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FINANCIAL STABILITY AND FINANCIAL SYSTEM

COMPANIES

INTERNATIONAL ECONOMICS AND FINANCING

GDP-indexed bonds: what are the benefits for issuing countries, investors and international financial stability?

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GDP-indexed bonds in current values (GIBs) are a type of bonds that stabilises the debt ratio in the economic cycle and thus provides the issuing countries with countercyclical room for manoeuver. To date, only GDP-linked bonds with detachable warrants that yield a compensation bonus beyond some real growth thresholds have been issued and solely associated with debt restructuring. However, interest in GIBs has grown in the context of the broad current work on the contingent debt instruments which aim at strengthening the global financial safety nets by transferring part of the macroeconomic risk to private investors. This article quantifies the gains and identifies the challenges associated with GIBs. Firstly, the debt ratios of issuing countries are stabilised. Secondly, investors benefit from the catching-up in emerging economies and can deal with currency risk that extends beyond the maturities usually covered by financial markets. On this basis, we identify countries that would provide the seedbed for the development of this new type of bonds.

Key figures

15%
the average decline in the debt-to-GDP ratio resulting from the issuance of GIBs over a 25 year-horizon for the 5% least favourable debt paths.

12%
the average potential decrease in the volatility of the reference portfolio (80% US equities, 20% T-bills) for a diversification through investment in GIBs rather than in equities for a given country.

Gains for issuing countries and for investors

(in percentage points of debt over GDP for issuing countries ; in percentage points of standard deviation for investors)

■ Benefits for issuer (left-hand scale)   ■ Benefits for investors (right-hand scale)

Source: Banque de France.
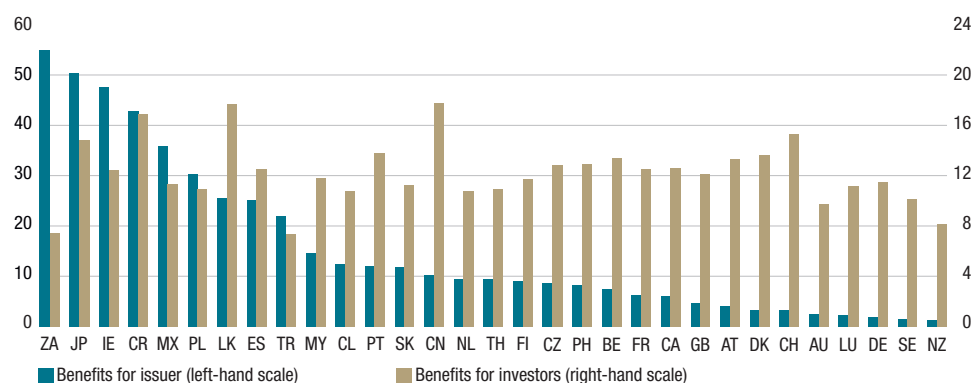Note: Gains for the issuing country: Decrease in the debt-to-GDP ratio resulting from the issuance of GIBs over a 25 year-horizon for the 5% least favourable public debt paths. Gains for the investors: Average potential decrease in the volatility of the reference portfolio (80% US equities, 20% T-bills) for a diversification through investment in GIBs rather than in equities for a given country.

1. Benefit for issuers of debt instruments linked to GDP

Unlike private firms which can issue equity and debt, governments can solely resort to debt financing. The debt instruments linked to GDP[1] can be of interest to governments since they transfer part of the growth risk to investors and thus reduce the probability of default.

So far, the link between debt repayment and GDP has been limited to a mechanism similar to a 'better fortunes' clause. Investors accept a debt restructuring while hoping to benefit from higher yields if the situation in the country improves. As such, warrants linked to real growth have been widely used in some major debt restructuring since the 1990s (Argentina, Greece and Ukraine). However, to date no GDP-indexed bonds in current values (GIBs) had yet been issued on financial markets. Several studies have suggested different designs for contingent debt related to economic activity. We summarise the characteristics of different proposals in Table 1.

GIBs can be used as an instrument for preventing potentially costly debt restructurings[2] by varying the debt-service with the level of economic growth and especially by stabilising the debt ratio.

In order to ensure an optimal coverage of growth risk, we consider that the GDP-indexed bond (on nominal GDP in local currency) must have the following characteristics: (i) principal indexed on nominal GDP which better stabilises the debt ratio, (ii) the interest expense varies with nominal GDP through the indexation of the principal, (iii) the interest rate can be fixed or variable but is not indexed itself on nominal GDP.[3]

T1 Some proposals for contingent debt related to economic activity

Article	Main features
Shiller (1993)	– Claims on the economy of the country: a trillionth of GDP with a coupon linked to economic growth (a Trill). – Ideally, perpetual security. – Possibility for governments to repurchase the trills.
Barro (1995)	– Security indexed on consumption or public spendings. – Allows an intertemporal smoothing of tax rates and an optimal debt management.
Borensztein and Mauro (2004)	– Coupon is linked to nominal growth but cannot be negative. – Limited maturity and characteristics closer to conventional bonds than Shiller (1993).
Barr et al. (2014)	– Full indexation of both debt and paid interests: stabilisation of the debt-to-GDP ratio

2. Analysis of costs and benefits for the issuing country

Impact on the risk premium

As compared to conventional bonds, the risk premium attached to GIBs can be affected by four factors (Blanchard et al., 2016). The diagram below shows the expected change in risk premiums after the introduction of GIBs. Firstly, an indexation premium covers the risk of greater volatility in the total return. The novelty premium compensates investors for the risk related to difficulties in pricing a new instrument. The introduction of a new category of sovereign debt increases the liquidity risk on the overall market. Finally, the introduction of GIBs reduces the default risk and therefore the risk premium, strictly speaking, of the entire debt.

In case of a low issuance of GIBs, the liquidity premium is high for GIBs because the market is

1 We distinguish between GDP-Linked Bonds (GLBs) and GDP-Indexed Bonds in current values (GIBs). GIBs are a specific case of GLBs where the link with GDP is "perfect" (the return varies directly with growth) while some GLBs only generate a premium when the growth is above a specific threshold.

2 See Barr et al. (2014) for a detailed review of the cost of debt restructuring.

3 Consequently, GIBs have very advantageous properties for improving State solvency (since they stabilise the debt-to-GDP ratio) but have less advantageous properties for solving the liquidity issues (reimbursement even in case of recession). Some contingent securities allow an automatic rescheduling of debt repayments during downturns.

shallow and the decrease in the default risk on the whole debt remains small. However, in the longer term, the novelty premium vanishes and, as the issuance of securities indexed on GDP increases, the liquidity premium decreases for GIBs and the default premium recedes. The risk premium on conventional bonds will be indirectly affected. On the one hand, the reduction in the default premium benefits equally all sovereign bonds, including conventional bonds. On the other hand, for a constant level of debt and if GIBs replace conventional bonds, the liquidity premium of the latter should increase.[4]

It is difficult to determine the net effect in terms of risk premium which will depend, not only on the volume of issuance, but also on the specific characteristics of each country. We assume in our simulations that the net effect is nil.

Illustration of the reduction in the volatility of the debt-to-GDP ratio with four types of bonds

In general, the debt dynamics depend on the interest burden and the primary balance:

$$d_t^i = \frac{(1+ c_{t-1}^i)\,(1 + x_t^i)}{1 + g_t}\, d_{t-1}^i - s_t$$

In order to simplify the calculation and for a better understanding, we assume that:[5]

$$d_t^i = (1 + c_{t-1}^i + x_t^i - g_t)\, d_{t-1}^i - s_t$$

i stands for the four types of debt considered; foreign and local currencies, local currency, inflation indexed and GDP indexed.

With d_t^i the debt as a percentage of GDP at t for the debt type i; s_t is the primary balance as a percentage of GDP; c_{t-1}^i the coupon paid on the debt type i at the end of the previous period; g_t the nominal growth rate and x_t^i the indexation variable. If the debt is denominated in foreign currencies,

C1 Change in the risk premium after the issuance of GDP-indexed bonds

Note: Proportions in this chart should be taken as an illustration since they are not based on empirical estimates..
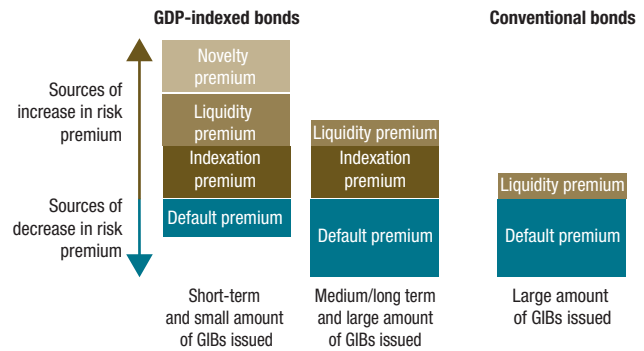
x_t^i is the change in the effective nominal exchange rate (the weighted average of exchange rates vis-à-vis other currencies). For securities indexed on inflation or GDP, x_t^i is either the inflation rate (in our simulations we use the GDP deflator) or the nominal growth rate.

For each security, the coupon c_t^i is known at the end of the period t-1, just as the debt d_{t-1}^i is. The uncertainty about the interest paid and the debt changes therefore results from the indexation variable, the nominal growth rate and the primary deficit. The total amount for the debt type i are the sum of the coupon and the change in the indexation variable. For example, in the case of a debt denominated in foreign currencies the total interests (expressed in local currency) increase when the local currency depreciates and vice versa. The "theoretical" interests to be paid on the debt in GIBs can be calculated by assuming that the financing costs over the whole period are the same on average irrespective of the type of debt. The volatility of the debt to GDP ratios, considering the different types of debt, can thus be compared: foreign currencies, local currency (removal of the volatility resulting from exchange rate variations), inflation-indexed bonds (removal of the volatility

4 The liquidity premium of conventional bonds will not increase in case inflation indexed bonds are replaced by GIBs.

5 That is to say, the impact of the second order components on the average change in the debt ratio is disregarded here.

resulting from inflation), GDP-indexed bonds (removal of the volatility resulting from real GDP).[6]

The charts below show the changes in the cost of financing and debt dynamics for the different types of bonds. The cost of financing combines the coupon and, where appropriate, nominal growth or the inflation rate. In case of financing through GIBs, the debt ratio is fully stabilised over the cycle because investors bear the nominal cyclical risk.

Hence, the use of financial products that link changes in the numerator and denominator of the debt to GDP ratio tends to reduce default risk and therefore improves long-term solvency. However, if this type of bonds allows a countercyclical reduction in the debt expenses, it is less effective, solely from this perspective, than a contingent debt instrument with an automatic mechanism for deferring debt payments in the event of a GDP shock.

3. Simulation of gains for the issuer and country selection

The countries where the gains related to GIBs are the highest are identified by using simulation results. To do this, we quantify the gains in terms of debt-to-GDP ratio for the 95th and 99th percentiles, i.e. the 5% and 1% least favourable debt paths by 2040, as compared to simulations with conventional bonds in both local and foreign currencies. The gains are broken down by sources: issuance in local currency,[7] indexation on inflation and indexation on real growth.[8] Selected countries benefit from the shift from both conventional bonds to GIBs and inflation indexed bonds to GIBs.

An indexation on GDP implies that governments producing national account statistics enjoy a certain level of credibility. We use the government effectiveness indicator published by the World Bank to proxy this level of credibility. We only select

6 The covariance between variables also needs to be taken into account.

7 The share of the debt issued in foreign currencies is converted into local currency following the current breakdown of public debt (see Appendix 1).

8 We assume that GIBs are always issued in local currency.

C2 Total cost of financing

(% of debt)
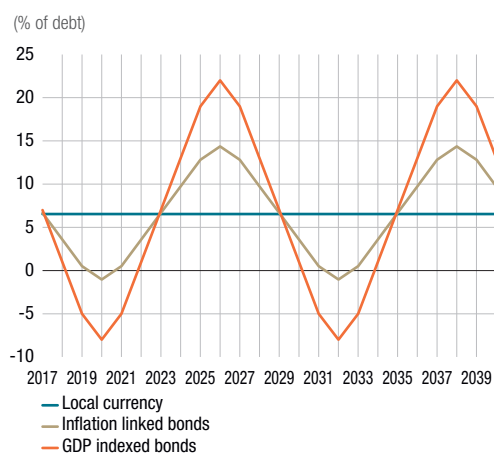
C3 Public debt-to-GDP ratio

(%)
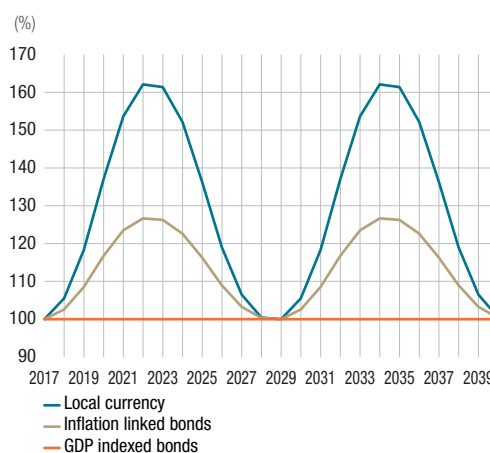
countries for which the indicator is positive. Note that many emerging and low income countries where GIBs may be particularly beneficial are discarded by this criterion.

Finally, the size of the economy is taken into account in order to ensure a minimum liquidity level which fosters GIB issuance initially. Therefore, we only select countries whose GDP is above

T2 Identification of the sources of gain (compared to conventional debt in domestic and foreign currencies)

(debt-to-GDP in percentage points)

Country	Government efficiency	Transition to local currency		Indexation to inflation		Indexation to nominal growth		Global gains	
		95th percentile	99th percentile	95th percentile	99th percentile	95th percentile	99th percentile	95th percentile	99th percentile
Japan	1.8	0	0	15	23	35	51	50	74
Ireland	1.6	0	-2	22	47	25	48	48	92
Costa Rica	0.4	5	9	19	33	19	30	43	72
Spain	1.2	0	0	9	14	16	26	25	39
Sri Lanka	0.1	14	26	2	2	10	16	25	44
United States	1.5	0	0	4	6	9	13	13	19
Slovakia	0.9	3	4	1	2	8	13	12	19
Belgium	1.4	0	0	0	-1	8	12	7	11
Malaysia	1.1	2	3	5	11	8	11	15	25
Netherlands	1.8	0	0	3	4	7	11	10	14
South Africa	0.3	46	129	3	5	6	10	55	144
Finland	2.0	0	0	4	7	5	8	9	15
France	1.4	0	0	1	1	5	8	6	10
Czech Republic	1.0	3	5	1	2	5	8	9	16
Canada	1.8	0	0	2	2	4	8	6	10
United Kingdom	1.6	0	0	0	0	4	7	5	7
Austria	1.6	0	0	0	0	4	6	4	6
Mexico	0.2	9	15	23	41	4	5	36	61
Poland	0.8	-5	-9	31	54	4	6	30	50
Chile	1.1	2	4	7	15	4	5	12	24
Panama	0.3	0	0	3	6	3	5	7	11
Turkey	0.4	2	28	17	20	3	9	22	57
Switzerland	2.1	0	0	1	1	3	4	3	6
Germany	1.7	0	0	-1	-1	3	4	2	3
Portugal	1.0	1	2	9	9	3	2	12	13
Sweden	1.8	0	0	0	-1	2	3	2	3
Denmark	1.8	0	0	1	2	2	3	3	5
Luxembourg	1.7	0	0	0	1	2	4	2	5
China	0.3	3	5	6	9	2	3	10	16
Thailand	0.3	7	13	2	3	1	2	9	18
Australia	1.6	0	0	1	3	1	1	2	4
New Zealand	1.9	0	0	0	1	1	2	1	3
Philippines	0.2	7	14	1	2	1	1	8	17

Sources: World Bank, Banque de France.
Note: The government effectiveness is a qualitative indicator published by the World Bank which varies between -2.5 and 2.5.

USD 50 billion in 2015. Based on these criteria 33 countries would benefit from the issuance of GIBs (see Table 2) including 11 countries recording gains above 5 and 10 GDP points for the 95th and 99th percentiles, respectively.

Chart 4 visually depicts the reduction in volatility resulting from the replacement of conventional bonds by other bonds in local currency only, indexed on inflation and indexed on GDP. For all countries, we observe a clear stabilisation of

C4 Simulations of debt trajectories for the 5 countries with the highest gains related to GIBs

(% of GDP)
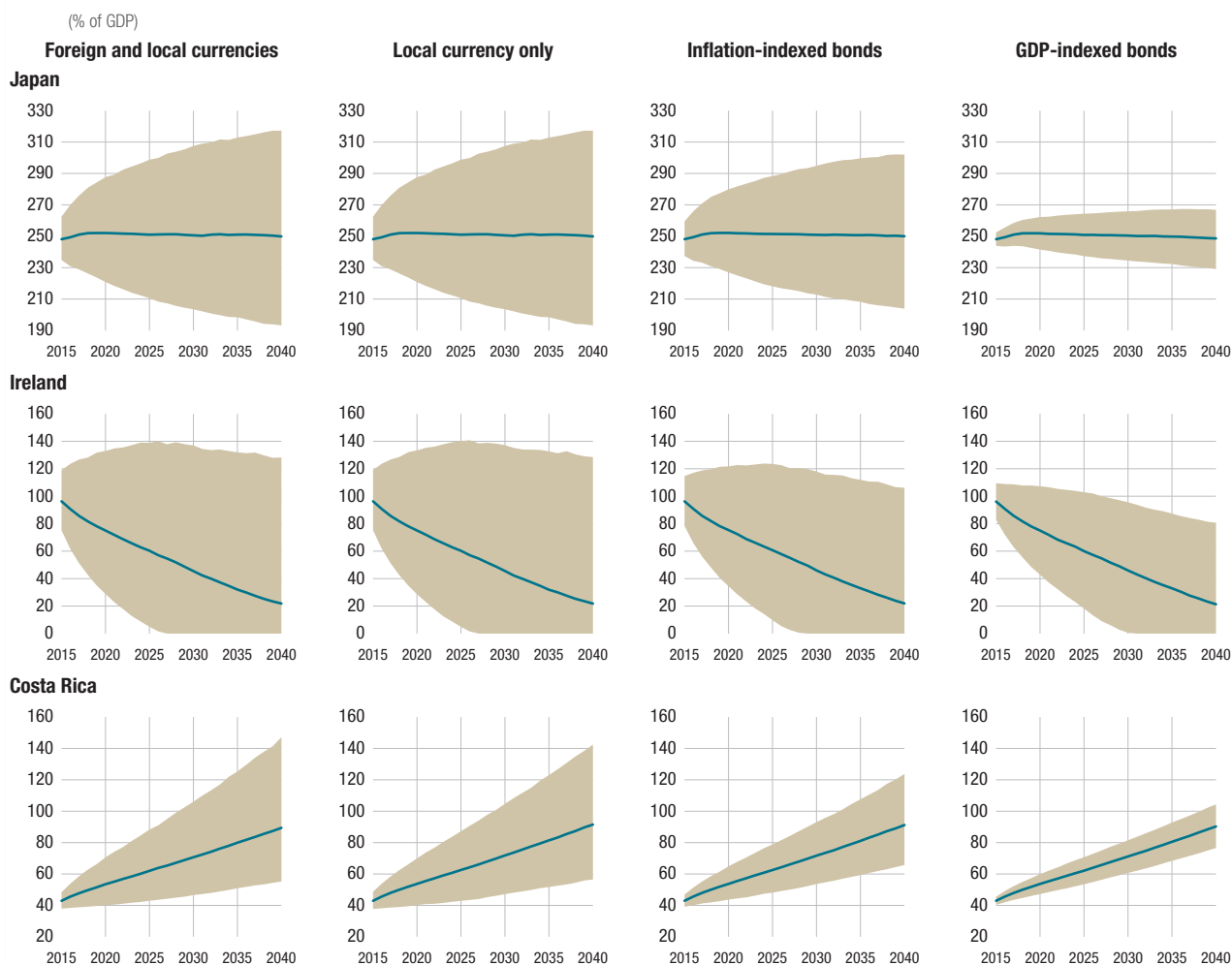
Source: Banque de France.
Note: The beige areas show the gap between the 5th and the 95th percentiles of simulations and the curve the median for 10,000 draws based on the variance-covariance matrix (see Appendix 1 for the methodology).

