Europe will decline in the future. New techniques such as fracking enable the exploitation of unconventional natural gas resources, which could potentially see the US become a strong natural gas exporter and also give other regions around the world the opportunity to extract their own natural gas. However, in Europe, the potential for additional production of domestic resources by extracting shale gas through fracking is rather limited for technical reasons and due to a lack of political support in the context of an adequate international natural gas supply. Asian demand for natural gas is expected to strongly rise as a result of the ever-increasing appetite for energy generated by economic growth. This demand region will absorb the major share of future natural gas trade. In Europe, the situation could develop along a number of different trajectories, depending on whether natural gas is used as a "bridge fuel" in the transition toward an energy system based on renewable energies or as a complement to fluctuating renewable power generation in the long term.

Natural gas is generally defined as a mixture of gases containing roughly 95 percent methane. It is either produced as a by-product of oil extraction (associated natural gas) or on its own. Natural gas deposits are subdivided into conventional and unconventional resources: conventional deposits are large, contiguous fields which can be exploited using industrial-scale extraction methods. Unconventional natural gas resources, however, are characterized by impermeable rock formations requiring special extraction technologies such as horizontal drilling and hydraulic fracturing (also known as "fracking"). The latter technique uses a mixture of water, sand, and chemicals to create fractures in the rock surrounding the natural gas deposits.

The German Advisory Council on the Environment (SRU) primarily distinguishes between three different types of unconventional natural gas resources:

- Tight gas in impermeable rock formations such as sandstone, limestone, and clay mineral,
- Shale gas in hydrocarbon-rich sediments, such as argillaceous and oil shale and,
- Coalbed methane from coal seams.[1]

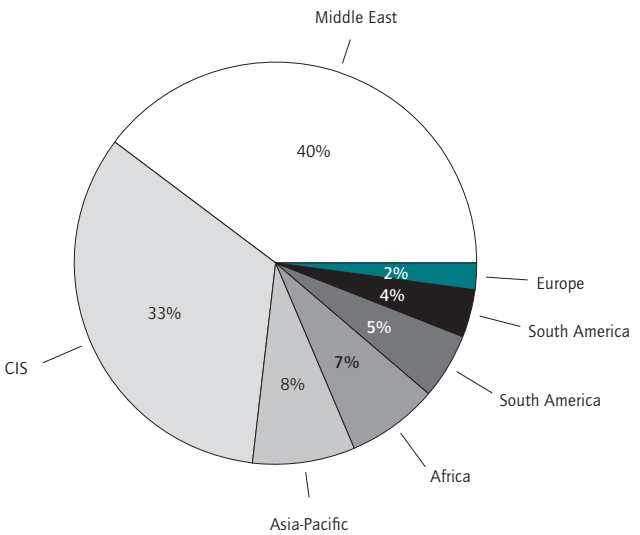
In addition, some seabed areas contain large quantities of gas hydrates, the extraction of which is technically difficult, however, and therefore not commercially viable in the medium term.[2]

1 See SRU, "Fracking for Shale Gas Production: A contribution to its appraisal in the context of energy and environment policy," Statement no. 18, May 18, 2013, p. 7.

2 In particular, the Japanese government has high hopes that methane hydrates can be exploited commercially in the long term and is promoting research into the exploration and development of this product; see www.mh21japan.gr.jp/english/, last accessed on July 8, 2013.

Figure 1

Natural Gas Reserves by World Region
Shares[1] in percent



1 Average across three studies.
Sources: BP; Detusche Rohstoffagentur (DERA); Energy Information Administration (EIA); calculations by DIW Berlin.

Almost three-quarters of global natural gas reserves are in the Middle East and CIS countries.