C4 Simulations of debt trajectories for the 5 countries with the highest gains related to GIBs (cont.)
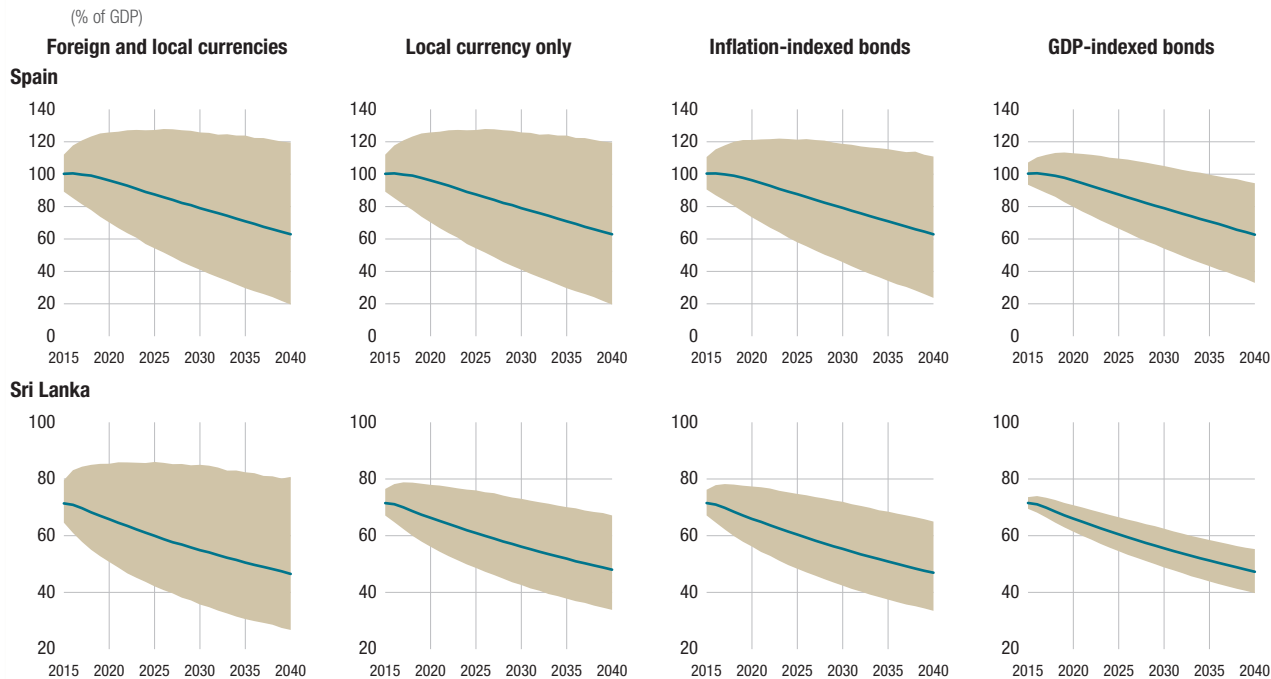
(% of GDP)

Foreign and local currencies	Local currency only	Inflation-indexed bonds	GDP-indexed bonds

Source: Banque de France.
Note: The beige areas show the gap between the 5th and the 95th percentiles of simulations and the curve the median for 10,000 draws based on the variance-covariance matrix (see Appendix 1 for the methodology).

the debt-to-GDP ratio. Sometimes the source of stabilisation is mostly nominal growth indexation (Japan, Ireland and Spain), but for emerging countries issuing a large part of their debt in foreign currencies, the gains associated with the conversion into local currency are substantial (Costa Rica and Sri Lanka). Even when these gains result mainly from local currency conversion (e.g. Turkey), they are not necessarily separable from GIBs. Indeed, the use of GIBs allows the country to issue bonds in local currency –since indexation on nominal GDP partly covers the currency risk, as shown below– while with conventional bonds some countries are forced to issue debt mainly in foreign currencies.[9]

4. Investors' potential gains

Partial currency risk hedging

GIBs may attract new investors because of the automatic partial long-run currency risk hedging they provide, which is not available in most emerging currency markets. Nominal exchange rate and nominal growth indeed influence each other. First, an increase in prices (and therefore in nominal growth) is likely to lead to a domestic currency depreciation because of purchasing power parity (PPP). Furthermore, an increase in real growth usually results in a real appreciation. Overall, the expected sign for the relationship

9 Eichengreen and Hausmann (1999) describe the "original sin" as a situation in which the domestic currency cannot be used to borrow long term.

C5 Exchange rate change vis-à-vis USD and nominal growth (1996-2015)

(in %)

a) Low income countries (28 countries)
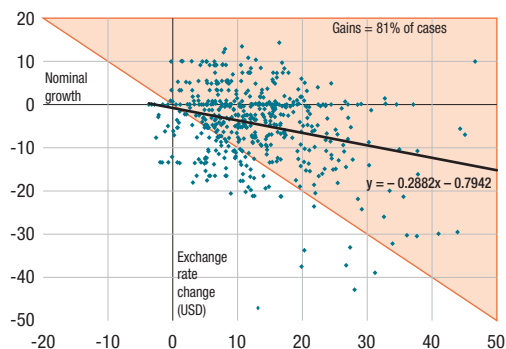
b) Lower middle income countries (48 countries)
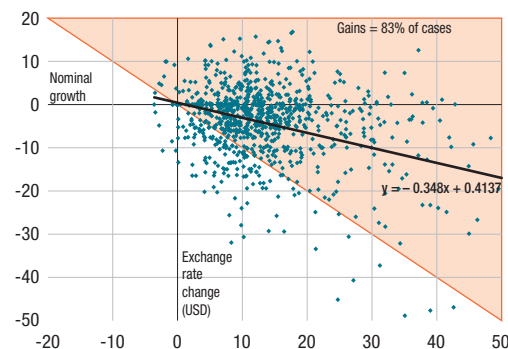
c) Higher middle income countries (44 countries)
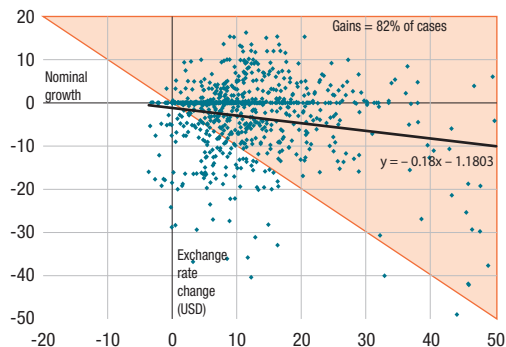
d) High income countries (35 countries)

Gains = 81% of cases

$y = -0.2882x - 0.7942$

Gains = 83% of cases

$y = -0.348x + 0.4137$

Gains = 82% of cases

$y = -0.18x - 1.1803$

Gains = 71% of cases

$y = 0.0563x - 1.5051$
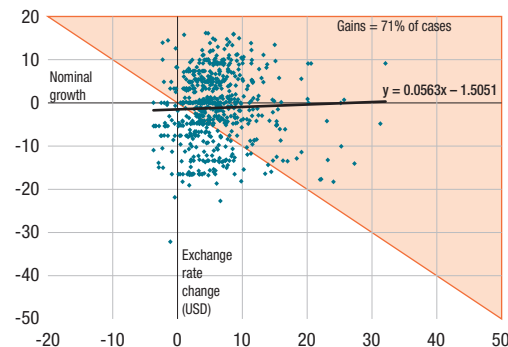
Source: IMF, World Economic Outlook, April 2016.
Note: Orange triangles correspond to area for which the combination of exchange rate change and nominal growth implies positive gains for investors. Income groups are from the World Bank.

between nominal growth and nominal exchange rate is uncertain and depends on the relative importance of both effects.

On the other hand, the exchange rate affects both inflation and nominal growth. First, a real depreciation should spur real growth (through exports) and is likely to increase the price of imports (and therefore lead to inflationary pressure). Moreover, in emerging countries, the catching-up process leads to a trend growth of relative prices due to the Balassa Samuelson effect and to relatively higher real growth.

In most cases, the combined effect of exchange rate change and nominal growth is positive (Chart 5), which implies gains for the investor. In more than 80 percent of cases, for lower income and middle income countries, the holder of GIBs in local currency will have positive gains in USD.[10]

10 This currency risk hedging is not equivalent to usual hedging and assumes a "buy and hold" strategy. In the short-run, GIB price volatility might be affected by the fact that the exchange rate risk is known before actual nominal growth.

C6 Average nominal growth breakdown in USD (1996-2015)

(average annual growth in %)
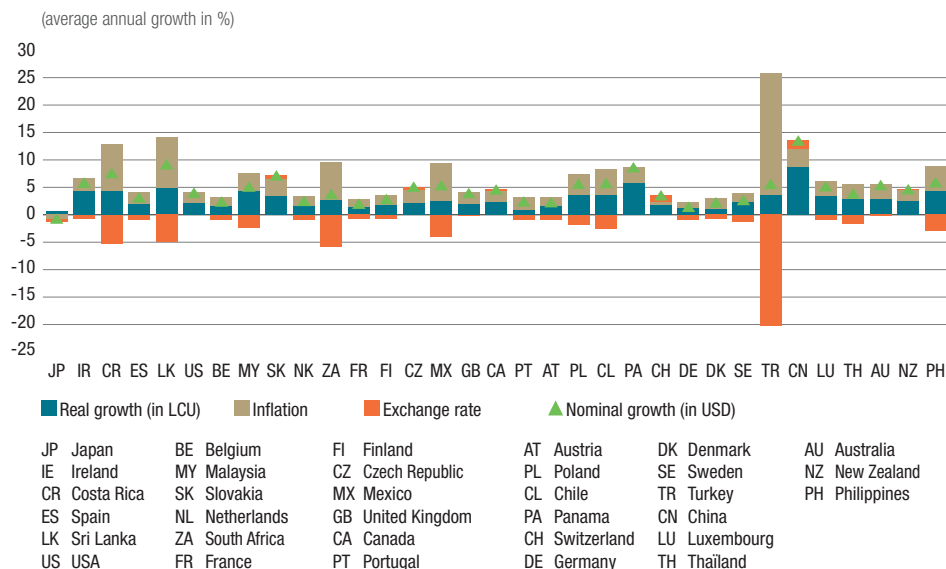
Source: IMF, World Economic Outlook, April 2016.

Average nominal growth breakdown for the thirty three selected countries above is useful to identify the main source of gains from GIBs (Chart 6). For all countries (except Japan) this average gain is positive and nominal growth gain more than compensates exchange rate change.

Estimated gains from portfolio diversification

We estimate in this section the potential gains to an investor willing to diversify his reference portfolio by investing in another country (one of the previously selected countries).[11] Should this investor choose to diversify through equities or through GIBs?

The investor initially holds a portfolio of US stock and T-bills and is looking to decrease the variance (1st criterion) and/or increase its Sharpe ratio (2nd criterion) through diversification.[12] For each criterion, we shall compare the portfolio with each asset (stock or GIB) for a given country (Table 3).[13] For a given country, nominal growth

(in USD) is usually less volatile and less correlated with the initial portfolio than the equity return, which may imply better diversification gains from GIBs. While nominal GDP growth is always less volatile than stock returns, the yield differential is usually in favour of equity returns.[14]

For each country/asset couple we select two portfolios: (i) the portfolio with the lower variance (columns 4 and 8) and (ii) the portfolio with the higher Sharpe ratio (columns 5 and 9). Choosing GIBs is always preferable to choosing the stock market when considering the variance of the final portfolio. This is due to i) a lower variance of nominal GDP growth than the variance of stock returns and ii) a lower correlation of nominal GDP growth with the initial portfolio.[15] Furthermore, in 75 percent of cases, the choice of GIBs is preferable (or equivalent) in order to maximise the Sharpe ratio. Therefore, our results suggest higher gains from diversification through GIBs than diversification through equities when starting from a reference portfolio.

11 We retain countries with a positive index of government efficiency (World Bank measure), which excludes some large emerging countries such as Brazil and Russia.

12 See Appendix 2 for more details about the Sharpe ratio.

13 See Appendix 2 for the detailed methodology. We assume a zero coupon for GIBs (conservative assumption). We compare on the one hand columns 4 and 8 and on the other hand columns 5 and 9 corresponding to portfolio 1.1 and 1.2, and 2.1 and 2.2 respectively.

14 However, GIB prices might be much more volatile than nominal growth because of the uncertainty surrounding the publication of the figures.

15 Since GDP data are available on a quarterly basis, we also use this frequency for stock indexes.

T3   Comparison of a diversification through GIBs and a diversification through the stock market

Country	Stock index				GDP indexed bonds			
	Standard deviation	Correlation with reference portfolio	Standard deviation of the port, min. the var, (1.1)	Sharpe ratio of the port. max. the Sharpe ratio (2.1)	Standard deviation	Correlation with reference portfolio	Standard deviation of the port, min. the var, (1.2)	Sharpe ratio of the port. max. the Sharpe ratio (2.2)
Japan	40	0.62	24	0.18	10	-0.02	9	0.15
Ireland	52	0.72	22	0.13	11	0.04	10	0.47
Costa Rica	46	0.33	23	0.12	7	0.13	7	0.88
Spain	50	0.70	23	0.13	11	0.00	10	0.19
Sri Lanka	55	0.43	24	0.12	7	-0.08	6	0.73
United States	30	1.00	0	0.11	2	0.12	2	0.99
Belgium	47	0.70	23	0.14	10	0.03	10	0.14
Malaysia	62	0.37	24	0.14	15	-0.07	12	0.23
Slovakia	53	0.08	22	0.11	13	0.01	11	0.34
Netherlands	47	0.85	20	0.21	10	0.00	9	0.16
South Africa	48	0.75	22	0.14	17	0.19	15	0.13
France	44	0.79	22	0.14	10	0.02	10	0.12
Finland	65	0.70	22	0.11	11	0.01	10	0.16
Czech Republic	62	0.49	24	0.11	13	-0.15	11	0.32
Mexico	58	0.72	22	0.12	11	0.04	10	0.24
United Kingdom	38	0.86	22	0.21	10	0.18	10	0.16
Canada	47	0.74	23	0.11	11	0.09	10	0.25
Portugal	53	0.58	24	0.18	11	0.04	10	0.13
Austria	58	0.63	23	0.13	10	0.02	10	0.14
Poland	66	0.66	22	0.18	13	-0.06	11	0.31
Chile	50	0.56	24	0.18	14	0.15	13	0.26
Switzerland	36	0.80	23	0.11	9	-0.06	8	0.30
Germany	50	0.80	21	0.11	10	0.04	10	0.11
Denmark	44	0.73	23	0.15	10	0.01	9	0.13
Sweden	52	0.77	22	0.11	13	0.08	11	0.15
Turkey	91	0.63	22	0.11	17	0.05	14	0.22
China	72	0.42	24	0.13	7	-0.14	6	1.72
Luxembourg	66	0.69	22	0.21	11	0.07	11	0.40
Thailand	76	0.45	24	0.13	15	0.04	13	0.19
Australia	47	0.74	23	0.12	14	0.12	13	0.25
New Zealand	43	0.80	22	0.11	16	0.15	14	0.19
Philippines	66	0.52	24	0.13	11	0.06	11	0.36

Source: Banque de France.
Note: 4 columns for each asset (stock index or GIB) which could be added to the reference portfolio. The first two columns show the variance of the asset and its covariance with the reference portfolio. The last two columns show the characteristics of the selected portfolio. See appendix 2 for further details.

5. Conclusion: challenges and potential solutions for GIB development

GIBs enable governments to remove the impact of macroeconomic shocks on the debt-to-GDP ratio, hence mitigating the default risk. They also enable investors i) to invest directly in a given country's nominal growth, potentially taking advantage of the catching-up process, ii) to partially hedge against currency fluctuations, and iii) to efficiently diversify their portfolio. The development of GIBs would also contribute to global financial stability by reducing default risk and offering issuers more countercyclical policy leeway. This contribution to a public good (international financial stability) would justify an international coordination, including by regulation authorities, to address the obstacles to GIB development.

The first challenge is the potential stigmatisation of issuers (giving reason to believe that future GDP growth will be low). Since the benefits for the issuer depend partially on the volume issued, it is essential to achieve a critical size and a sufficient number of issuers.

The second challenge lies in the pricing of these assets. Establishing a term sheet of a simple product (indexation of the principal and fixed or variable interest rate based on the principal, minimum maturity) would make it possible to reduce the novelty premium and even the liquidity premium. However, the pricing issue remains challenging (Bowman and Naylor, 2016).

The third limit, which is crucial, concerns national account statistics. A potential solution is to use data produced and/or certified by a "trustworthy third-party". A working group made up of practitioners from the City and the Bank of England suggested identifying major events affecting data reliability, which would trigger an automatic buy-out option by the issuer at a favourable price for the investor.

Finally, the role of GIBs in restructuring operations and prudential regulation is worth questioning. On the former point, GIBs could include specific collective action clauses (CAC) because of their automatic adjustment mechanism. As regards the latter point, prudential regulation could also take into account the fact that the default risk on GIBs is lower.

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Appendix 1
Methodology and data used for debt ratio simulations

1. Data

We use data from the IMF WEO (*World Economic Outlook* – WEO, April 2016) for nominal GDP (local currency and USD), the GDP deflator, the primary deficit, the budget balance, sovereign debt (local currency and USD), and the exchange rate. From the primary deficit, the budget balance and the level of debt (lagged), we are able to recover (net) apparent interest rate payments as a percentage of debt. This is useful to estimate coupons of each type of debt.

We use World Bank data (*World Development Indicators* – WDI) for the composition of debt by currency for most countries. We use EuroStat data for European Union countries, and IMF data (only local and foreign currency) for the remaining countries. For countries with a non-nil "multi-currency" share we use the SDR rate.

2. Methodology

Using the methodology of Blanchard et al. (2016) and Benford et al. (2016), debt dynamics are simulated from 2015 to 2040, for each type of debt:

- debt by currency (each weight changing over the simulation horizon);

- debt entirely denominated in local currency;

- debt consisting of inflation-indexed bonds;

- debt consisting of GDP-indexed bonds.

The central scenario for inflation, growth, the primary balance, the apparent interest rate and the exchange rate is based on IMF forecasts to 2021 (stabilised until 2040). Strictly speaking there is no exchange rate forecast; however we can derive it from the GDP forecast in local currency and USD. The interest rate of each type of debt is on average equal to the apparent interest rate at each period, which enables us to calculate a theoretical coupon.

Dispersion around the central scenario is based on the variance/covariance matrix between variables for available data from 1996 to 2015.[16] This allows us to break down the volatility gains from the transition to GDP-indexed bonds (GIB) into several effects: exchange rate, inflation, and real GDP growth.

16 These variables are: inflation, nominal growth, the apparent interest rate, the primary balance, the exchange rate vis-à-vis the dollar. These exchange rates (local currency, Euro, Pound, Swiss Franc and Yen) paired with the weights of the different currencies in the debt enable us to recover a nominal effective exchange rate.

Appendix 2
Methodology for comparing portfolios

We assume that the reference portfolio consists of 80 percent of US shares (S&P 500) and 20 percent of risk-free assets (3 month Treasury bills - T-bills) over the period 1997-2015. This "naïve" strategy without rebalancing during the period yields an average annual return of 4.56% and a standard deviation of 23.93%, and hence a Sharpe ratio of 0.11 (the average risk free rate is about 2.00%). As a reminder, the Sharpe ratio is a simple measure of portfolio performance. For a given portfolio, the Sharpe ratio is the excess returns on the standard deviation. Hence, it gives the number of units of additional returns for each additional unit of risk. The Sharpe ratio (Sr_p) is given by:

$$Sr_p = \frac{r_p - r_{sr}}{\sigma_p}$$

where r_p is the portfolio return (here « US » because the reference portfolio is composed of US assets), r_{sr} the risk-free rate and σ_p the standard deviation of the portfolio.

The investor willing to invest in a given country will compare a portfolio diversified through the usual stock market ("shares added" portfolio) and a portfolio diversified through GIBs ("GIB added" portfolio). We assume that he will choose to allocate a share of his portfolio to one of these assets, keeping the same composition in the remaining share (80 percent US shares, 20 percent T-bills). Return and variance of the final portfolio depend on the characteristics of the reference portfolio, the asset added, and their correlation:

$$r_p = wr_{pus} + (1 - w)r_j$$

where r_p is the return of the final portfolio, r_{pus} the return of the reference portfolio, r_j the return of the added asset and w the weight of the initial portfolio in the final portfolio. The variance is given by:

$$\sigma_p^2 = w^2\sigma_{pus}^2 + 2w_1(1-w)\sigma_{pus}\sigma_j c_{pus,+} + (1-w)^2\sigma_j^2$$

where σ_p, σ_{pus} and σ_j are the standard deviations of the final portfolio, the reference portfolio and the added asset respectively. $c_{pus,j}$ is the correlation between the initial portfolio and the added asset.

We finally select portfolios according to two criteria: either the investor is willing to minimise the risk (volatility of returns), or he is willing to maximise his Sharpe ratio. For each country we keep two sets of portfolio: a portfolio in which the investor diversifies through shares ("shares added" portfolio), a portfolio in which the investor diversifies through GIBs ("GIB added" portfolio). For each of these two sets, we select the portfolio that maximises the Sharpe ratio and the portfolio that minimises the variance. We end up with four portfolios for each country.

We compare on the one hand 1.1 with 1.2 and on the other hand 2.1 with 2.2.

TA1   Selected portfolio for each country

Portfolio	Minimising the variance	Maximising the Sharpe ratio
Shares added	1.1	2.1
GIB added	1.2	2.2

Green bonds: a solution for financing the energy transition or a simple buzzword?

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The COP 21 conference stressed the importance of directing financial flows towards the financing of the energy transition. Given the magnitude of the needs (over USD 53 trillion by 2035), new sources of financing are needed, such as green bonds. This article looks at the underlying factors of the boom in this market and the tools that would help to develop it without increasing the risks to financial stability.

Green bonds are seen as a privileged financing instrument, both by issuers to diversify their investor base and benefit from oversubscription, and by investors to fulfill their mandate and implement their long-term strategy. Thus, green bond issuance increased four-fold between 2013 and 2015, reaching USD 42 billion in 2015. However, green bonds pose risks (counterparty risk, credit risk, green washing risk, which consists in terming projects green where they are not) and additional costs compared to standard bond issuance (labeling, reporting).

To develop this market, public authorities have a role to play in fostering its organisation, without, however, increasing the risks for the financial system.

Key figures

USD 53 trillion
needed by 2035 for energy efficiency and renewable energy

USD 42 billion
worth of green bonds issued in 2015, compared with USD 10 billion in 2013

43%
of green bonds have a European issuer

Amount of global annual issues of green bonds and breakdown by issuer
(EUR billions)

Legend: Supra, Agency, Local authorities (excl. municipalities), Municipal, Corporate – Non-financials, Corporate – Financials, Total outstanding (right-hand scale)
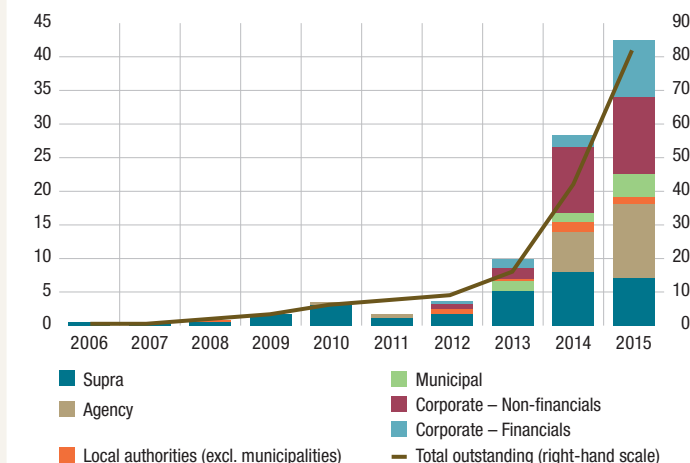
Sources: Bloomberg and Crédit Agricole CIB (2015).

T he COP 21 conference recognised that the current trajectory of greenhouse gas emissions was having extreme consequences on the climate. Limiting global warming to below 2° C by the end of the century relative to the pre-industrial era presupposes the existence of a limited planetary carbon budget and therefore of "finance flows consistent with a pathway towards low greenhouse gas emissions" (Article 2 of the Paris Climate Agreement).

The objective of the 2 ° C would imply, according to the International Energy Agency - IEA (2014), investing a total of about USD 53 trillion by 2035, in particular for energy efficiency and renewable energy. The New Climate Economy (2014) initiative estimates the required investments in transport, energy and water infrastructure to be USD 93 trillion by 2030. However, the allocation of capital remains sub-optimal today due to the lack of adequate carbon prices, weak political signals (persistence of carbon subsidies) and the uncertainty about the consequences of greenhouse gases (Knight, 2015). Achieving the 2° C objective therefore implies increasing the financing of investments in low-carbon activities, as in the case of green bonds.[1]

Green bonds are a recent type of bond (2006), most often labelled, for which the outstanding amount is allocated to the financing of projects or activities with an environmental reach, in particular energy efficiency, renewable energy and transport. It is customary to distinguish the market for climate aligned bonds, which has reached USD 576 billion (Climate Bonds Initiative - CBI, 2016) and whose underlying assets are presumed to prevent climate change, from that of green bonds (USD 118 billion), which are labelled and, most often, externally reviewed. This article looks at the underlying factors of the growth in the green bonds market, their usefulness and the way in which public authorities can promote them.

1. The growing interest in the green bonds market should not overshadow its risks

Green bonds appear as a key instrument for financing the energy transition

The emergence of sources of financing that are complementary to bank financing is necessary to finance the long-term energy transition, given the importance of investment needs and their different maturity compared to available bank financing (OECD, 2015a). In addition, reducing the carbon content of infrastructures will cost about 4.5% more than business-as-usual (OECD, 2015b). In addition, the implementation of Basel III regulations could have a negative impact on infrastructure financing by requiring additional liquidity for banks to hold long-term assets (Campiglio, 2014).

While green bonds are a complementary means of financing the energy transition, they do not paradoxically offer the issuer a financial benefit. While some studies show the existence of a green premium paid by investors (Barclays, 2015, estimates it to be around 20 basis points), this goes against the experience of economic players (GlobalCapital, 2015). Other studies (duPont, Levitt and Bilmes, 2015) consider that such a premium would not be justified by less risk taking (OECD, 2015a). Green bonds actually represent an additional cost for the issuer due to labelling (an external review costs between USD 10,000 and USD 50,000), and for the investor who has to devote more time to the analysis of this type of bond. Transparency requirements may also conflict with the issuer's confidentiality constraints (in the case of research and development, innovative technologies, etc.).

However, some advantages explain the emergence of green bonds. They enable issuers to diversify their investor base and in particular to attract

1 (not applicable)

responsible[2] and long-term investors. The issuance of green bonds enables the company to enhance its sustainable development strategy, like Toyota (USD 1.6 billion worth of green bonds issued in 2016 for the development of its hybrid and electric vehicles) or Apple (USD 1.5 billion in February 2016). As for investors in green bonds, they are less price-sensitive and more inclined to hold the securities (according to a buy and hold strategy), which could reduce the volatility of securities in the secondary market (duPont, Levitt and Bilmes, 2015). Their attractiveness is also explained by the increase in the available information on the underlying asset and more generally on the strategy of the issuing company (KPMG, 2015). Green bonds also enable investors to diversify their portfolios, in particular towards assets that do not pose the risk of turning into stranded assets.[3] They contribute to implementing their own long-term climate strategy and to advertising it to savers.

In practice, issues are systematically over-subscribed (GlobalCapital, 2015), which puts the issuer in a favorable position. This over-subscription reflects the existence of institutional investors which allocate part of their portfolio to green assets (Green Growth Action Alliance, 2013). For example, Axa IM, Mirova, Calvert Investment and Nikko AM have created funds dedicated to green bonds. The Swedish public pension fund AP2 allocates 1% of its funds to green bonds.

However, the risks associated with green bonds should not be overlooked

To date, a multitude of standards define green bonds. The most widely accepted are the green bond principles (GBP), voluntary principles drawn up by the International Capital Market Association (ICMA), which impose above all requirements of transparency in the process. The CBI offers voluntary climate-oriented certification. In addition,

there exists an abundant ecosystem of non-financial rating agencies, of "second" and "third opinion", and auditing agencies. Rating agencies have recently been more interested in green bonds, such as the valuation methodology published by Moody's in March 2016.

However, labeling and the use of external reviews are not mandatory in existing approaches. According to CBI (2016), only 60% of green bonds are externally reviewed. Market players fear above all the reputational risk linked to green washing, i.e. the issuance of green bonds to finance projects that are not "green" or that do not meet commitments, which would affect investor confidence. Issuers may also face a green default risk (Institute for Climate Economics - I4CE, 2016), in other words they might be held liable for not complying with commitments.

In addition, for a given issuer, green bonds do not necessarily have a less risky profile than a standard issuance. While more than three quarters of green bonds have a rating higher than A, the quality of the signature is essentially due to the type of issuer (development bank, community, large enterprise). The sectors that benefit from financing in the form of green bonds can offer uncertain returns, like in the case of the massive investments in renewable energy in Europe. The Spanish giant of renewable energy Abengoa for example (EUR 500 million of green bonds issued in 2014) had to negotiate the conditions for restructuring its debt which reached EUR 9.4 billion at end-2015.

To date, the development of green bonds does not appear to have increased green financing flows since the underlying bonds and projects would in any case have been financed. Green bonds therefore play a complementary role in financing the transition but do not necessarily lead to increased investment flows (I4CE, 2016).

2 Investors integrate into their decisions the environmental, social and quality of governance criteria.

3 Assets devalued due to substantial and abrupt changes in legislation, environmental constraints, or to technological breakthroughs.

2. The current dynamism of the market must be steered by the authorities to meet financing needs

The green bonds market is growing rapidly, particularly in France
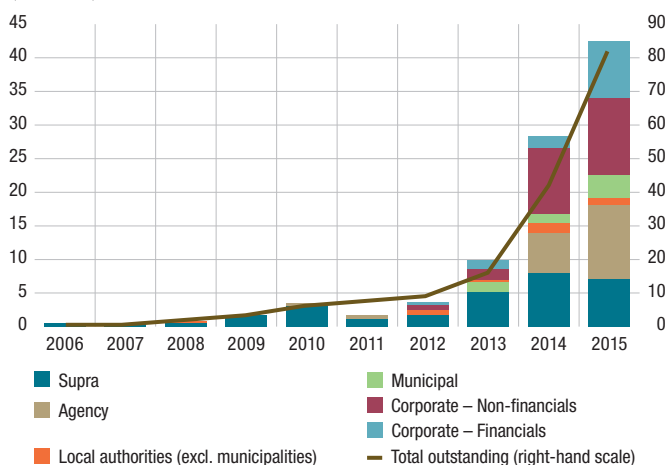
Green bonds increased fourfold worldwide between 2013 and 2015, reaching USD 42 billion in 2015 (CBI, 2016). Issuance in the first half of 2016 reached USD 26 billion and estimates for 2016 range from USD 55 billion (HSBC, 2016) to USD 100 billion (IWC, 2016). The OECD (2015a) estimates that the 2020s could be golden years, as a result of the maturation of technologies and lower emission costs.

This growth is accompanied by a change in the characteristics of the market. Initially, the market was dominated by development banks, which accounted for up to two thirds of the market in 2013. Non-financial corporations gradually moved into the market (Apple, Toyota, Engie, EDF, etc.) through significant issues. The average issues are high: half of them offer more than EUR 1 billion and the rest mostly exceeds EUR 100 million. Public authorities (New York City, Seattle, London, Washington, Ville de Paris) have also moved into the green bonds market to finance transport infrastructure, town planning, etc. Maturities have tended to increase since 2014 due to a low interest rate environment. Today, the majority of issues have a maturity of more than five years.

Europe and the United States are still the top issuing regions (43% and 23%, respectively). In the United States, the market is largely made up of large companies, as well as municipalities (LaFrance and Hanify, 2016) that benefit from tax exemptions. The preponderance of the United States and Europe explains the fact that the euro and the dollar account for 80% of issues.

C1 Amount of global annual issues of green bonds and breakdown by issuer
(EUR billions)

Supra
Agency
Local authorities (excl. municipalities)
Municipal
Corporate – Non-financials
Corporate – Financials
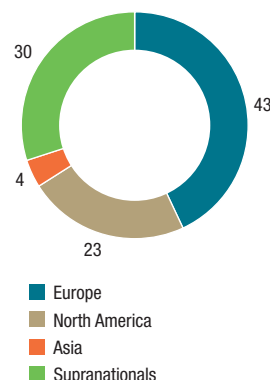Total outstanding (right-hand scale)

Sources: Bloomberg and Crédit Agricole CIB (2015).

However, developing countries account for an increasing share of issues, in line with their energy needs. China is the top climate-aligned bonds issuer with 36% of the market.
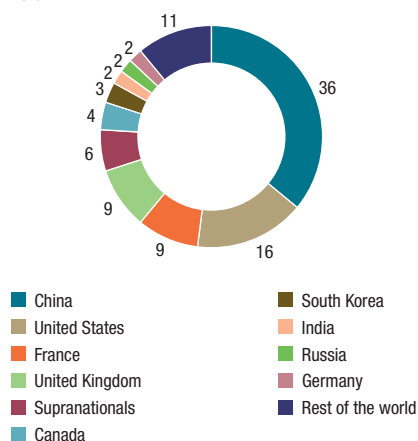
C2 Breakdown of green bond issues by issuer origin in 2015
(%)

Europe
North America
Asia
Supranationals

Source: Barclays Research (2015).

C3 The top ten countries of issuance of climate-aligned bonds
(%)

- China
- United States
- France
- United Kingdom
- Supranationals
- Canada
- South Korea
- India
- Russia
- Germany
- Rest of the world

Source: CBI (2016).

France occupies a privileged position on the green bonds market: it accounts for up to 21% of the green bonds stock (CBI, BNP, 2015) and is the third largest issuer of climate-aligned bonds with 9 % of issues (IWC, 2015). According to Paris Europlace (2015), this is due to the presence in Paris of the entire value chain: large issuing enterprises and public authorities, mobilised investors and recognised arrangers and non-financial agencies. The French State was also the first to announce the issuance of green bonds, for a total of nine billion euros from 2017. France also has an innovative regulatory environment, in particular the provisions of Article 173 of the Energy Transition Act.

The authorities have a role to play in supporting the development of the market

The green bonds market still accounts for only a small share of bond issues and remains largely insufficient to cover the financing needs of the transition. Several international bodies have started to tackle the subject, such as the G20 Green

Finance Study Group (GFSG), whose work compilation published in September 2016 proposes to develop indices, stock market quotations, national markets and to lower labeling and reporting costs. The European Commission could also seek to develop the market in the framework of the Capital Markets Union (CMU).

Possible avenues include creating incentives to hold green bonds. These mechanisms could take the form of prudential adjustments for holding securities that finance the energy transition (for example a green supporting factor by analogy with the existing mechanism for financing small and medium-sized enterprises - French Banking Federation, 2016). For 2 ° Investing Initiative - 2 ° ii (2015), the green bonds market should be stimulated by monetary policy measures similar to a "green" quantitative easing. Michel Aglietta and Etienne Espagne (2015) propose, for example, having recourse to monetary policy by rendering eligible for the ECB's asset purchase programme private securities that finance activities whose low carbon content is guaranteed by public authorities. However, this approach does not correspond to the role of central banks which is to ensure adequate financing for the economy as a whole and not for a particular sector. Furthermore, these incentives are likely to create a bubble due to the small size of the green asset market. In addition, the concept of a green asset does not have a precise and unquestionable definition. Finally, the implementation of measures for relaxing prudential rules may affect the ability of investors to integrate risk and ultimately affect their confidence in the market.

Conversely, defining and implementing common standards would make it possible to develop and secure the market. An improved standardisation of the market would, for example, increase transparency for investors, thereby reducing reputational risk and transaction costs. The People's Bank of China (PBoC) and the Reserve Bank of

India have their own rules for assessing and labeling green assets. France has also created a more targeted label, "*Transition énergétique et écologique pour le climat*". This diversity appears in fact to reflect the persistence of high heterogeneity or Fifty shades of green (RBC Capital Markets, 2014). To put an end to this, some market players argue for the adoption of the same approach as the TLAC[4] (Mullin, 2016). A dilemma appears between adopting a flexible label that preserves the share of initiative and the dynamism of the market and opting for a stricter label that improves its integrity and the confidence of investors. The idea of a voluntary label that is stricter in terms of definition than current labels is relevant but can in practice only apply to a region where the same conception of "green" prevails, like a possible European label. Thus, I4CE (2016) proposes to build on a common set of procedures and reporting principles (based on the green bonds principles), to which additional regional standards could apply.

Other market initiatives can also contribute to the growth of the green bonds market. The development of indices (Bank of America Merrill Lynch, Barclays MSCI, S&P and Solactive) improves the comparability of green bonds, thereby reducing the cost of access to information for investors. Stock markets have launched dedicated exchange listings that also facilitate access to information and contribute to the development of the secondary market, like in London, Oslo, or Stockholm.

Another solution for public authorities would be to require private players to take into account negative externalities (for example by setting a high carbon price) or financial risks linked to assets that are likely to turn into stranded assets.[5] Such measures would indirectly increase the cost of polluting investments and reduce the relative cost of green bonds without increasing the risks to financial stability.