Table 1

Natural Gas Reserves by World Region
In trillion cubic meters

	BP (2012)[1]	DERA (2012)[2]	EIA (2012)[3]	Average
Middle East	80.0	79.7	76.1	78.6
CIS	74.7	62.3	61.3	66.1
Asia-Pacific	16.8	16.8	15.2	16.3
Africa	14.5	14.6	14.7	14.6
North America	10.8	9.8	10.7	10.4
South America	7.6	7.6	7.6	7.6
Europe	4.0	4.3	4.4	4.2
Total	**208.4**	**195.1**	**189.9**	**197.8**
R/P ratio[4]	62	58	57	59
CO_2 content[5] in gigatons	444	416	405	422

1 BP, Statistical Review of World Energy (2012).
2 DERA, DERA Rohstoffinformation. Energiestudie 2012 (2012). Reserven, Ressourcen und Verfügbarkeit von Energierohstoffen. (Hannover: BGR).
3 EIA International Energy Statistics (Washington D.C.: US Department of Energy, 2012).
4 Reserves in relation to volume produced in 2011 according to DERA (2012).
5 Average emission factors for natural gas combustion according to Intergovernmental Panel on Climate Change (IPCC) 2006. IPCC Guidelines for National Greenhouse Gas Inventories 2, Energy, Geneva.
Sources: BP; DERA; EIA; calculations by DIW Berlin.

Reserve estimates are very similar, with the exception of those for the CIS.

No Long-Term Threat to Natural Gas Availability

Geological estimates attempt to quantify the natural gas resource potential, (the total existing quantity) and the more narrowly defined volume of reserves (resources that can be economically recovered at current prices). These estimates differ in terms of the degree of detail, technical classification types, and supplemental expert opinions. Consensus largely prevails with regard to the volume of available reserves: global estimates broken down by region place current reserves at around 200 trillion cubic meters (see Table 1). Assuming annual production equals that of 2011, reserves would last for approximately 60 years.

By far the largest natural gas reserves can be found in the Middle East and CIS countries which together account for roughly three-quarters of all reserves (see Figure 1). There are also significant reserves in Africa, the Asia-Pacific region (East and Southeast Asia and Oceania), and North and South America, while Europe by far has the smallest natural gas reserves with around 4.2 trillion cubic meters, located mostly in the Netherlands and Norway.

To date, information on unconventional natural gas deposits has rarely been captured by the reserve statistics, but has been included in the more comprehensive resource statistics instead. The discrepancies between different estimates of the existing natural gas resource potential are particularly significant with regard to the share of unconventional resources (see Table 2). The conventional resources numbers span a narrow range of 321 to 498 trillion cubic meters. Unconventional resources estimates, on the other hand, vary widely (between 275 and 917 trillion cubic meters). For example, the estimates by Rogner (1997) and Rogner et al. (2012) are almost three times as high as the more conservative estimates (DERA, 2012, and IEA, 2012).[3] This has less to do with the timing of the survey, but is more a result of the different geo-scientific and statistical survey methods. These differences are less relevant, however, for

3 H.-H. Rogner, "An Assessment of World Hydrocarbon Resources," Annual Review of Energy and the Environment 22 (1997): 217-262; H.-H. Rogner, R. F. Aguilera, C. Archer, R. Bertani, S. C. Bhattacharya, M. B. Dusseault, L. Gagnon, H. Haberl, M. Hoogwijk, A. Johnson, M. L. Rogner, H. Wagner, and V. Yakushev, "Energy Resources and Potentials," chap. 7 in: Global Energy Assessment – Toward a Sustainable Future (Cambridge, New York, and Laxenburg: Cambridge University Press and The International Institute for Applied Systems Analysis, 2012), 423-512;
International Energy Agency (IEA), World Energy Outlook 2012 (Paris: OECD/IEA, 2012).