4   The purpose of the total loss-absorbing capacity (TLAC) is to impose on systemically important banks a minimum level of capital and equity related instruments to absorb resolution losses. This regulation was the subject of a term sheet negotiated by the members of the Financial Stability Board (FSB), designed to harmonise its terms of implementation.

5   For example, the Board of Governors of the Federal Reserve of 12 September 2016 submitted for consultation a draft regulation which would require financial holding companies (FHC) to hold additional capital for their activity on the hard commodities market (Mineral resources, fossil fuels) carrying an environmental risk.

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The cost of equity for large non-financial companies in the euro area: an estimation over the last decade

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The cost of equity (CoE) borne by a company is a significant component of its overall cost of financing, which influences a firm's ability to invest, notably in innovative projects with more uncertain, longer-term returns. Theoretically, the CoE is equal to the return expected by an investor to buy a share in the company as compensation for the risk incurred. It cannot be observed directly but may be estimated by applying an equity valuation model to the company's stockmarket data.

This article proposes an estimation of the average CoE for large listed companies in the four largest euro area countries over the 2006-16 period. We find that average CoE rose sharply during the 2008-09 financial crisis and again during the euro area sovereign debt crisis in 2011-12. It declined in nominal terms thereafter, falling below 10% in late June 2016, i.e. on a par with pre-2008 levels. However, since 2008, the long-term nominal risk-free interest rate has decreased from around 4% to virtually 0% in the euro area, notably owing to the Eurosystem's highly accommodative non-standard monetary policies. The fact that the CoE has seemingly stabilised therefore reflects a trend increase in the equity risk premium (ERP). Yet because of the impact of monetary policy on firms' cost of debt, which has fallen to historically low levels, this stabilisation of the CoE has been accompanied by a decline in the weighted average cost of capital (WACC) for large companies over recent years.

Key figures

9.2%
average CoE for large non-financial companies
in the four main euro area countries in June 2016
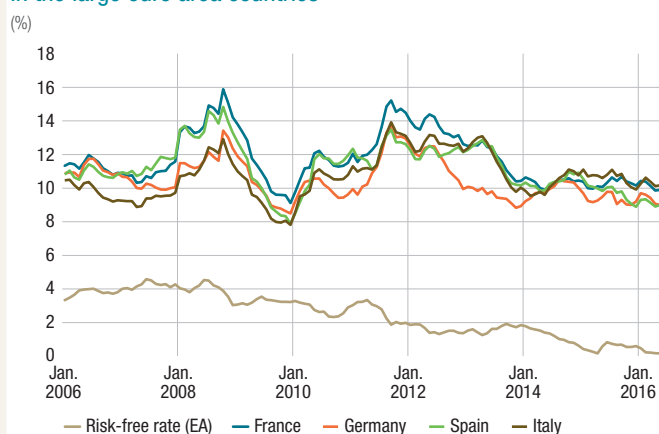
5.3%
WACC for large listed French companies
in June 2016

1.3 percentage points
increase in the European ERP
between June 2014 and June 2016

Average CoE for large non-financial companies in the large euro area countries

(%)

Risk-free rate (EA) — France — Germany — Spain — Italy

Sources: Bloomberg, Datastream, Eurosystem. Calculations: Banque de France.

1. Estimating the cost of equity for large European companies: a two-stage approach

An economy's potential growth depends in part on the ability of its companies to innovate in order to boost productivity and offer new goods and services. This ability depends in turn on having access to adequate financing. Financing for investments aimed at break-through innovations needs in particular to be tailored to the long timeframes of such projects and the heightened uncertainty surrounding their outcomes. In principle, equity financing provides a more effective response than debt financing to these risk and timing criteria.

Yet financing a risky project by issuing equity is generally more costly than financing through a debt issue (bank or bond financing), as the required return must cover the greater risk of loss because equity holders are junior to debt-holders. What is more, in most countries, debt enjoys tax advantages over equity, since interest payments are deductible. Accordingly, innovative firms must estimate ex ante the additional cost that equity financing entails relative to bank financing. Where this cost is too great and exceeds the project's estimated internal rate of return, it becomes an obstacle to investment. Once again, the impact of this additional cost is in principle higher for break-through investments that are less likely to be financed by way of a debt issue.

We define the cost of equity (CoE) borne by a company as the return expected by an investor to purchase a share in the company. It is a theoretical cost that may be estimated by applying an asset pricing model that compares the expected return and the risk of investing in the capital of the company relative to alternative investments. The valuation method that we use in this paper combines two standard approaches.[1] We assume first of all that the risk premium required by an investor to hold one share of a European company depends linearly on the risk premium of the European stock market, consistent with the standard capital asset pricing model (CAPM). To estimate a time-varying measure of the risk premium for the broad European index, we then use a simple dividend discount model (DDM) of payment flows (dividends and share buybacks) made to shareholders by listed companies from the overall European market. Share buybacks are included because they account for a significant share of shareholder remuneration over the period under review: this inclusion automatically raises the estimated level of the European ERP. In our modelling, buybacks account for approximately two percentage points of the risk premium in 2016.[2]

These two stages are described in detail in Part 1. Part 2 presents the results of our estimation of the CoE for large non-financial companies in the euro area's four largest countries. Part 3 assesses the impact of this cost on the overall cost of financing for companies in the four countries.

CoE and market risk as measured by the CAPM

We assume first of all that the excess return (i.e. adjusted for the risk-free rate) of a share in company i is described by a standard CAPM model. This simple model, which is widely used by practitioners to estimate an investment's expected profitability, assumes that an investor who is planning to add a new share to an already correctly diversified portfolio will require a risk premium that increases with the correlation of the share's return with that of the overall market index, which is treated here as the non-diversifiable macroeconomic risk factor. The security's exposure to systematic risk is measured by its beta coefficient (cf. Box 1 for more details).

In practice, we estimate betas for each European company in our sample and each month over a rolling window of one year using daily returns data (i.e. for the 260 business days preceding the end of the month in question).[3] The market factor

1 The ECB uses a similar methodology to our two stage approach to regularly measure the CoE of Europe's major banks, cf. ECB (2015), p. 61-62. For other examples of CAPM- or DDM-based CoE estimates, cf. King (2009), De Bandt et al. (2014) and Bundesbank (2016). Cf. also the website of Damodaran (A.), who teaches corporate finance and valuation at Stern School of Business at New York University and who advocates a DDM by market type approach: *http://pages. stern.nyu.edu/~adamodar*

2 Cf. Box 2.

3 Source of market data (individual share prices and index): Datastream.

Box 1

An application of the capital asset pricing model (CAPM)

The CAPM is derived from classic portfolio optimisation theory. In this simple framework, the mean and variance of a portfolio's return, which is assumed to be Gaussian, are the only variables that are relevant to the investor's decision. The investor is thus seeking to maximise the expected return on the portfolio for a given level of risk (described by the variance of the return). The market portfolio, represented by the market index (weighted by capitalisation), is assumed to be perfectly diversified. Its return is the only systematic or non-diversifiable risk factor in the model. The risk associated with the share that the investor is considering adding to the portfolio thus depends only on the correlation of the return on the share with this risk factor.

Since the investor is risk averse, exposure to a non-diversifiable risk factor must in theory be compensated for by a risk premium. In this setting, the expected return on share i, which is required by the investor and therefore measures the nominal CoE for the company in question, is written:

$$E_t(R_{i,t+1}) = r_{f,t} + \beta_i [E_t(R_{m,t+1}) - r_{f,t}] \qquad (1)$$

where β_i denotes the systematic risk exposure of share i at time t, $r_{f,t}$ is the risk-free rate at time t, $E_t(R_{i,t+1})$ is the expected return on share i at time t and $E_t(R_{m,t+1})$ is the expected market return at time t.

The CoE for company i is thus expressed as the sum of the risk-free rate and a risk premium. The premium is in turn the product of the risk premium of the market portfolio, $E_t(R_{m,t+1}) - r_{f,t}$, and the share's beta coefficient, which is equal to the covariance between the excess return (relative to the risk-free rate) on the share and the market, divided by the variance of the excess return on the market.

In practice, the relationship described above is generally estimated by means of a linear regression, replacing the expected returns on share i and the broad market index by historical daily returns (dividend adjusted), or $\tilde{R}_{i,t}$ and $\tilde{R}_{m,t}$ respectively. For each company and over a given window of time, we can thus estimate the company's beta, β_i, using the ordinary least squares method:

$$\tilde{R}_{i,t} - r_{f,t} = \alpha_i + \beta_i [\tilde{R}_{m,t} - r_{f,t}] + e_{i,t} \qquad (2)$$

If markets are efficient, the CAPM predicts that the coefficient α_i, which represents a risk-adjusted measure of the share's historical performance, will not be significantly different from zero. The residuals $e_{i,t}$ are, moreover, assumed to be independent, identically distributed and have a zero mean.

is represented by the broad European index, the Eurostoxx 600.[4] The risk-free rate is measured by the yield on German ten-year bunds.[5]

We then construct equally-weighted portfolios by grouping together companies by country for the four largest countries in the euro area. The beta of the non-financial companies (NFCs) in each portfolio is obtained by calculating the average of the betas of

firms making up the portfolio.[6] The average CoE for the companies of a given country is then computed by multiplying, at each date, the country's estimated beta coefficient at that date by the European market risk premium, to which is added the risk-free rate. The separate estimation of a time-varying risk premium for the overall European stockmarket makes up the second stage in our methodology for estimating the CoE.

4 We adopt the viewpoint of a European investor by assuming that capital is sufficiently mobile in Europe to ensure that transaction costs are negligible and the opportunities for arbitrage between domestic equity markets are low.

5 The risk-free rate (default and liquidity) is often in practice the interest rate observed on the market for liquid government bonds of countries considered to be solvent. In Europe, the bund is the usual benchmark. The EONIA swap rate may also be used. We select a long maturity to reflect the horizon of equity investors, who are assumed to take a long view.

6 Extreme values below the 5th or above the 95th percentile of the empirical distribution at each date are excluded when calculating the average to reduce the impact of potential outliers.

Estimating the European market risk premium

There are several options when it comes to measuring the risk premium for the European stockmarket. The market risk premium can be measured as the historical average of the annualised excess return of the stockmarket index over a long period. Fama and French (2002) estimate this average premium at between 3% and 8% for the US market. When estimating the CoE of major banks in developed countries, King (2009) takes up the estimates provided by Dimson et al. (2002), who measure the market risk premium using average historical returns over a century (1900-2001) for 16 countries. The authors obtain an average ERP of around 7% for France. The recent report by France's *Conseil national de l'information statistique* (CNIS – National Council for Statistical Information) on the cost of capital (Garnier et al., 2015), meanwhile, uses ERP values for different countries taken from the survey by Fernandez et al. (2012). Average premiums ranged between 5% and 6% for the four largest European countries.

Representing the ERP using a long-run average assumes however that the quantity of systematic risk on the market, as well as the price of that risk, which depends on investors' risk aversion, are constant. Such an assumption strikes us as unconvincing for an observation period spanning the two most recent crises suffered by euro area economies. We therefore opted for a different approach, which consisted in using a classic dividend discount model (DDM) to estimate a time varying measure of the European ERP for each month.

The simplest DDM method, which is routinely used to give an order of magnitude for the ERP, is based on the assumption that future dividends grow at a constant rate from year to year. Under this assumption, the risk premium is proxied by the sum of the dividend yield for the market in question and the expected nominal growth rate of future dividends less the risk-free rate. In our article, we use a more sophisticated version of the DDM, which we owe to Fuller and Hsia (1984) and which allows us to relax the assumption of a constant growth rate for future dividends. The dividends considered in our application are all dividends paid by Eurostoxx 600 firms over a rolling 12-month period. We add to dividends *stricto sensu* flows of share buybacks by firms in the index, as buybacks have made up a significant portion of shareholder remuneration since the beginning of the crisis of 2008 and hence of the cost borne by companies. Between 2006 and 2016, buybacks accounted for around one third of cash flows from companies to shareholders on the broad European market. Taking them into account raises the ratio of these cash flows to capitalisation by 1% to 2% over the period. In the context of our modelling, this increase feeds automatically through to the estimated CoE and the weighted average cost of capital (WACC) (cf. Box 2).

In considering the impact of share buybacks, we follow the practice of others, including Damodaran (A.) of New York University. This methodological choice has a material effect on

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Box 2

The place of share buybacks in free cash flows to shareholders

Dividends and share buybacks are, from the company's perspective, two ways to remunerate shareholders. For the business, the aggregate effect of these different free cash flows is identical: a portion of the firm's cash leaves the company and is paid to shareholders. For this reason, we prefer to include buybacks in our estimation of the return expected by shareholders, even if this appears to contradict the simplifying assumption of long-term investment underpinning our DDM. The specific effects of these two forms of payment – different market reactions, change (or not) to ownership structure, different tax treatment for beneficiary shareholders and so on – may however lead a cash-rich company to opt for one over the other in a given year. For more details, cf. for example Garnier et al. (2015) and Damodaran (2016).

our findings, for if buybacks are not included, the average CoE for the four large European countries would be approximately two percentage points lower at around 8%, while the WACC would be down approximately 1 to 1.5 percentage points at around 4.5% in the second quarter of 2016. Chart 1 shows the series of European ERPs that we obtained. The premium has fluctuated considerably since 2006, peaking during the financial crisis in 2009 and Europe's sovereign debt crisis in 2012. After declining for a while, it has again been rising since mid-2014. This recent trend primarily reflects the decrease in the risk-free rate over the last two years; the estimated expected return on European shares appears to have stabilised during this period.

C1 Equity risk premium in Europe (Eurostoxx 600)
(%)

— Risk premium (Eurostoxx 600)

Sources: Bloomberg, Datastream, Eurosystem. Calculations: Banque de France.

Box 3

A DDM to estimate the risk premium in Europe

The dividend discount model (DDM) is a standard equity valuation model. The value of one share is theoretically equal to the expected sum of discounted dividends and the share's sale price, which is also discounted by applying the investor's discount factor. Assuming the asset is held for a long time (or even indefinitely), the discounted sale price will tend towards zero. Assuming a constant expected growth rate for future profits g, a constant discount rate r and a dividend distribution rate of 1, the price of one share at $t = 0$ is thus written:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} = \sum_{t=1}^{\infty} \frac{D_0 (1+g)^t}{(1+r)^t} = \frac{D_1}{r-g} \qquad (1)$$

where r denotes the (annualised) discount rate for future income flows: put another way, it is the rate of return expected by investors, and hence the cost of equity (CoE). If investors are not risk neutral, they require a risk premium $k = r - r^f$ to compensate for the uncertainty surrounding future returns. In this highly simplified framework, the ERP is written:

$$k = \frac{D_1}{P_0} + g - r^f \qquad (2)$$

The simplification obtained with the second term of the equation (1) is possible only because the expected growth rate for future dividends is assumed to be constant. To avoid making this strong

assumption while keeping the benefits of a simple model, practitioners sometimes use a slightly more sophisticated version of the DDM, called the H-model, presented by Fuller and Hsia (1984). The H-model allows for an expected growth rate g_t for future dividends that is variable over time while adopting a profile that is compatible with a relatively simple calculation formula. Here, we consider that, at each period T, investors expect future dividends to grow at $g_{a,T}$ from year one to year three, and at $g_{n,T}$ from year seven onwards. From year three to year seven, the expected growth rate is assumed to converge linearly from $g_{a,T}$ to $g_{n,T}$.

Under these assumptions, the ERP is expressed as (we drop the T index for the sake of readability):

$$k = r - r^f = \frac{D_0}{P_0}\left[(1+g_n)+\frac{H}{2}(g_a-g_n)\right]+g_n-r^f \tag{3}$$
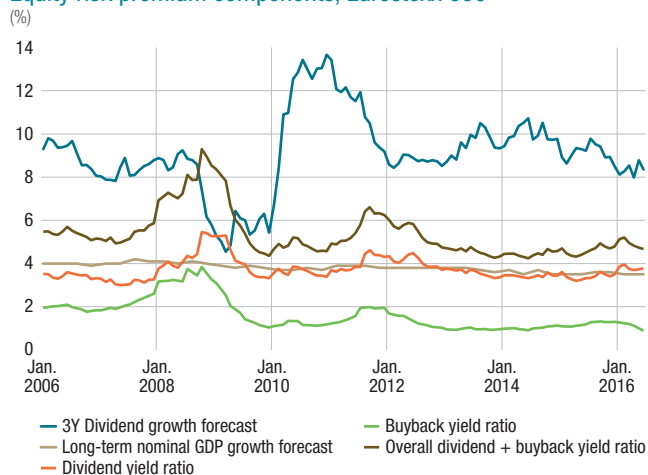
We apply this formula to the broad European stockmarket (Eurostoxx 600), taking account of the impact of share buybacks on the index's valuation. Accordingly, the ratio represents the ratio of dividends paid over the last 12 months by firms in the index to the index's capitalisation $\frac{D}{P}$ (dividend yield), to which is added the ratio of share buybacks to capitalisation (buyback yield). We use forecasts of nominal medium-term (three-year) growth in expected earnings per share provided by the Institutional Brokers' Estimate System (I/B/E/S) to calibrate the growth rate g_a for each period. The long-term growth rate g_n is measured by the sum of long-term growth forecasts for euro area GDP and inflation derived from the ECB's Survey of Professional Forecasters. The risk-free rate is measured using 10-year bund yields.

Chart 2 shows the data series used to calculate the ERP for the European market. We see that periods of falling share prices during the 2008-09 and 2011-12 crises are associated with spikes in the dividend yield (augmented to include the buyback yield). This may be interpreted as reflecting a preference among large companies for stability in the income flows paid to shareholders. Similarly, the expected income growth rate tends to increase after a sharp fall in prices (as in 2010), suggesting expectations of a catch-up following a period of value destruction.

2. Cost of equity for companies in the four largest countries of the euro area since 2006

We apply the methodology set out above to estimate an average CoE for large NFCs in the four largest countries of the euro area, namely Germany, France, Italy and Spain. The sample of firms includes the 102 listed NFCs featuring in the narrow indices of each of these countries, i.e. The DAX 30, CAC 40, FTSE MIB and IBEX 35 respectively. This choice ensures good stability for the sample and enables us to select around 25 large NFCs for each country. The decade under investigation spans almost two business cycles and two major crises.

C2   Equity risk premium components, Eurostoxx 600
(%)

- 3Y Dividend growth forecast
- Long-term nominal GDP growth forecast
- Dividend yield ratio
- Buyback yield ratio
- Overall dividend + buyback yield ratio

Sources: Bloomberg, Datastream, Eurosystem.