Table 2

Estimated Worldwide Natural Gas Resources
In trillion cubic meters

	Conventional	Unconventional				Total	RP/P ratio[1]	CO_2 content[2] in gigatons
		Tight gas	Shale gas	Coalbed methane	Total			
DERA (2012)	498	63	160	51	275	772	232	1,647
IEA (2012)	462	81	200	47	328	790	237	1,684
Rogner (1997)[3]	389	208	453	256	917	1 306	391	2,784
Rogner et al. (2012)[4]	321	211	392	245	848	1 170	350	2,493

1 Resource Potential in relation to volume produced in 2011 according to DERA (2012).
2 Average emission factors for natural gas combustion according to Intergovernmental Panel on Climate Change (IPCC) 2006. IPCC Guidelines for National Greenhouse Gas Inventories. 2, Energy, Geneva.
3 For better comparability, the volume that was already produced between 1995 and 2011 was deducted from the conventional resources figures (volume produced according to BP, 2012).
4 Excluding pseudo-unconventional resources such as deep-sea natural gas with a volume of roughly 200 trillion cubic meters. For conventional natural gas resource potential, Rogner et al. refer to USGS (2008): Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle. Fact Sheet 2008–3049. US Geological Survey, Washington DC.
Sources: BP; DERA; IEA; Rogner; Rogner et al.; calculations by DIW Berlin.

Resource estimates vary according to the institution providing them, particularly for unconventional natural gas resources.

the purposes of a medium-term analysis of natural gas trade patterns.

Irrespective of the source used, it is apparent that the physical availability of natural gas will not be a limiting factor in the coming decades as it should last around 232 to 391 years. Theoretically, this would mean that natural gas could both cover a continued demand boom in Asia and also act as a more climate friendly substitute for coal in electricity production.

However, one potential problem is the level of carbon dioxide released during the assumed complete combustion of natural gas. Current natural gas deposits designated as reserves are associated with approximately 400 gigatons of CO2 emissions.[4] For comparison: according to a rule of thumb, the available carbon budget is around 1,000 gigatons of CO2 for the next decades in order to still have a good a chance of achieving the two-degree global warming target.[5] However, emissions from the use of coal and crude oil in particular, which currently account for a significantly higher share of total emissions, are also included in this ceiling. Consequently, a global, politically determined emissions ceiling would in fact result in a binding reduction in future natural gas consumption.

Shale Gas: Production Boom in US, Limited Potential in Europe

In the 2000s, the US experienced a strong price increase from less than three US dollars per MBtu[6] at the beginning of the millennium to a peak of more than 13 US dollars per MBtu in mid-2008.[7] As a result, the country has seen a boom in the exploration and production of unconventional shale gas enabled by the use of new production technologies, particularly horizontal drilling and hydraulic fracturing. Overall, natural gas production in the US climbed from 520 billion cubic meters (2006) to around 680 billion cubic meters (2012).[8] This corresponds to a 25-percent increase and is exclusively the result of growth in shale gas production. This supply shock rendered the previous expectations of a growing need for imports obsolete. The drop in the natural gas wholesale price in the US since mid-2011, at times to under two US dollars per MBtu (early 2012), resulted in an increase in domestic use, particularly for electricity generation.

Until recently, the US did not meet the conditions, both from a technical and a foreign trade law perspective, to export significant quantities of natural gas outside North

4 According to even the most conservative estimates, burning all natural gas resources would release at least 1,647 billion tons of CO_2 over a longer period of time.

5 See M. Meinshausen, N. Meinshausen, W. Hare, S. C. B. Raper, K. Frieler, R. Knutti, D. J. Frame, and M. R. Allen, "Greenhouse-gas emission targets for limiting global warming to 2°C," Nature 458, no. 7242 (2009): 1158–1162.

6 Million British thermal units.

7 Henry Hub natural gas spot price on the wholesale market collected by the Energy Information Administration (EIA), a division of the US Department of Energy, www.eia.gov/dnav/ng/hist/rngwhhdD.htm, last accessed on July 16, 2013.

8 EIA, Annual Energy Outlook, (Washington D.C.: US Department of Energy, 2009); IEA, Medium-Term Gas Market Report (Paris: OECD/IEA, 2013).

America. Due to its geographical location, these exports must be in the form of liquefied natural gas (LNG) but the LNG export infrastructure is still under developmental. Exports to countries that have not signed a free trade agreement with the US (currently the case for Europe and Japan) must be authorized by the US authorities (Department of Energy). During the course of the permitting process for some terminals, a lively debate took place in the US as to whether or not it is in the public interest to authorize exports. However, the US Department of Energy recently granted general export licenses for five terminals for a total annual export capacity of almost 70 billion cubic meters.[9] Applications have been submitted for licenses to increase the annual export capacity to a total of 340 billion cubic meters per annum. It remains to be seen whether or not the entire capacity will be developed, but it appears unlikely.

Apart from North America, there are also other regions in the world with significant shale gas resources (see Table 3). It is assumed or has been extrapolated from initial exploration that this is particularly the case in South America, South Africa, Australia, and China. However, the figures obtained from such explorations are subject to considerable uncertainty as the most recent update of estimates by the US Energy Information Administration (EIA) demonstrates. Accordingly, the International Energy Agency (IEA) has focused for some years on establishing the requisite conditions for widespread production of shale gas.[10] It is assumed that China in particular is likely to commence shale gas extraction in the near future. However, it is not anticipated that regions with equally significant conventional reserves such as Russia will embark on the presumably more expensive shale gas production, even in the long term.

In Europe, too, there is some hope that a shale gas boom could help to improve the competitiveness of the continent's energy-intensive industries. However, information available to date does not substantiate this hope: the more stringent environmental regulations in some European countries, low and very uncertain estimates of shale gas resources, the wider dispersion of (smaller) deposits, public ownership of land rights (as opposed to private ownership in the US), the higher population density in Europe, and bans on the extraction of shale gas that have already been enacted in some EU countries (including France and Bulgaria) are effective obstacles to easy and cost-effective exploitation of shale gas deposits. A push for shale gas extraction cannot be expected in Germany, either: a draft law for the regulation of shale gas exploration has been under discussion for some years but, once again, was not introduced in the parliamentary debate in June 2013. In a recent statement, the German Advisory Council on the Environment (SRU) concludes that fracking is not necessary from an energy policy point of view and shall currently not be allowed on a commercial scale due to serious knowledge deficits.[11]

Table 3

Ranking of 15 Countries with Largest Shale Gas Resources

In trillion cubic meters

	DERA (2012)[1]	EIA (2011)[2]	EIA (2013)[3]
Argentina	21.92	21.92	22.71
Mexico	19.29	19.28	15.43
US	16.41	24.41	18.83[4]
South Africa	13.74	13.73	11.04
Australia	11.22	11.21	12.37
Russia	9.50	n.a.	8.07
China	8.60	36.10	31.57
Libya	8.21	8.21	3.45
Algeria	6.51	6.54	20.02
Brazil	6.40	6.40	6.94
Poland	5.30[5]	5.30	4.19
France	5.10	5.10	3.88
Canada	3.65	10.99	16.23
Norway	2.35	2.35	0.00
Chile	1.80	1.81	1.36

1 DERA, DERA Rohstoffinformation. Energiestudie 2012 (2012). Reserven, Ressourcen und Verfügbarkeit von Energierohstoffen. (Hannover: BGR).
2 EIA, World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States (Washington D.C.: US Department of Energy, 2011).
3 EIA, Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale formations in 41 Countries Outside the United States (Washington D.C.: US Department of Energy, 2013).
4 www.eia.gov/analysis/studies/worldshalegas/, last accessed on July 8, 2013.
5 Polish Geological Institute, Assessment of Shale Gas and Shale Oil Resources of the Lower Paleozoic Baltic-Podlasie-Lublin Basin in Poland. First Report (Warsaw: 2012) estimates resources that can be extracted in Poland at under a trillion cubic meters.
Sources: DERA; EIA; calculations by DIW Berlin.

Shale gas can also be found in many countries that do not have significant conventional resources.

Global Natural Gas Trade and Liquefied Natural Gas on the Rise

Currently, both the supply and demand structures in global natural gas trade are undergoing significant

9 See US Department of Energy list http://energy.gov/fe/downloads/summary-lng-export-applications.

10 IEA, "Are We Entering a Golden Age of Gas?," Special Report. World Energy Outlook 2011 (Paris: OECD/IEA, 2011); IEA, Golden Rules for a Golden Age of Gas – World Energy Outlook special report on unconventional gas (Paris: OECD/IEA, 2012).