Chart 3 presents the findings of our CoE estimates for the four company portfolios. Since 2006, the nominal CoE for large companies in the main euro area countries has ranged between 8% and 16% approximately. Episodes of high CoE reflect the impact of the major crises during the period, i.e. the post Lehman crisis in late 2008, the first phase of the euro area sovereign debt crisis in 2010, followed by the second phase, which ran from mid-2011 to mid-2013. Equity financing became somewhat more expensive in 2014-15, with the average CoE per country reaching between 10% and 11%, in line with the concerns being expressed at that time by some observers.[7]

Although average CoEs by country are highly correlated, the average in Germany is lower than in the other three countries, including France, during the crisis period. Furthermore, while average CoEs remained relatively high in 2014-15, exceeding 10% in three countries despite the decline in the risk-free rate, expected returns decreased from mid-2015, reverting to around 9%, or below the averages seen before the subprime crisis. The downward movement appeared to continue in the first half of 2016. Cross-country differences persist but an analysis of estimated CoEs for individual firms reveals that these spreads are small compared with the spreads between firms from different sectors within the same country.[8]

Chart 4 shows the spread of situations within each country, suggesting that the spreads between average country CoEs are not very significant in the final quarters. The distribution of individual beta values within each country portfolio is represented by the interquartile range around the average CoE value. This range is at its widest during crises and remained substantial at the

C3 Estimated CoE for NFCs in the four largest euro area countries

Sources: Bloomberg, Datastream, Eurosystem. Calculations: Banque de France.

end of the period under review, particularly in Spain and Italy.

It is important to understand that the results presented in this section are contingent on the modelling assumptions and underlying specification choices. Accordingly, they are subject to uncertainty and must be treated with care.[9] That being said, our country results are comparable to those of other studies. Damodaran (A.) of NYU Stern estimated the ERP (excluding the risk-free rate) at end-June 2015 to be 6.3% in France, 5.8% in Germany, 8.2% in Italy and 7.8% in Spain.[10] If we add a long run nominal risk-free rate of around 1%, we obtain CoEs in the region of 7%-9% for mid-2015, or slightly lower than those shown in Chart 1.

A recent report by the McKinsey Global Institute (2016) also proposes comparable results, estimating that the real CoE fluctuated between 6% and 8% on average over the 1965-2014 period in Europe, which gives a long-run average nominal CoE of 8%-10% assuming long-run inflation

7 Cf. in particular, in France, the Villeroy de Galhau report entitled *"Le financement de l'investissement des entreprises"* (2015).
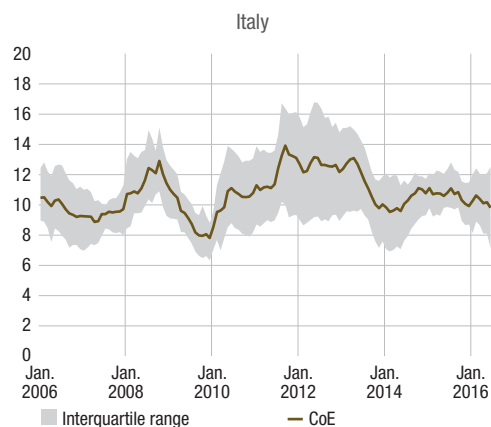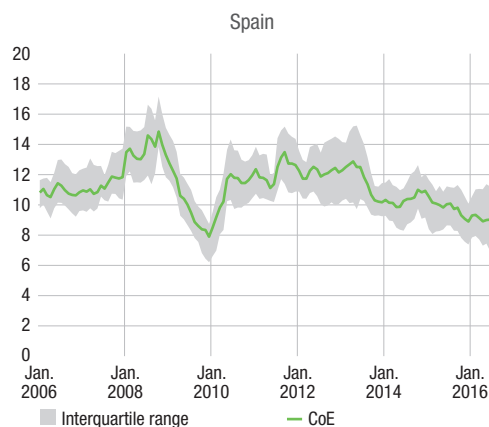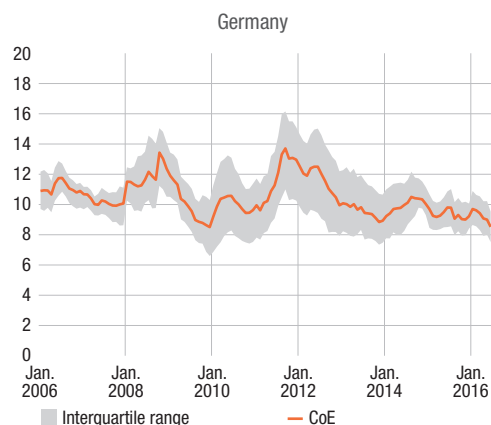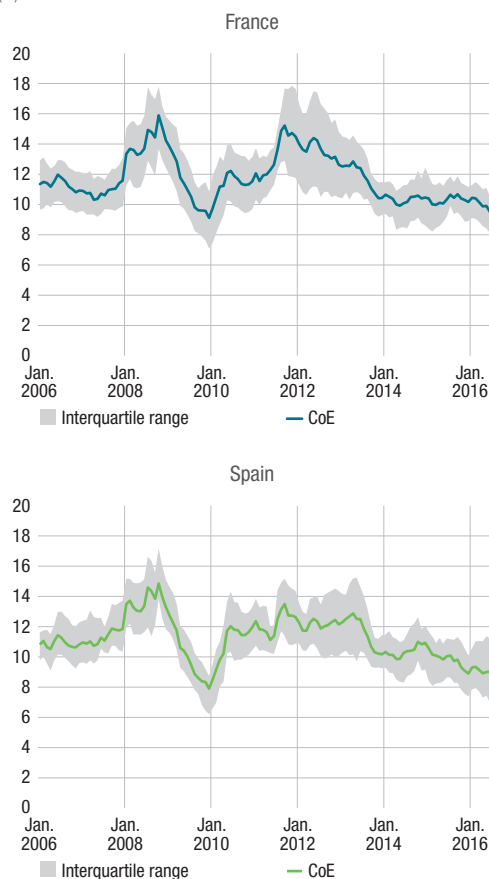
8 In the last three years, country fixed effects accounted for 3% of CoE variance for the 102 firms in our four country portfolios, while sector fixed effects (for the nine main non-financial sectors of the Eurostoxx 260) accounted for 14%.

9 The uncertainty stems from our numerous modelling and estimation choices, including the decision to use a single factor model of individual returns (CAPM) in stage one, uncertainty over beta estimates linked to the finite size of the rolling windows, the non-weighting and composition of country portfolios (uncertainty surrounding the average), and the assumptions made in the risk premium calculation method in stage two (choice of expected profit profiles, etc.). Compounding these factors is the possible measurement error linked to the choice of expected profit data and risk-free rate.

10 Calculations available at *http://www.stern.nyu.edu/~adamodar/pc/datasets/ctrypremJuly15.xls*

C4   Estimated average CoE for NFCs

(%)

France

Germany

Spain

Italy

Sources: Bloomberg, Datastream, Eurosystem. Calculations: Banque de France.

is close to the Eurosystem target.[11] Lastly, the ECD (2015) estimates a CoE of approximately 12% for industrial firms in advanced economies in 2014.[12]

3. The weighted cost of financing has declined to below its pre-crisis level

The average country CoEs estimated above can be used to estimate the overall cost of financing for large European NFCs as an average of the costs of

equity and debt weighted by their relative shares in companies' liabilities (i.e. a measure of WACC). Debt itself can be broken down into bond and bank debt.[13] We measure the cost of bond debt by the average yield on bonds issued by the main NFCs of each country.[14] To estimate the cost of bank debt, we take the rate on new loans of more than EUR 1 million extended to NFCs (source: ECB) as a proxy for the rate applied to large firms. Chart 5 shows how the debt financing costs of large companies in the four main euro area countries have moved, falling to a record low

11 The report also finds that the CoE has remained stable despite the decline in rates since 2008, attributing this divergence to increased risk premiums.

12 The OECD estimates use a sample of some 10,000 large listed firms provided by Bloomberg (Bloomberg World Equity Index).

13 Cf. Box 4.

14 The method used to calculate these yields is described in Gilchrist and Mojon (2014).

C5   Cost of bond and bank debt for large non-financial companies in the euro area
(%)

Bond yield

Bank interest rate
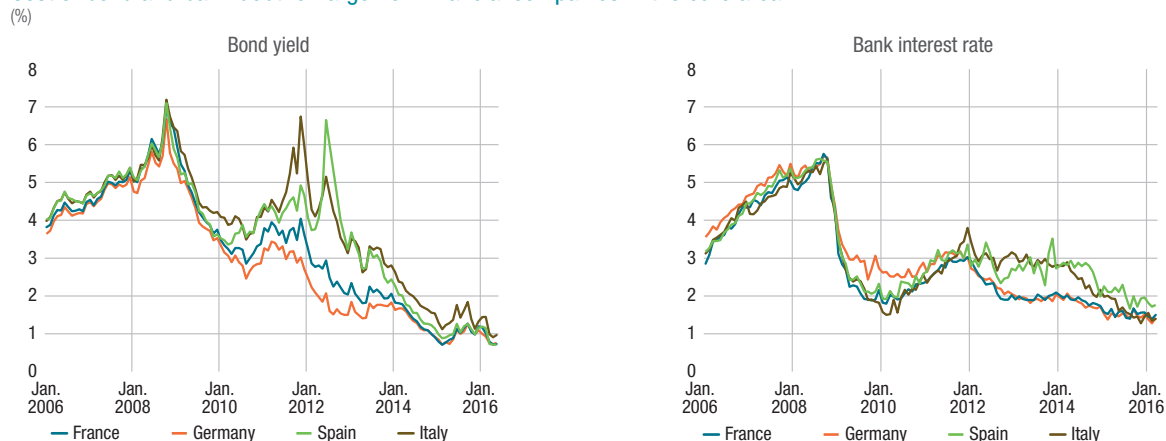
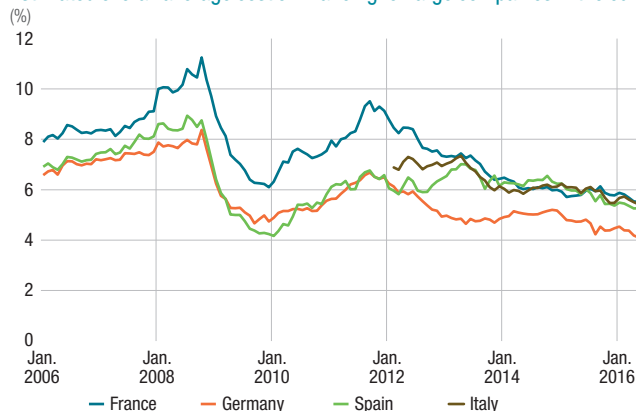Sources: Bloomberg, Eurosystem. Calculations: Banque de France.

in 2016, notably reflecting the impact of the Eurosystem's highly accommodative non-standard monetary policies. In many countries, interest paid on corporate debt is entirely or partly tax-deductible. In practice, the applicable tax rules may be complex, with threshold effects and the possibility that different debt classes might be treated differently. In our first analysis, we ignore the impact of these tax deductions, which amounts to calculating a pre-tax cost of debt. If we consider our CoE estimate to be an after-tax cost for the firm (because it relies on a measure of dividends actually paid via the dividend yield ratio), our approximation of WACC therefore aggregates cost measures that are not strictly comparable.

We calculate weightings for the various financing costs of large companies in each country by using the quarterly financial accounts of non-financial agents produced by the Eurosystem. The financial accounts series aggregate the situation of all the companies in a given country. However, insofar as company size is extremely variable (generally speaking, each country has many smaller firms and a handful of really large firms), a granularity assumption whereby ratios are heavily influenced by changes affecting the largest firms seems

reasonable. We therefore assume that the leverage ratios derived from the national financial accounts are a good proxy for the ratios of large listed companies for which we estimated a CoE.

The overall weighted average cost of financing for large NFCs estimated for the four countries is shown in Chart 6. It stood at around 5.3% for France, Spain and Italy in June 2016,

C6   Estimated overall average cost of financing for large companies in the euro area
(%)

Sources: Bloomberg, Datastream, Eurosystem. Calculations: Banque de France.

and was slightly lower in Germany, at 3.9%. The cost is highly correlated with the estimated CoE, reflecting equity's sizeable share of the liabilities of large European companies. The lower WACC for German companies reflects a slightly weaker estimated CoE but also the smaller average proportion of net equity in liabilities (approximately 40% in late 2015, compared with around 50% for French NFCs). In contrast, the leverage of French companies measured based on national accounts data was the lowest in 2016 of the four countries under review, which magnifies the impact of the estimated CoE in their average cost of financing.

Box 4

National financial accounts and estimating the WACC

The weightings for the various financing costs of large companies in each country are calculated here using the quarterly financial accounts of non-financial agents produced by the Eurosystem. For each country, we consider outstanding net bank debt (B_t) (calculated from the following items: bank debt on the liability side (AF4) – bank debt on the asset side (AF4)), outstanding bond debt (S_t) (AF3) and net equity (E_t) (equity (F51) on the liability side – equity (F51) on the asset side) for the NFC sector.

The use of net outstanding amounts aims at limiting the impact of double counting linked to intra-group loans and cross-shareholdings. The equity recorded in the national financial accounts includes listed shares, which are valued at market prices, as well as unlisted shares, whose market value is the result of an estimate derived from the book value of equity (which includes, in addition to share capital, profit or loss for the financial year, amounts carried forward, reserves plus any revaluations).[1] Based on these national financial accounts, bank debt accounted for approximately 30% of the financing sources of French companies at end-2015 compared with approximately 20% for bond debt. Equities thus make up about half of the net external financing sources of French companies. The same methodology finds that equity comprises a much larger share – some 75% – of the financing of US firms.

At the time of writing, sector financial accounts for each country were available only up to the first quarter of 2016 and, in the case of Italian data, only from the first quarter of 2012 onwards. We extend the March 2016 values through to June 2016 in order to calculate the weightings for 2016.

1 For more details, cf. Garnier et al. (2015, p. 55).

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4. Conclusion

This article proposes an estimation of the CoE for large NFCs in the euro area, which draws on standard asset valuation methods. Despite their acknowledged theoretical and empirical limitations, these simple approaches continue to be frequently used by practitioners, are easily replicable and may provide useful insights in the economic policy debate. In principle, the ability of companies to obtain financing by issuing equity at a reasonable cost is favourable to investment and innovation, and hence to higher potential growth for the economy.

Our estimates suggest that the nominal CoE for the large listed companies of the four main euro area countries has returned to a level that is on a par with, or even below, that seen before the 2007-08 crisis. With the sharp decline in bank lending rates and expected returns on euro area corporate bonds over recent years, reflecting the effect of the Eurosystem's highly expansionary monetary policies, the weighted average cost of financing for companies in these four countries is now below the level seen in 2006 in nominal terms. However, the fact that the CoE has stabilised, while the long term risk-free interest rate has fallen steeply since the beginning of 2014, suggests a trend increase in the ERP in Europe similar to that seen in the United States.[15]

It is hard to identify the reasons for this increase in the risk premium and hence to say whether it will prove lasting. The debate over secular stagnation in developed countries, political tensions in Europe, and regularly voiced concerns over the formation of asset price bubbles in a low interest rate environment may have helped to heighten the perception of increased risk. Investors may also have become more risk averse since the last crisis.

Whatever the case may be, this indicator deserves to be watched closely in the coming quarters. A high ERP at a time of low interest rates could encourage companies to increase their debt at the expense of equity financing. Insofar as this increased debt is partly put towards maintaining a high level of dividend payments or share buybacks consistent with expected shareholder returns, we can only expect it to have a mildly positive impact on investment and productivity growth. Given that this growth remains weak in developed countries, and R&D investment needs to be stimulated after slowing with the recent crisis, it is important to encourage equity financing, which takes a longer view.

15 The report by the McKinsey Global Institute (2016), "Diminishing returns: why investors may need to lower their expectations", spotlights the historically high level of the US ERP in 2015, particularly considering the decline in interest rates. According to calculations by Damodaran (A.), the ERP for S&P 500 firms rose from 5% in early 2014 to just over 6% in mid-2016.

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In the first half of 2016, the main French groups increased their profitability

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Anne Sophie Lafon
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Companies Observatory

The 80 largest French industrial and commercial groups listed on segment A of Euronext Paris recorded a 4.1% decline in business activity in the first half of the year. The main groups were adversely affected by unfavourable exchange rate effects together with lower organic growth. This observation should nevertheless be qualified since it is influenced by the underperformance of just one of the 80 groups, operating in the energy sector; if the impact of this group were cancelled out, turnover would fall by 2%.

For the 80 groups as a whole, the favourable operating conditions nevertheless made it possible to limit the fall in operating profit to 2%. Furthermore, there were a number of items not included in operating activities, notably asset sales, that resulted in a significant increase in the profitability rate and net profit (18%).

The decline in cash flow from operating activities did not have an impact on the cash position which rose by 1% thanks to stable dividend payments and a 4% decrease in investment. As regards the latter, the increase in financial investment was not sufficient to offset the decline in tangible and intangible investment.

The main French groups took advantage of the ongoing favourable financing conditions to borrow and restructure their debts with a marked appetite for bonds which remain the main source of financing for the groups under review.

The 6% rise in financial debt combined with the 2% fall in equity had a negative impact on the groups' financial structure. However, the latter remains robust.

Key figures

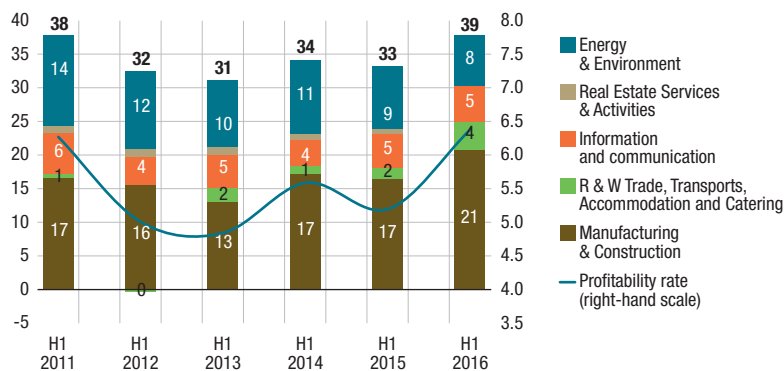**–4.1%**
the decline in turnover

18%
the rise in net income

EUR 158 billion
the amount of cash flow
as at 30 June 2016

EUR 548 billion
the amount of financial debt
as at 30 June 2016

Net profit by sector and profitability rate

(amounts in EUR billions – rates in%)

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

1. The main groups' turnover declined in H1 2016

Turnover fell to the level of 2014

In H1 2016, the 80 largest French groups saw a 4.1% decrease in their turnover compared with H1 2015 (see Chart 1),[1] reaching a total of EUR 613 billion. This reduction is very largely due to the sharp 12.6% drop in the energy and environment sector. The groups in this sector were faced with particularly unfavourable conditions. In contrast, the other sectors displayed relatively stable turnover.

The geographical breakdown of turnover has the same profile as in H1 2015. Europe accounted for the bulk of the main French groups' activity (60%), while the Americas and the rest of the world represented 16% and 24% respectively. Over a longer period, we observe a gradual expansion into markets further afield, with European markets losing 5 percentage points since 2011.
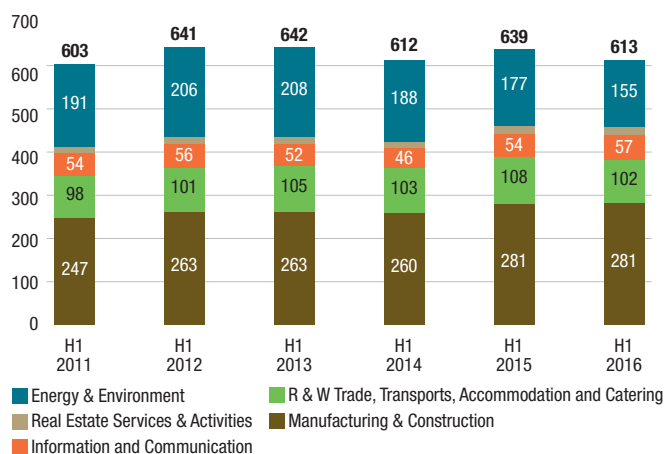
Organic growth and negative exchange rate effects affected turnover

The 4.1% fall in the turnover of the main French groups can be analysed in terms of its different components: exchange rate effects, consolidation effects and organic growth.