11 SRU, Ibid, 2013, p. 42.

Kasten

The Global Gas Model (GGM)

The Global Gas Model is a comprehensive partial equilibrium model for the natural gas market that represents the entire natural gas value chain including production, transport, storage, as well as end users in the electricity sector, industry, and private households. The model was developed in cooperation with NTNU Trondheim and is one of the most comprehensive models currently available. Based on the European Gas Model[1] and the World Gas Model,[2] the Global Gas Model is designed to provide geographically detailed calculations for approximately 120 countries or regions up to 2040. The model's base year is 2010. Typical information provided by this model includes production volumes and trade flows as well as regional prices and infrastructure expansion projects. The focus of the analyses presented here, however, is on the volumes produced and traded and on capacity requirements. The model's high geographical disaggregation allows the specific regional availability and production costs of shale gas to be incorporated into the calculations and regional consumption patterns to be distinguished.

The model was most recently used within the Energy Modeling Forum 28 to calculate the effect of different climate scenarios on European and global natural gas markets.[3] It illustrates Asia's increasing significance for the global market and simultaneously waning demand in Europe, which will not only result in a shift in trade flows but also in infrastructure investment.

1 R. Egging, S.A. Gabriel, F. Holz, and J. Zhuang, "A Complementarity Model for the European Natural Gas Market," Energy Policy 36, no. 7 (2008): 2385–2414.

2 R. Egging, F. Holz, and S. A. Gabriel, "The World Gas Model – a multi-period mixed complementarity model for the global natural gas market," Energy 35, no.10 (2010): 4016–4029.

3 F. Holz, P.M. Richter, and R. Egging, "The Role of Natural Gas in a Low-Carbon Europe: Infrastructure and Regional Supply Security in the Global Gas Model,"DIW Discussion Paper, no. 1273 (Berlin: 2013).

shifts. On the supply side, along with the Gulf States, the Asia-Pacific region is gaining ground; in the medium term, the US may become a significant natural gas exporter. On the demand side, Asia is emerging as a key region for future natural gas markets due to exponential growth.

The following presents the results of computations with a model developed by DIW Berlin in collaboration with the Norwegian University of Science and Technology (NTNU) Trondheim with the aim of forecasting future natural gas trade and the natural gas infrastructure that will be required in form of pipelines and LNG terminals. To this end, the Global Gas Model (GGM) was used, which provides a very detailed representation of global natural gas markets (see box).[12] In a Base Case the continuation of incremental climate and energy policy is assumed, particularly in Europe and the OECD countries which achieve 30 percent reduction, or seven percent respectively, in CO_2 emissions by 2035 compared to 1990. The climate scenario, on the other hand, assumes more stringent global climate policy in order to achieve the two-degree global warming target. The reference point for natural gas production and consumption are the recent estimates developed by the International Energy Agency.[13]