The growing internationalisation of the main French groups raises their sensitivity to exchange rate fluctuations. For instance, the conversion of foreign subsidiaries' accounts into euro at the end of the accounting period has a marked impact on their consolidated turnover. In H1 2016, and contrary to that which was observed in 2015, exchange rate effects had a negative impact on the turnover

of the main French groups. They contributed 2.7 percentage points or EUR 17 billion to the decrease in turnover. This can mainly be attributed to the fact that some emerging currencies fell sharply against the euro, in particular the Brazilian real, the Mexican peso and the Russian rouble. The uncertainty stemming from the Brexit referendum led to a rise in the euro against sterling, which had a mechanic impact on the turnover in euro of the French groups with large scale activities in the United Kingdom.

C1   Turnover by sector

(EUR billions)

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

1 Unless otherwise stated, the situation in H1 2016 is compared with H1 2015.

T1   Geographical breakdown of turnover

(%)

	2011	2012	2013	2014	2015	2016
Europe	65	64	62	62	60	60
Americas	13	14	16	15	16	16
Rest of the world	22	22	22	23	24	24
Total	100	100	100	100	100	100

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

C2 Growth rate of turnover

(in EUR billions and %)
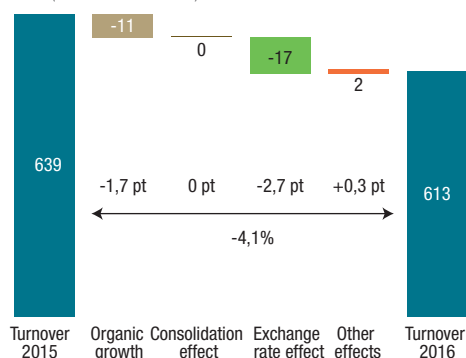
Source: Financial reports of the 80 main groups at 30 June 2016.
Banque de France calculations, September 2016.

C3 Operating income by sector

(EUR billions)

- Energy & Environment
- Real Estate Services & Activities
- Information and Communication
- R & W Trade, Transports, Accommodation and Catering
- Manufacturing & Construction

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

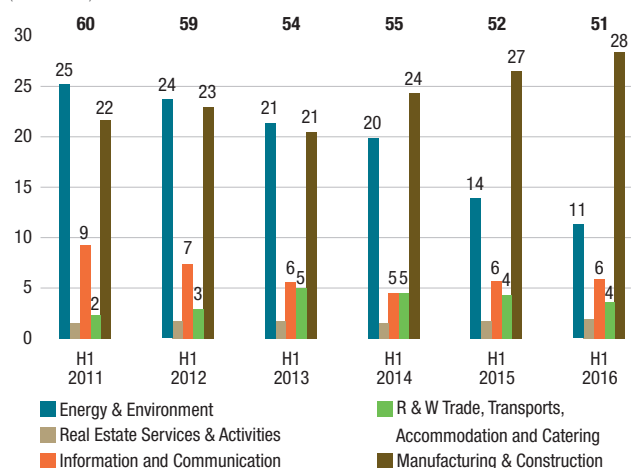Consolidation effects reflect the acquisitions and divestments of subsidiaries of the main groups and, thus, the contribution to turnover made by entities entering the consolidation scope minus that of those exiting it. Most groups report these changes in scope or provide enough elements to make it possible to assess these effects. For the groups under review as a whole, the contribution of this component was zero in H1 2016.

Once the exchange rate and consolidation effects are stripped out, we obtain organic growth. The latter was negative in H1 2016, to the tune of 1.7 percentage point or EUR 11 billion. This observation should nevertheless be qualified. Indeed, this decline was concentrated in the energy and environment sector, and more specifically can be attributed to one group in this sector that experienced, in H1 2016, a decrease in turnover on a like-for-like basis. Aside from this group, overall organic growth was positive even though it remained weak.

2. A sharp increase in the profitability of the main French groups

Operating income fell by 2%

Operating income, i.e. operating profit minus operating expenses, measures the intrinsic performance of the groups' businesses, before financial gains/losses and taxes. For the 80 groups under review, it stood at EUR 51 billion in H1 2016 (see Chart 3), or down by 2% against H1 2015.

Using a sectoral analysis, we observe that the two main sectors contributing to operating income, energy and environment, and manufacturing and construction (78% of the total in 2016, like in 2011), saw diametrically opposed developments. The former has declined each year since 2011 (–55% in 2016 compared with 2011) due to the fall in

commodity prices, in particular the hydrocarbon sector. This therefore results in lower turnover. But it also leads to asset impairments, with lower prices causing a decline in the estimated future flows used to determine the value of the assets.

Conversely, manufacturing and construction benefited from more favourable operating conditions and in particular from lower commodity prices that led to a rise in profitability. Its operating income therefore improved (up 31% in 2016 compared to 2011) more rapidly than its turnover (up 14% over the same period).

Sharp increase in profitability

Changes in the net profit, which is calculated by incorporating financial income, earnings from discontinued operations and tax expenses into operating income, show that profitability increased sharply in H1 2016 with a rise in net profit of 18% compared with H1 2015.

This rise is directly linked to two sectors of activity: trade, transport, accommodation and food services (up 169% on H1 2015) and manufacturing and construction (up 25% over the same period). For the latter, income from the sale of a business line (EUR 2.5 billion) explains the marked rise in the sector's net profit. After adjusting for this sale, net profit nevertheless grew by 13%. However, for the trade, transport, accommodation and food services sector, net profit growth stemmed from an overall improvement with 84% of the companies under review posting gains in the first half of the year.

The profitability of the companies under review measured by the net profit margin (net profit as a percentage of sales revenue) rose very significantly to 6.4% (up 1.2 percentage point on H1 2015) due to both the fall in turnover and the rise in net profit. The net profit margin reached historical

C4   Net profit by sector and profitability rate
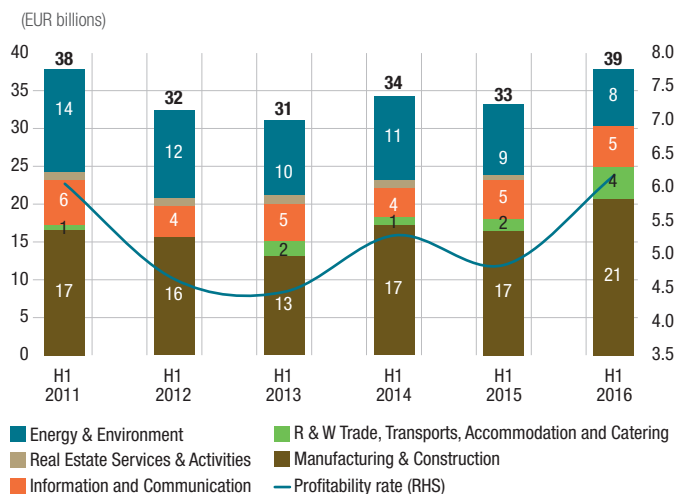
(EUR billions)

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

highs in the period under review but it was mainly the most profitable companies that grew the most in 2016 (up 2.3 percentage points of turnover).
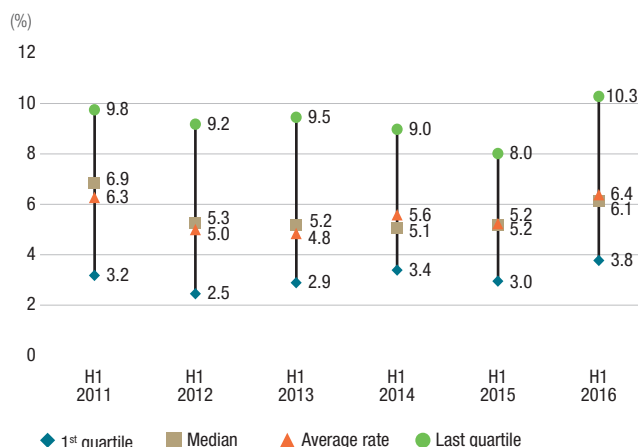
C5   Net profit margin (net profit/turnover)

(%)

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

3. Groups continued to consolidate their cash position and investment fell slightly

Further improvement in the cash position

At the end of H1 2016, the cash position of the main groups continued to improve, reaching a historical high over the period under review of EUR 158 billion (up EUR 2 billion on June 2015) or up 26% on June 2011.

The sectoral analysis shows that, contrary to previous years where most sectors increased their cash position, this time the rise was chiefly concentrated in the manufacturing and construction sector (EUR 7 billion). Conversely, the poor operating conditions of companies in the energy and environment sector led to a reduction in cash flows from operating activities and required a drawdown of EUR 3 billion from the cash position to cover investments and dividend payments.

Dividends relating to the financial year to end December 2015 and paid out in H1 2016 rose slightly to EUR 30 billion, against EUR 29 billion for the previous year.

Cash flows remained stable

In order to analyse in greater detail changes in the cash position of the main groups in H1 2016, cash flows can be broken down as follows: cash flows from operating activities, cash flows from investment activities and cash flows from financing activities (outlined below).

Total cash flow amounted to EUR –17 billion at end June 2016 (stable compared with 2015) but displayed disparities vis-à-vis H1 2015 due notably to the decline in flows generated by operating activities.

C6 Cash position at accounts closing

(EUR billions)
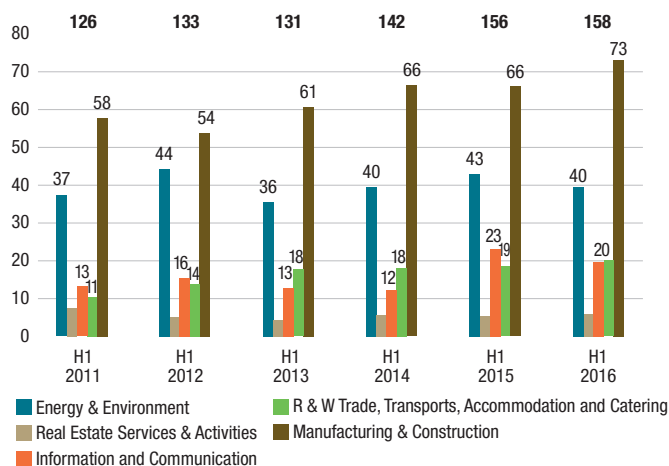
Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

C7 Breakdown of cash flow

(EUR billions)

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

Operating cash flows

According to the standard definition used in financial analysis, operating cash flows correspond to the difference between a company's internal financing capacity and th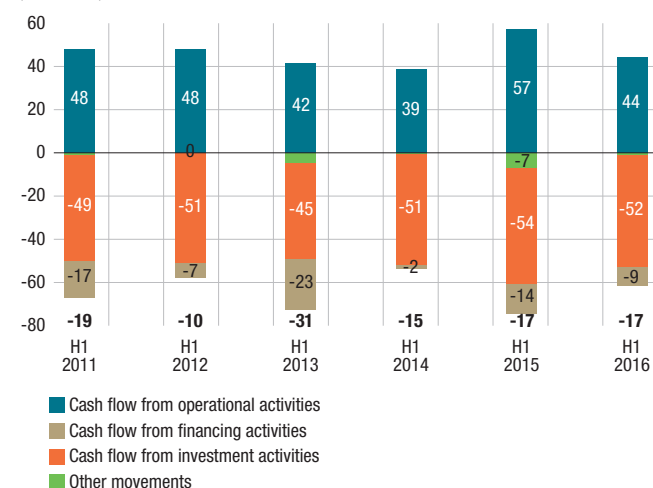e changes in its operating working capital requirement (OWCR) over a given period. Cash flows generated by operating activities fell to EUR 44 billion against EUR 57 billion. This decline should be put into perspective given that this item had reached a very high level in 2015, far above that observed for the previous period 2011-2014. At EUR 44 billion, it corresponds to the average over the period 2011-2014.

The OWCR increased slightly at end-June 2016, (up EUR 3 billion on 2015) following a rise in trade credit, despite a slight reduction in inventories. At EUR 169 billion, it remained at a low level over the review period.

Financing flows

Flows from financing activities primarily include equity transactions (dividend payments, share issues and buybacks), and financial debt (debt issues, repayments). Cash flows contracted by EUR 5 billion, which is counter intuitive given the rise in financial debt, which increased by EUR 32 billion at end-June 2016 (see Section 4). However, part of the additional debt may have been taken out in H2 2015 and therefore cannot be included in H1 2016 financing flows.

T2 Operating working capital requirement formation

(amounts in EUR billions)

	2011	2012	2013	2014	2015	2016
Trade receivables (A)	249	263	263	244	241	243
Trade payables (B)	213	223	225	214	239	236
Balance of trade credit (A – B)	36	40	38	30	3	7
Inventories (C)	148	156	155	156	163	162
OWCR (A – B + C)	184	196	193	186	166	169

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

Investment

Investment flows can be broken down into five components:

- acquisitions of tangible and intangible fixed assets;

- acquisitions of financial fixed assets;[2]

- disposals of tangible fixed assets;

- disposals of financial fixed assets;

- "other changes".[3]

2 Data on acquisitions of financial fixed assets are taken from cash flow statements published by the groups, which does not allow us to distinguish between acquisitions leading to a takeover of the target and those resulting in a minority stake.

3 «Other changes», which corresponds to the net balance of operations that cannot be classified under any of the four items.

C8 Investment flows by sector

(EUR billions)
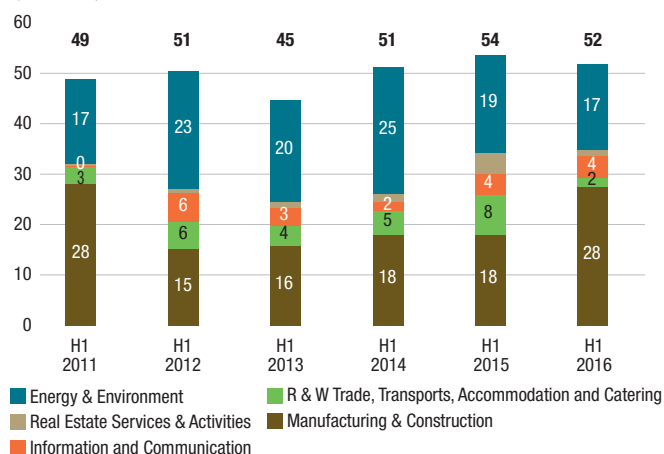
Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

Investment declined in H1 2016. It fell by 4% against 2015, but remained at a level equivalent to that of previous years. The sectoral analysis shows a sharp increase in the manufacturing and construction sector, following an external growth operation carried out in H1 to the tune of EUR 12 billion.

Investment in tangible and intangible assets aimed at ensuring the future organic growth of firms contracted by 3% at the end of H1 2016. At the same time, flows related to the acquisitions of financial fixed assets grew by 57% compared with 2015 and reached a record high of EUR 23 billion. However, in reality, this rise can be ascribed to the aforementioned operation of EUR 12 billion.

C9   Breakdown of cash flow from investment activities

(EUR billions)

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

Box 1

Changes in the main groups' net goodwill

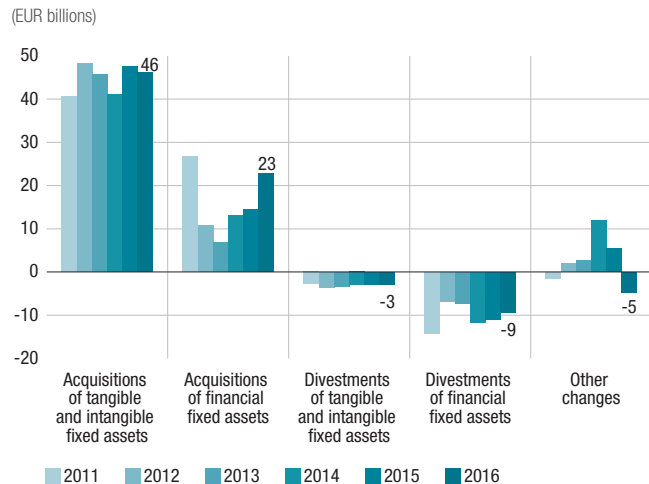Goodwill represents the excess of the cost of acquisition, during a takeover or a merger, over the fair value of the Group's share of the identifiable assets and liabilities. For instance, IFRS require companies to «test» goodwill for impairment at each balance sheet date, by updating forecasts to take account of changes in indicators, of which some may be external to the firm. If the forecasts are revised downwards, the company is required to reflect this loss in its balance sheet by recording the impairment of the asset in question.

For the 80 groups under review, we observed between 2011 and 2012 an increase in net goodwill, in the wake of an aggressive external growth strategy of the groups in the manufacturing and construction sector (35 groups out of the 38 in the study), amounting to a total of EUR 16 billion.

Net goodwill fell in 2014 on the back of difficulties encountered by one player in the energy market forced to impair certain assets and of a disposal on the telecoms market (information and communication sector). For the latter sector, this decline should nevertheless be put into perspective in that this operation generated a rise in net goodwill in 2015.[1]

.../...

1 It should be noted that this study covers non-financial groups listed on the Paris financial market, publishing their annual accounts on 30 June 2016, and belonging to segment A of Euronext (capitalisation above EUR 1 billion). Furthermore, these companies are required to have observed these criteria for at least two financial years, which explains why the company in question was included in the study sample in 2015 and not in 2014.

Since 2014, there has been a return to upward momentum, still driven by the manufacturing and construction sector where 31 out of the 38 firms saw an increase in their net goodwill in 2015. In the period under review, this sector experienced two years of sharp rises (2012 and 2015).