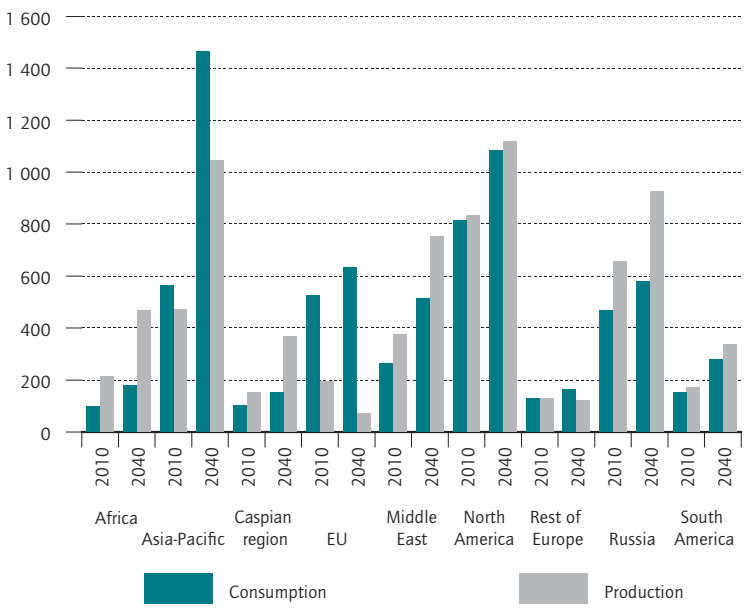
The model calculates the consumption and extraction volumes in 2010 and projections for 2040, differentiated by region and scenario (see Figures 2 and 3). The values differ significantly, both over time and between the two scenarios. While the Base Case shows an increase in natural gas consumption in all regions (globally by more than 50 percent compared with 2010), developments are more strongly differentiated in the climate scenario: in Europe, Russia, and North America, demand falls, whereas especially the Asia-Pacific region sees a strong increase in its market share driving global demand, which is projected to increase by 20 percent between 2010 and 2040. In both scenarios, North America extracts the most natural gas but an increase in volume is also observed in the Asia-Pacific region. Nevertheless, this region is dependent on increasing imports and over time overtakes Europe as the largest natural gas importer. However, Europe's imports continue to increase despite falling overall demand as domestic production plummets. Overall, in both scenarios, global trade flow volumes more than double compared to current levels.

12 This Wochenbericht summarizes research findings from the "RESOURCES" Project in the framework of the BMBF funding priority, "Economics of Climate Change".

13 IEA, World Energy Outlook 2012 (Paris: OECD/IEA, 2012).

Figure 2

Regional Natural Gas Balances in Base Case
In billion cubic meters

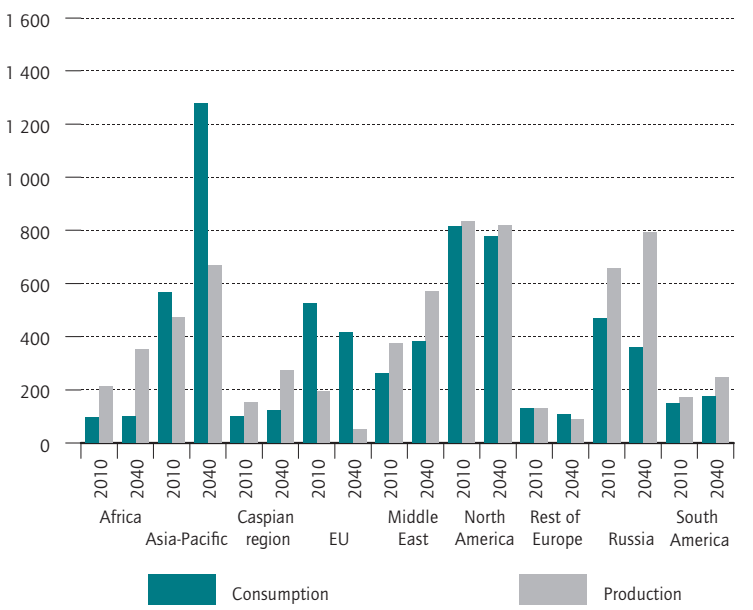


Source: calculations by DIW Berlin.

The Asia-Pacific region will overtake North America as the world's largest natural gas consumer.

Figure 3

Regional Natural Gas Balances in Climate Scenario
In billion cubic meters



Source: calculations by DIW Berlin.

Consumption is declining in regions that are currently significant, while growth in the Asia-Pacific region is all the more substantial.

The demand boom in the Asia-Pacific region is not limited to a small number of countries but rather affects the whole region. In as early as 2025, the region could be consuming more natural gas than North America, which has traditionally been the largest consumer. Some Asian countries such as Japan and Korea have already been importing natural gas on a significant scale for many decades. It was the supply of natural gas in particular that helped Japan to maintain a stable power system after all nuclear power plants were shut down in the wake of the Fukushima disaster in March 2011. Other countries such as China or India only recently started using natural gas in appreciable quantities and are steadily expanding their consumption. All producer countries in the region will increase their production of conventional, but also unconventional natural gas (at this stage predominantly in the form of coalbed methane). The most significant growth in production will occur in Australia and China. Despite impressive growth in domestic natural gas production in China, natural gas is likely to continue to play a relatively marginal role in the coming decades compared to coal, and natural gas imports from Central Asia combined with LNG will be needed to complement the domestic supply.

Apart from the clear shift in trade flows toward Asia, the growth in LNG trade is also particularly striking (see Figure 4). In contrast to Europe, the Asian import countries such as Japan, India, and China have only had limited connections with potential suppliers via pipeline networks to date. Thus the import of LNG will continue to dominate over pipeline gas. The climate scenario sees the net import of LNG increasing from approximately 100 to over 300 billion cubic meters. This development requires a large number of infrastructure projects.

The Asia-Pacific region continues to import its LNG in particular from the Middle East (almost exclusively from Qatar). The Middle East remains a swing supplier between the Atlantic and Pacific Oceans due to its geographical location and significant LNG export capacity. Thus, the region supplies importers both on the Atlantic market (e.g., Europe) and also in Asia. However, it is likely that African producers such as Algeria and Nigeria will play an increasingly significant role in global trade. Russia will increase its exports to Asia in order to profit from the region's growth in demand. Simultaneously, Europe will be able to reduce its dependence on Russia due to the expansion of import infrastructures from Africa and the Caspian Sea region. The abandon of the Nabucco Pipeline project just a few months ago will not affect this situation as there are already alternative plans for the import of gas from the Caspian region.

Development Trends in Europe: Natural Gas as Bridge or Backup for Renewable Power Generation?

Over the next 20 years, natural gas will be vital for the decarbonization of the European energy economy, particularly the electricity industry. Its development can essentially take one of the following two directions:

Natural gas could play a bridge role in the transition to a system of electricity supply secured predominantly by renewable energy sources; according to this scenario, natural gas would be used over the next 15 to 20 years to offset fluctuating supply from wind and solar energy, and its significance would decline when penetration rates of renewables have reached 80 to 95 percent. The almost entire replacement of fossil fuels in this scenario would lead to a significant reduction in CO_2 emissions.

Alternatively, it may be deemed necessary to use natural gas as a long-term backup to cope with the variability of renewable energy sources. Consumption would remain at a high level even beyond 2030 and may actually even increase further Europe-wide. The achievement of an ambitious carbon emissions reduction target would be impossible with this scenario, however.

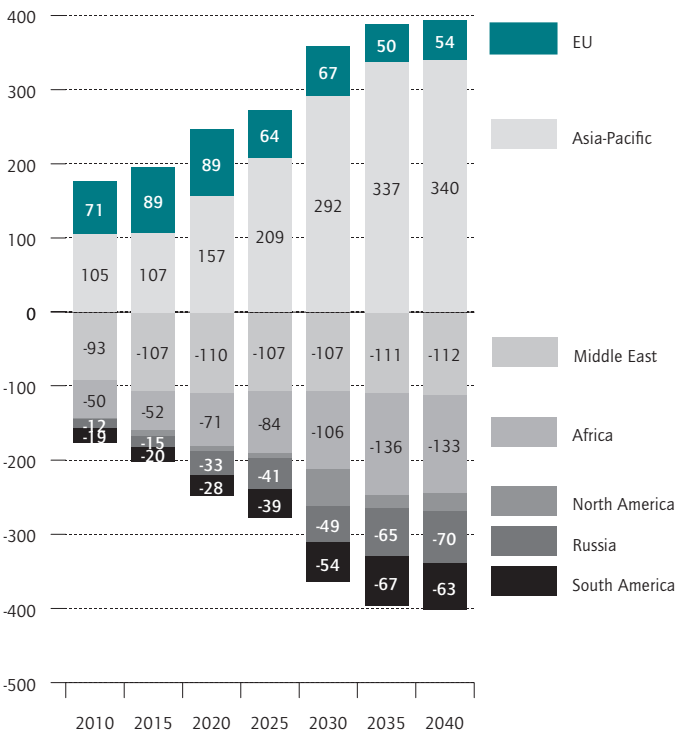
As part of an international model comparison to estimate future infrastructure requirements, the Global Gas Model was applied to these two scenarios for the European natural gas market (see Figure 5).[14] DIW Berlin also analyzed infrastructure expansion requirements such as new pipelines and LNG terminals in the EU and compared them with the Ten-Year Network Development Plans developed by the European gas pipeline operators which regularly evaluate and list requirements and projects.[15] In addition to the diversification of European natural gas supplies, these plans also anticipate the expansion of reverse flow capacity which would create import opportunities by Eastern Europe from Western European countries, i.e., in the opposite direction to traditional supply routes.