Changes in net goodwill by sector
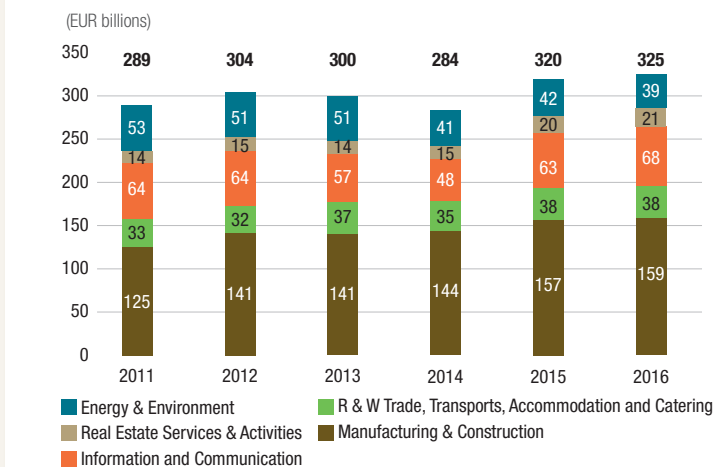
(EUR billions)

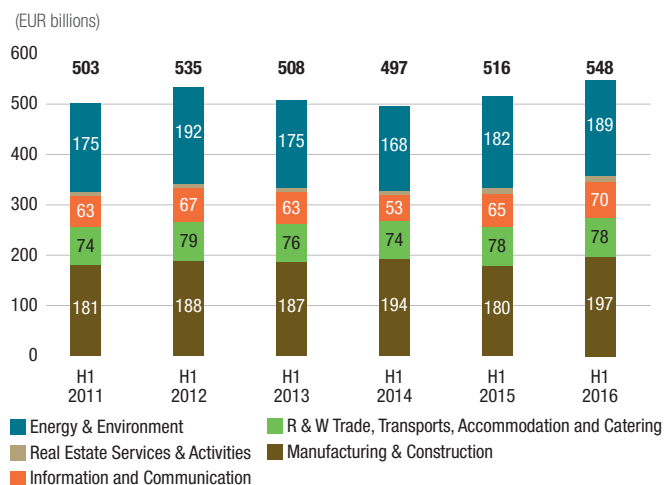|	2011	2012	2013	2014	2015	2016
Total	**289**	**304**	**300**	**284**	**320**	**325**
Energy & Environment	53	51	51	41	42	39
Real Estate Services & Activities	14	15	14	15	20	21
Information and Communication	64	64	57	48	63	68
R & W Trade, Transports, Accommodation and Catering	33	32	37	35	38	38
Manufacturing & Construction	125	141	141	144	157	159

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

4. Financial debt increased while equity fell

A rise in financial debt

Underpinned by very favourable issuance conditions, the financial debt of the groups under review grew by 6% at end-2016 and reached a record high over the period. The rise in the volume of financial debt (EUR 32 billion) can partly be attributed to an external growth operation (EUR 12 billion) entirely pre-financed by debt on 30 June. While all sectors saw an increase in financial debt, the aforementioned operation explains the significant rise in the manufacturing and construction sector (10% year-on-year).

C10   Financial debt by sector

(EUR billions)

	H1 2011	H1 2012	H1 2013	H1 2014	H1 2015	H1 2016
Total	**503**	**535**	**508**	**497**	**516**	**548**
Energy & Environment	175	192	175	168	182	189
Information and Communication	63	67	63	53	65	70
R & W Trade, Transports, Accommodation and Catering	74	79	76	74	78	78
Manufacturing & Construction	181	188	187	194	180	197

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

Furthermore, part of the additional debt observed between 2015 and June 2016 may have been taken out in H2 2015.
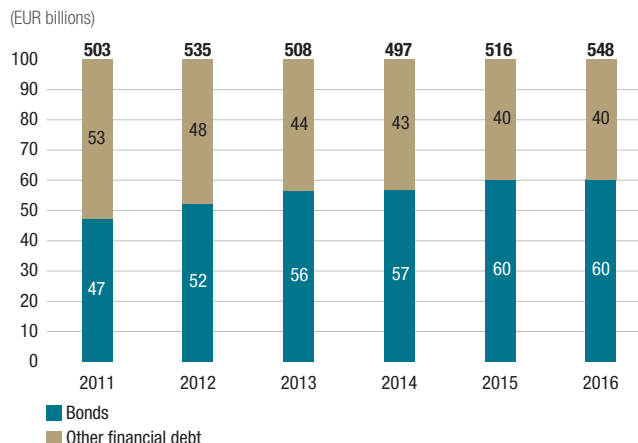
Taking advantage of the good issuance conditions, groups were highly active on the bond market, which for the past few years has been their preferred means of raising funds.

The debt ratio increased significantly in 2016 (7 percentage points on average, to 82%) with a scissors effect between the rise in financial debt (6%) and the contraction in equity (–2%). After a period of falling debt ratios between H1 2013 and 2015, groups took advantage of their low leverage ratios and favourable market conditions to increase their debt without unbalancing their financial structure.

Equity contracted for the first time since 2011

The equity level of the groups under review fell to EUR 630 billion, breaking the upward trend observed since 2011 (see Chart 13). While the trade and industry and construction sectors were

C11   Breakdown of financial debt

(EUR billions)

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

C12   Financial debt to equity (distribution and average ratio)

(%)

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

C13   Group equity

(EUR billions)
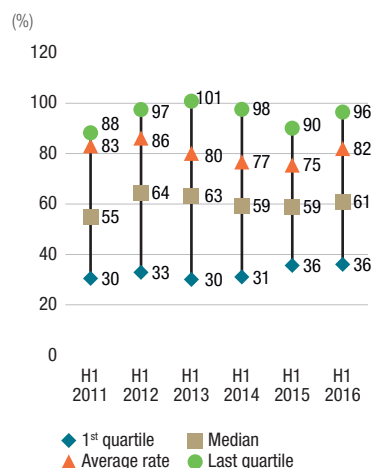

Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

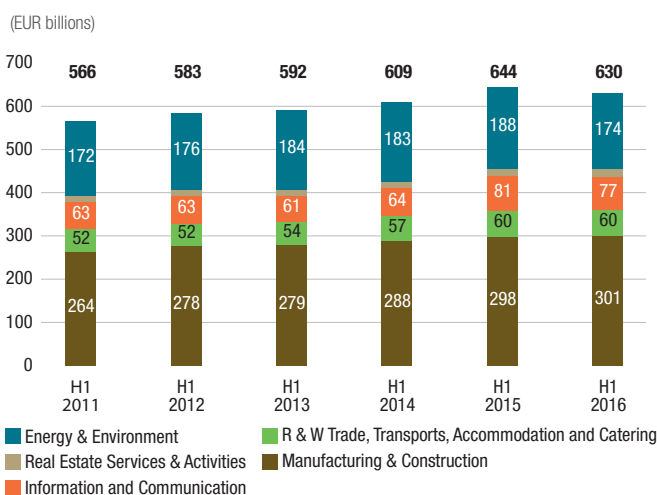relatively stable, the energy and environment sector saw the largest decline in equity. Thus, equity only accounts for, on average, 31% of the total balance sheet, compared with 33% at its highest level in 2014.

OCI explains the decline in equity

The contraction in equity can largely be attributed to the increase in other comprehensive income (OCI).[4] While it had a positive impact in H1 2015 (EUR 18 billion), it has strongly negative impact in H1 2016, i.e. EUR −15 billion (see Chart 14). Levels of OCI depend on highly volatile exogenous factors such as exchange rates or hedging strategies for operational risks. The high volatility of these variables can lead to significant changes from one year to the next. In H1 2016, the decline in OCI and ultimately in equity can chiefly be explained by actuarial gains and losses and, to a lesser degree, currency translation adjustments and changes in available for sale assets.

A sharp fall in market capitalisation

Uncertainty surrounding Brexit and the global economy in general weighed on the financial markets in H1 2016. Hence, the market capitalisation of the 80 main French groups decreased to EUR 1,184 billion at 30 June 2016,

against EUR 1,349 billion one year earlier. The simultaneous decline in market capitalisation and equity resulted in a fall in the price-to-book ratio[5] to 1.77% on average, compared to its high of 1.97% at 30 June 2015.

4 Income and expense entries, booked directly as equity, which they can affect significantly, do not however have an impact on the cash position of firms or on their net profit. Together with the latter, they define OCI, which then includes gains or losses gains arising from valuation adjustments of certain assets or liabilities measured at fair value in accordance with IFRS.

5 Price-to-book ratio = market capitalisation/equity

C14   Breakdown of other comprehensive income
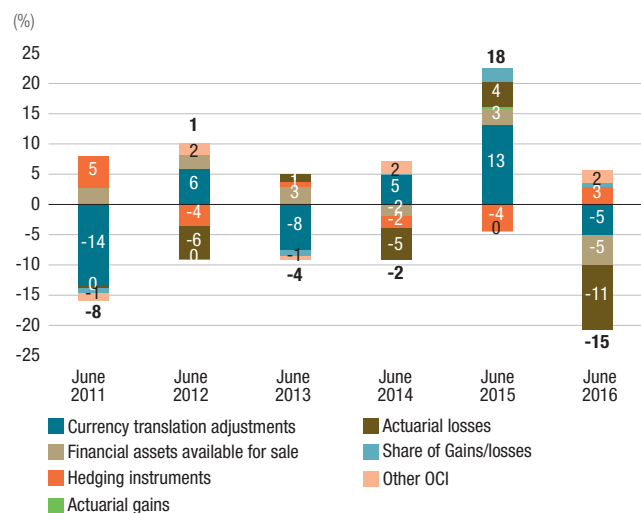
Source: Financial reports of the 80 main groups at 30 June 2016. Banque de France calculations, September 2016.

Appendix 1
Methodology

This study covers non-financial groups listed on the Paris financial market, publishing their annual accounts on 30 June 2016, and belonging to segment A of Euronext (capitalisation above EUR 1 billion). Furthermore, these companies are required to have observed these criteria for at least two financial years and to have kept records for the whole period under review. The sample contains 80 groups.

The half-yearly consolidated accounts for 2011 to 2016 are taken into consideration and the groups are classified according to the following sectors (see table below).

The sample does not include the following groups:

• groups whose majority shareholders are not French or only conducting a marginal share of their business in France: Arcelor Mittal, Lafarge Holcim, Schlumberger, STMicroelectronics, XPO Logistics ;

• financial institutions and alike: Amundi, AXA, BNP Paribas, CIC, CNP, Crédit Agricole, Coface, Euler Hermès, Eurazéo, Natixis, NYSE Euronext, Rothschild & Co, Scor SE, Société Générale ;

• Groups with financial years not ending 31 December: Alstom, Beneteau, Elior, Eutelsat Communications, LDC, Neopost, Pernod Ricard, Rémy Cointreau, Sodexo, Ubisoft, Vilmorin & Cie, Zodiac Aerospace ;

• property companies: Altarea, Eurosic, FDL, Foncières des murs, Foncière de Paris, Foncière des régions, Foncière lyonnaise, Gecina Nom., Icade, Klépierre, Mercialys, Silic, Unibail-Rodamco ;

• groups already consolidated into another group or investment fund: Artois Nom., Burelle, Cambodge Nom., Casino Guichard, Christian Dior, Colas, Faurecia, FFP, Fimalac, Financière de l'Odet, Havas (starting from 2013), Paris-Orléans, TF1, Unibel, Worldline.

Groups taken into account

Energy & Environment	Areva, EDF, Engie, Suez Environnement, Total, Veolia Environnement
Manufacturing & Construction	Airbus group, Air Liquide, Arkema, Bic, bioMérieux, Boiron, Bouygues, Danone, Dassault Aviation, Essilor, Eurofins, Groupe Bel, Hermès, Imerys, Ingenico, Ipsen, Legrand, Lisi, L'Oréal, LVMH, Michelin, Nexans, Peugeot SA, Plastic Omnium, Renault, Safran, Saint-Gobain, Sanofi, Sartorius Sted, SEB, Schneider Electric, Somfy, Thales, Valeo, Vallourec, Vicat, Vinci, Virbac
Trade, Transports, Accommodation and Catering	Accor, ADP, Air France-KLM, Bolloré, Carrefour, Casino Guichard, CFAO, Eiffage, Eurotunnel, Kering, Korian, Orpéa, Rexel, Rubis
Information and Communication	Atos, Capgemini, Dassault Systèmes, Gemalto, Illiad, Ipsos, Lagardère, Métropole TV, Numericable-SFR, Orange, Sopra Steria Group, Technicolor, Vivendi
Real Estate Services & Activities	Alten, Altran Techn., Bureau Veritas, Edenred, Havas, [a] JCDecaux, Nexity, Publicis, Technip, Téléperformance

a) Havas, included in our sample in 2011 and 2012, was absorbed by the Bolloré group in 2013.

Appendix 2
Data analysed

The principal accounting items analysed for the 80 groups chosen for the 2016 sample group:

General information
Company name
SIREN business identification number
NACE code of group's principal activity
INCOME STATEMENT
Turnover
o/w turnover in France
o/w turnover by geographical area (Europe, Americas, rest of the world)

Comprehensive income
Operating income
Current operating income
Net income
Change in currency conversion differences
Financial assets available for sale
Cash flow hedges
Revaluation differences
Actuarial gains and losses
Earnings and losses booked directly
as equity method
Others
Comprehensive income

Balance sheet
Goodwill – Net value
Other intangible assets
Tangible assets

Inventories
Trade receivables
Total assets (current and non-current)
Total financial debts
o/w bond debt
Minorities
Equity
Trade payables
Total liabilities (current and non-current)

Change in equity
Change in issued share capital
Dividends paid (group share + minority share)
Currency translation adjustments
Gains/losses on financial instruments
Revaluation of other assets
Actuarial gains and losses
Companies consolidated by the equity method

Cash flow
Cash flow from operational activities
Cash flow from investment activities
• acquisitions of tangible and intangible fixed assets
• acquisitions of financial fixed assets
• disposals of tangible and intangible fixed assets
• divestments of financial fixed assets
Cash flow from financing activities
Change in net cash position
Net cash position at year-end

Market capitalisation

France's pharmaceutical industry in global value chains

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Balance of Payments
Directorate
Synthesis Department

Companies are increasingly engaged in global value chains (GVCs). All of their activities, from design to bringing products to market, are spread across a variety of domestic and foreign participants. Taking the example of the French pharmaceutical industry, we use trade in value added indicators to examine this phenomenon. Over the 2000-2014 period, the French pharmaceutical industry opened up to GVCs, as reflected in the 392% increase in the share of imported value added in its exports and the 185% increase in the share of exported domestic value added. After being especially pronounced between 2007 and 2010, however, this integration process has slowed since 2012: the share of foreign value added in exports was smaller in 2014 than in 2012.

The degree to which companies participate in GVCs is heterogeneous: exporting firms make greater use of imported inputs and are thus more integrated than those that produce for the domestic market. Foreign multinational businesses operating in France participate to a larger extent in GVCs than French multinationals producing in France.

The opening up of the pharmaceutical industry to GVCs has been accompanied by greater diversification in trade partners and increased production sharing with zones outside Europe's borders. Today, international production sharing within the industry involves the major euro area countries but also the UK, Switzerland, the USA, Poland, as well as the large Asian economies such as China.

Integration of the French pharmaceutical industry in GVCs has gone hand in hand with rising direct investment, both outward by French firms and inward by foreign firms in France, and an increase in income earned by the French economy within the framework of the international organisation of production.

Key figures

27%
foreign content in French pharmaceutical exports, compared with 17% for the industry's total output.

42%
the share of euro area countries in foreign (or imported) value added contained in exports by the French pharmaceutical industry in 2014. This share is declining: it was 46% in 2000.

Balance of income relating to globalisation of the French pharmaceutical sector

(EUR billion)

Sources: WIOD and Banque de France.
Note: Trade balance adjusted using WIOD tables. Balance of FDI income taken from Banque de France data.

The gap between a sector's turnover, whether international or domestic, and value added corresponds to purchases across all sectors of intermediate goods and services required for production, plus trade and transport margins and taxes on products. These purchases reflect the integration of a given industry within domestic value chains (DVCs) and global value chains (GVCs). A DVC[1] is a chain in which inputs are purchased from domestic suppliers, while a GVC is a chain in which resident companies interact with foreign suppliers. In advanced economies, service sectors are playing a growing role owing to the specialisation of domestic production systems. This is translating into greater interdependence between industrial and service sectors within DVCs. Meanwhile, the rapid increase in the international fragmentation of production within GVCs is boosting the share of imported French value added in production.[2] As a result, in France, the share of imported value added in total value added was close to 30% in 2014, up from 25% 15 years earlier.

This paper is part of a broader project involving Insee, the General Directorate of Customs and Excise and the Banque de France on the globalisation of the French pharmaceutical industry.[3] This paper contributes by offering an analysis of the international integration of the French pharmaceutical industry in two value chains – domestic and global – and describing their interdependence. It identifies the domestic and foreign sectors that contribute to the production of French pharmaceutical exports, as well as the countries involved in the international process of manufacturing pharmaceutical products.

The analysis primarily uses indicators of trade in value added. These indicators isolate domestic and foreign contributions to international trade flows and specify the sectorial and geographical origin of these contributions (see the methodological appendix for more details). They are calculated from the global tables produced by the World Input Output Database (WIOD) project.[4] To refine the results, the paper also draws on granular data covering 357 pharmaceutical groups in France and based on a collaboration between Insee, French customs authorities and the Banque de France. The analysis is rounded out with information on foreign direct investment by pharmaceutical firms gathered by the Banque de France.

1. Exported domestic value added comes essentially from the pharma sector itself or services

The French pharmaceutical industry's domestic value chain (DVC) encompasses all the tasks needed to manufacture pharmaceutical products and preparations that are performed in France. Here, value added is produced either directly by the pharmaceutical sector, or indirectly by other industries taking part in the production process, notably by supplying inputs. Accordingly, we can analyse exported domestic value added by separating out the contribution made by each sector to production.

The French pharmaceutical industry's DVC primarily comprises the pharmaceutical sector itself, which is responsible for the lion's share of the domestic value added contained in pharmaceutical exports, accounting for 69.3% of the total in 2014. This share has risen slightly since 2000 (65.5%), which marks the beginning of our study period.

Service sectors contributed 26.7% to the DVC in 2014, down from 29.9% in 2000. The decline chiefly reflects decreased use of

1 "Domestic" means "resident", i.e. carrying out economic activity within French territory.

2 Cf. Cezar et al. (2016).

3 The pharmaceutical industry was chosen for this study because it is well represented in the national economy at every stage in the value chain (from R&D to distribution, and including manufacturing and packaging). It is also heavily globalised and comprises firms of varying sizes, some of which are French controlled, while others are under foreign control. For more details, cf. Cayssials and Ranvier (2016), Cayssials et al. (2016) and Direction Générale des Douanes et Droits indirects, Études et éclairages No. 66 (2016).

4 Cf. Timmer et al. (2015).

high-tech services (from 19.2% to 14.2%), likely owing to internalisation of R&D within the pharmaceutical sector.[5]

Manufacturing sectors (excluding the pharmaceutical sector) accounted for 3.7% of exports in 2014, mainly reflecting the contribution from mid- and high-tech industries (3%), including chemicals. The agrifood and extractive sectors play a marginal role over the entire period (around 0.4%).
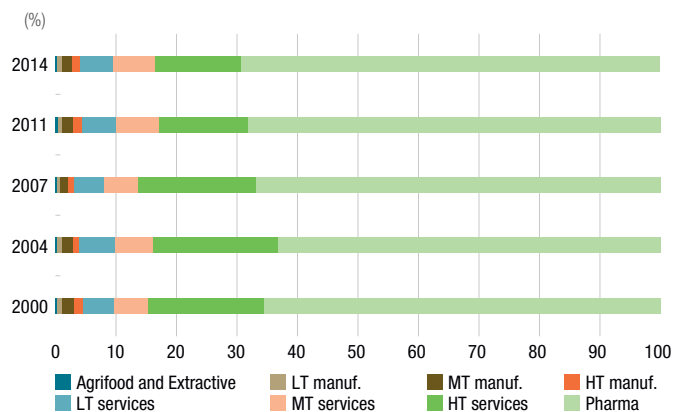
2. The share of foreign-origin value added in exports increased until 2012

In addition to the domestic value added described above, export flows contain imported value added. The rise of global value chains (GVCs) has accentuated the international fragmentation of production and boosted the share of inputs produced abroad in the manufacturing process and hence in exports, amid efforts to locate manufacturing stages in countries offering optimal conditions of efficiency.[6]

Within this new organisation of production, the French pharmaceutical industry participated in the development of GVCs over the analysed period, and particularly between 2006 and 2012. The share of imported value added in pharmaceutical exports accordingly climbed in France by 7.9 percentage points between 2000 and 2014 (11.1 points between 2006 and 2012), for growth of 57%. This was attributable to a relatively stronger increase in foreign inputs (392%) even though domestic value added also rose – by 185% – reflecting the positive impact from integration in GVCs.