The bridge scenario analyzed by DIW Berlin would see a slight increase in European natural gas consumption by 2030, followed by a substantial fall. Around the end of the period analyzed, natural gas disappears de facto from the European power generation landscape and is only used in industry and households. As a result of the decline in fossil fuel consumption, the EU is able to meet the target of reducing greenhouse gas emissions by 80 percent by 2050 in comparison with 1990 levels. Accordingly, import dependency decreases in the natural gas sector which plays only a marginal role from 2040 on as a result of the plummeting volumes. At that time, production in Europe is also focused on Norway, (i.e., a non-EU country). In this scenario, companies invest very little in the natural gas infrastructure as investment would not pay off during such a short period. During the transition phase of strong consumption up to 2030, the region largely taps the flexible LNG import capacity available in many European coastal countries.

In the backup scenario, on the other hand, natural gas consumption steadily increases until 2050, when it reaches 580 billion cubic meters. Due to sustained use of fossil fuels, this scenario sees only a smaller reduction in greenhouse gas emissions in the EU, i.e, approximately 40 percent in relation to 1990. In light of decli-

Figure 4

Net Trade Flows for Liquified Natural Gas (LNG) in Climate Scenario
In billion cubic meters



Source: calculations by DIW Berlin.

Even if ambitious climate change targets are met, global trade in liquefied natural gas will still see a strong increase by 2040.

14 F. Holz, P.M. Richter, and R. Egging, "The Role of Natural Gas in a Low-Carbon Europe: Infrastructure and Regional Supply Security in the Global Gas Model," DIW Discussion Paper, no. 1273 (Berlin: 2013).

15 For Europe: ENTSOG, Ten-Year Network Development Plan (Brussels: various years (2009–13)).

ning natural gas production in Europe due to limited reserves, import dependency rises to over 90 percent. Our model calculations indicate, however, that the dependency on Russia falls since Russian exports are increasingly focused on Asia, especially China. Some new pipelines are built to transport increasing natural gas imports from other regions such as North Africa or the Caspian region to Europe.

Conclusion

Natural gas is an important building block in the decarbonization of energy systems, not only in the German energy transition, but across Europe, in the US, and in the future also in Asia. Currently, supply and demand structures are shifting: while the Middle East remains a strategic supplier, Russia's significance in supplying Europe with natural gas is declining. Simultaneously, the US is moving from its position as a natural gas importer to a potential exporter. Additionally, global demand for natural gas is shifting further toward Asia.

For Central and Eastern Europe, which in recent years has suffered repeatedly from supply disruptions of Russian natural gas, the shift in global trade flows toward Asia will result in a decline in the region's dependency on Russia: in the future, natural gas can increasingly be transported from the west (e.g., from Norway via Denmark or Germany) to Poland or the Czech Republic. In combination with the Russian natural gas that Central and Eastern Europe will continue to use, albeit to a lesser extent, this will result in a more diversified and thus also more secure natural gas supply for the region.

The continued reliable import of natural gas into Europe requires only small infrastructure investment, primarily to further diversify European imports, for example, from North Africa and the Caspian Sea region and also in reverse flow capacity. In light of the current financial crisis, the EU must be prepared to step into the breach in case of possible funding shortfalls for reverse flow capacity.

In Europe, the potential of the new fracking technology to exploit more domestic shale gas appears small due to technical reasons and a lack of political support in the context of an adequate international natural gas supply.

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