However, the proportion of foreign value added has since come down from its 2012 peak of 24%,

pointing to a slowdown in the GVC integration process. The cooler pace of international trade and its effects on the expansion of GVCs following the financial crisis account for much of this contraction.[7]

This ratio of foreign value added in exports varies according to firm characteristics (cf. Box below).

C1   National value chain, French pharmaceutical industry

Source: Calculated from WIOD tables.
Note: LT, MT and HT denote Low, Mid and High Technology industries respectively (cf. Table 3 in the appendix).
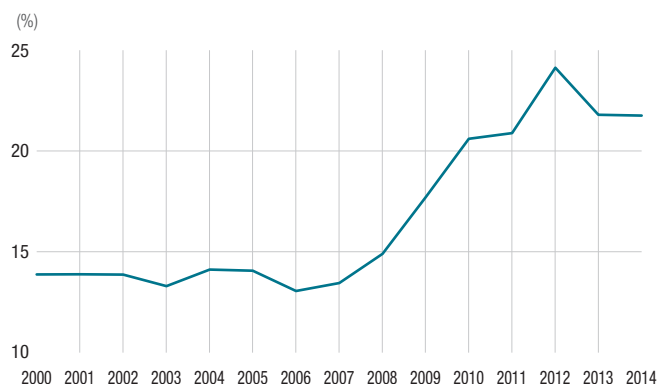
5 This "external" consumption accounted for 7.2% of domestic production in 2000 and just over 0% in 2014.

6 Cf. Cezar (2016).

7 Cf. IRC Trade Task Force (2016).

C2   Participation of the French pharmaceutical sector in the global value chain
Share of foreign value added in exports

Source: Calculated from WIOD tables.

Box 1

Foreign content in production varies depending on firm characteristics

Indicators of trade in value added, which are used to distinguish between the domestic and foreign value added of exports, are constrained by the assumption that production functions are uniform. Specifically, this assumption requires that all the companies within an industry always use the same proportion of inputs to produce, whether to satisfy their own domestic market or exports. As a result, the proportion of foreign content in exports calculated using global tables is an aggregate rate based on total production in the industry. This assumption is especially restrictive because the production function of exporting firms differs in general from that of companies serving their domestic market.

To get round this assumption and refine the results described above, we recalculate the imported content in pharmaceutical production using granular data covering 367 pharmaceutical groups based in France in 2012.[1] This database contains data on broad production $(Y\acute{e}_i)$ – equal to revenues plus capitalised production –, total production (Y_i), total imports (Mt_i), final goods (Mf_i) and total exports (X_i). Foreign content in production (a) and in exports (b) is measured for each observation and then summed for all observations using the following equations:

$$C\acute{e}\,Y = \frac{\sum_{i=1}^{367} C\acute{e}_i \star Y_i}{\sum_{i=1}^{367} Y_i} \quad \text{(a)} \qquad \text{and} \qquad C\acute{e}\,X = \frac{\sum_{i=1}^{367} C\acute{e}_i \star X_i}{\sum_{i=1}^{367} X_i} \quad \text{(b)}$$

where $C\acute{e}_i = \dfrac{Mt_i - Mf_i}{Y\acute{e}_i}$ is the share of foreign content in the production of group i.

In 2012, the share of foreign content in total pharmaceutical production in France stood at 17.6%. This is very close to the average rate between 2000 and 2014 measured using global tables, which is 16.8%; but conceals substantial differences within the industry. Notably, the share of foreign content in exports, at 27.7%, is much higher than the overall rate. Since exporting firms are often larger and more integrated within GVCs, their production function uses more imported inputs.

T1 CForeign content in production and in exports, French pharmaceutical industry (2012)[2]
(%)

Variable	Total		French MFs		Foreign MFs	
	Production	Export	Production	Export	Production	Export
Foreign content	17.6	27.7	11.9	12.7	26.8	38.6

Source: Banque de France, Customs and Insee.

Foreign content in production also varies according to company nationality. Foreign controlled multinational firms (MFs) producing in France use more imported inputs in their total production (26.8%) and in their exports (38.6%) than French MFs producing in France (11.9% and 12.7% respectively). Foreign MFs are thus more integrated within GVCs, while French MFs rely more heavily on their domestic value chains.[3]

1 For more information about the data, cf. Cayssials and Ranvier (2016).

2 A substantial share of pharmaceutical activity in France is concentrated with a small number of companies, which may introduce biases and render the analysis of firm data unstable over time.

3 These results are consistent with the findings of the study on services by Castor et al. (2016).

3. An industry that chiefly imports services and is diversifying its supply sources

As with domestic value added, the imported content of pharmaceutical exports is produced by companies from the same industry but also by companies from other industries or service sectors located outside the national borders. The sector composition of the foreign content exported by the French pharmaceutical industry differs from that of the national content. Notably, it is more diversified.

Service sectors accounted for 49.6% of the foreign value added contained in the exports of the French pharmaceutical industry in 2014, or almost twice as much as for domestic value added. High-tech services (23%) and mid-tech services (13.4%) play the biggest role.[8]

The agrifood and extractive industries account for 11% of exported foreign value added, a share that has risen since 2000 (7%), partly on the back of higher commodity prices. The contribution from manufacturing industries (excluding pharma) is 26.2%. High-tech industries account for 14.5% of the total, with chemicals supplying 10.4%.

The share of the pharmaceutical industry in the foreign value added contained in exports was 13.5% in 2014 and has been steady at around this value over the 15 years covered by our study. This is considerably lower than the level observed for domestic value added (average of 66.5% over the period).

The geographical origin of the foreign value added contained in exports offers a way to identify countries with which France shares pharmaceutical production and that make up the links in the value chain in which France's economy is integrated.

Euro area member countries represented the primary geographical source of the imported

C3 Sectorial origin of foreign value added contained in exports of the French pharmaceutical industry
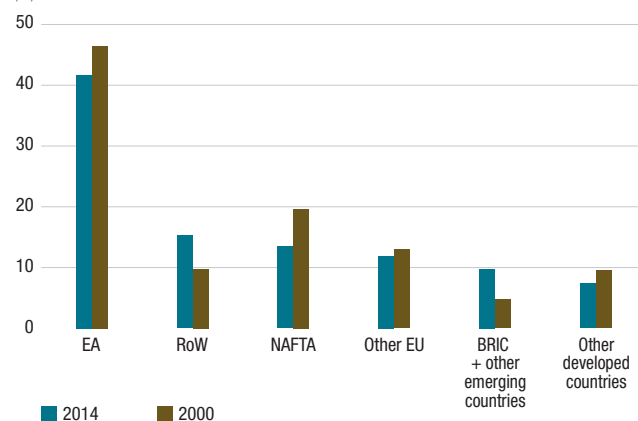
(% of exported foreign value added)
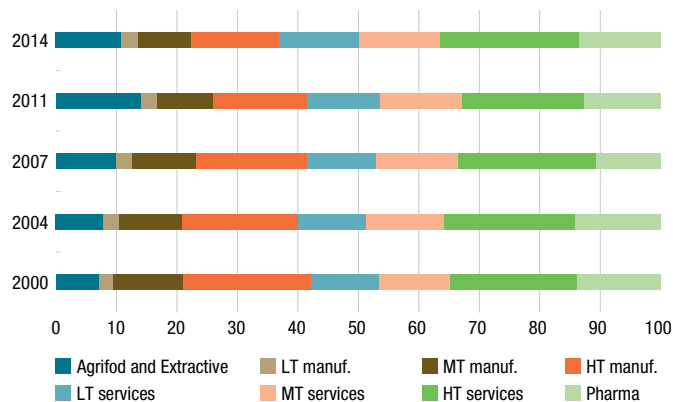
Source: Calculated from WIOD tables.
Note: LT, MT and HT denote Low, Mid and High Technology industries respectively (cf. Table 3 in the appendix).

C4 Geographical origin of foreign value added contained in exports of the French pharmaceutical industry

(%)

Source: Calculated from WIOD tables.
Note: As a % of exported foreign value added. Cf. Table 2 in the appendix for the list of countries.

value added contained in French pharmaceutical exports in 2014, accounting for 42% of the total. Germany (15.6%), Belgium (6.3%), Italy (5%) and the Netherlands (4.5%) are the main contributors. The share of countries from this zone has however

8 Specifically, wholesale trade (8.7%), administrative and support service activities (5.7%), and legal and accounting activities; activities of head offices; management consultancy activities (4.5%) are the biggest contributors.

been falling since 2000, losing 4 percentage points, pointing to greater diversification of industry partners in the production chain. This trend reveals that the pharmaceutical value chain in which France is integrated is diversifying and becoming more global.

This diversification is benefiting BRIC[9] nations and countries that are not covered by the data, which are gathered in a "rest of the world" category. The first group accounted for 3.4% of exported foreign value added in 2000 and 8.8% in 2014.

The increase in production sharing has been particularly pronounced with China (276% increase) and Russia (111% increase). "Other EU" (non euro area countries from the European Union), NAFTA[10] and "other developed countries" groups contribute 12%, 13.5% and 7.4% to pharmaceutical exports respectively. These shares have been relatively stable since 2000, with the exception of NAFTA, which has seen a 30% decrease since 2000. Within these two groups, the USA (12%), the UK (7%) and Switzerland (3.5%) are the main partners.

9 Brazil, Russia, India and China.

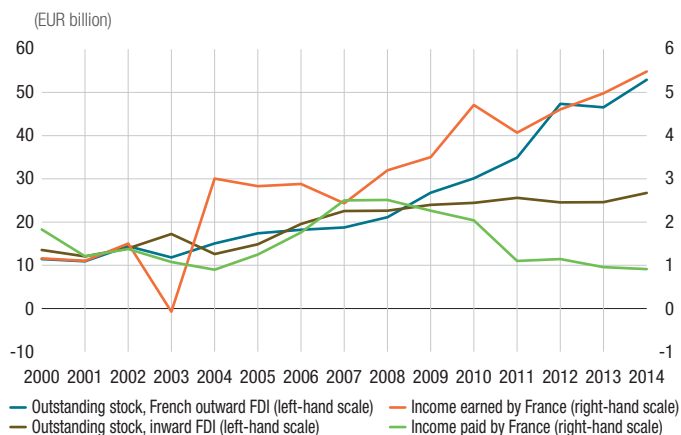10 North American Free Trade Agreement, including the USA, Canada and Mexico.

Box 2

Participation in GVCs and foreign direct investment: the "goods-services-income balance"

The international fragmentation of production within GVCs implies commercial relationships between companies located in different countries. These relationships may be based on foreign direct investment (FDI), where firms acquire suppliers, say, or on the construction of productive infrastructure outside the home country.[1]

The integration of France's pharmaceutical industry in GVCs has been accompanied by an increase in FDI.[2] The outstanding stock of French international investments in the pharmaceutical sector swelled by 362% between 2000 and 2014, and especially between 2003 and 2012 (301% increase) when openness to GVCs was particularly pronounced. The increase in income linked to this investment was even greater over the period, climbing from approximately EUR 1 billion in 2000 to almost

CA   FDI, outstanding stock and income, French pharmaceutical industry
(EUR billion)

Outstanding stock, French outward FDI (left-hand scale)
Income earned by France (right-hand scale)
Outstanding stock, inward FDI (left-hand scale)
Income paid by France (right-hand scale)

Source: Banque de France.
Note: The study period is constrained by the availability of WIOD data (cf. methodological appendix).

EUR 5.5 billion in 2014, or an increase of 373%. The slower rate of expansion in GVCs in 2012, which is observed for value added indicators, is also observable in FDI data, but is no longer in evidence by 2014.

1 Cf. Antràs et al. (2013) and Cezar et al. (2015).

2 FDI data exclude intragroup lending/borrowing and trade receivables/payables.
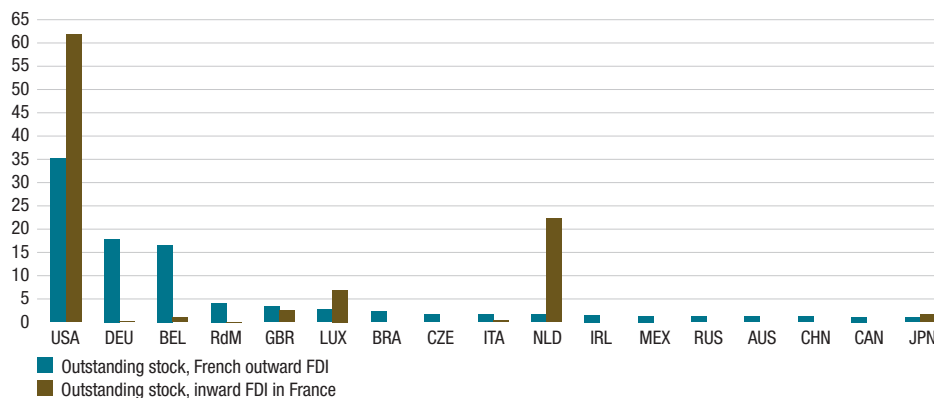
Foreign investment in France changed more moderately. The outstanding stock of FDI in France increased by 97% between 2000 and 2014, while income declined by 50%.[3]

Production sharing as measured by FDI data is concentrated with a handful of countries. Together, the USA, Germany and Belgium take almost 70% of the stock of French pharmaceutical FDI, while the USA, Netherlands and Luxembourg account for around 90% of FDI in France. However, it can be hard to precisely identify the immediate or final holder of investments and hence the origin of investment income.

CB Geographical breakdown of FDI, French pharmaceutical industry (2013, 17 main countries)
(EUR billion)

a) Outstanding stock

■ Outstanding stock, French outward FDI
■ Outstanding stock, inward FDI in France

b) Income

■ Income earned by France
■ Income paid by France
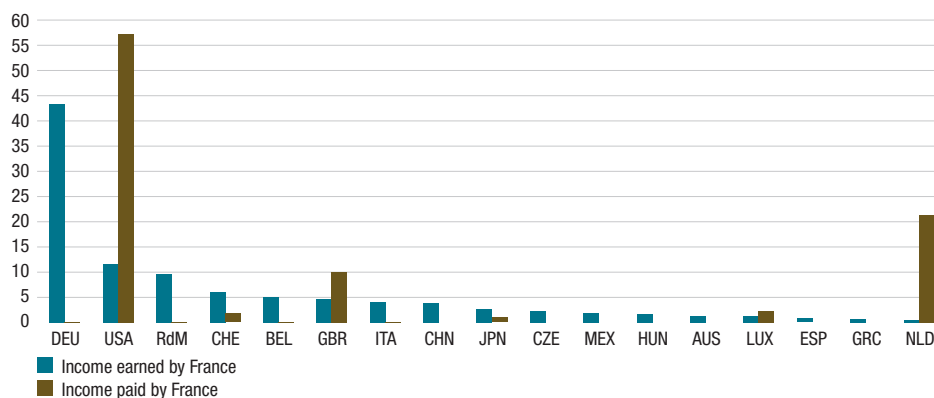
Source: Banque de France.

3 One explanation for the decline could be the strategy pursued by some multinational firms of using transfer pricing to shift their profits to countries with low rates of tax (cf. Vicard, 2015).

To capture all income earned from the net productive supply of the French pharmaceutical industry vis-à-vis the rest of the world, the "goods-services-income balance" groups together net exports and the balance of income earned within the framework of the international organisation of production (including participation in GVCs), in the shape of FDI income. Recognising all income linked to globalisation, the "goods services income balance" of the French pharmaceutical industry has been in surplus since 2009 and was almost at equilibrium between 2004 and 2006 despite a substantial trade deficit. The improvement in the balance since 2007 mainly reflects increased FDI income, although net trade has also played a part.

CC   **Balance of income relating to globalisation of the French pharmaceutical sector**

(EUR billion)

— Trade (WIOD database)   — FDI income   — Total balance
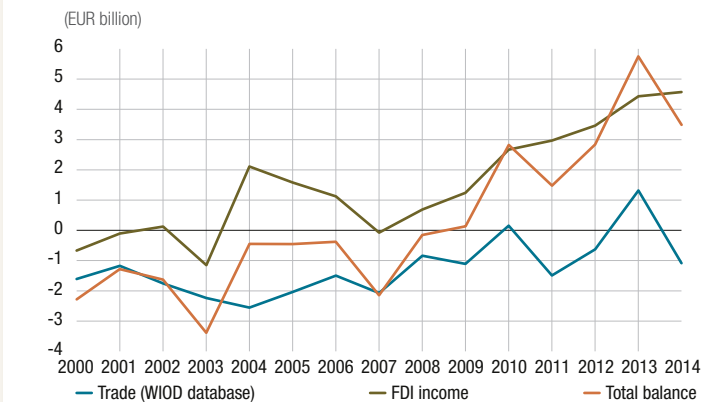
Source: WIOD and Banque de France.
Note: Trade balance adjusted using WIOD tables. Balance of FDI income taken from Banque de France data.

4. International production sharing mainly involves Europe and the USA

The international fragmentation of production is the result of increasingly integrated and complex international chains. Domestic value added exported by the French pharmaceutical industry is composed of final and intermediate products. Final products are generally consumed in the country that is the immediate trade destination, while intermediate exports go into global value chains (GVCs).

For example, a portion of France's exports to Germany is used as input in German production. The French value added contained in German production is then sold on the German domestic market or re-exported. The French value added that is re-exported from Germany is then consumed by third countries, including France. Using this example, it is possible to calculate the ratio of French pharmaceutical value added re-imported by France from Germany to the total French pharmaceutical value added contained in German exports. This ratio is a good indicator of the integration of production between the two countries, as is the ratio of German pharmaceutical value added that is re-imported from France; with a high ratio denoting significant sharing.

The x-axis in Chart 5 shows the share of French pharmaceutical value added contained in exports from countries in the sample that is re-exported to France. It thus describes the use of French inputs in the production of foreign exports and shows that a task in the pharmaceutical industry's production process is conducted abroad before the product returns to France to be finished or consumed. In 2014, euro area countries stand out in the sample, particularly Belgium, Spain and Austria, which re-export to France 14.8%, 12.6% and 12.5% respectively of the total French value added that they export. Next come Portugal (8.8%), Italy (8%) and Germany (7.7%). Poland (6.9%) and the UK (6.5%) are the non-euro area countries that participate most in the international sharing of French pharmaceutical production.

The y-axis shows the same ratio but for foreign value added re-exported by France, or, put another way, the use of foreign inputs by France to produce pharmaceutical exports. The axis shows that a task in the international production process is carried

out in France before the product is finished or consumed abroad. France plays an important part in the international production process of German companies, as indicated by the fact that Germany re-imported, in 2014, 12.5% of its own value added exported by France. French pharmaceutical production also uses inputs from other major countries around the world within global production chains, with high ratios for the UK (8.7%), Italy (8.6%), Spain (6.9%) and the USA (6.2%).

Overall, an analysis of the indicators presented in Chart 5 reveals similar findings to those of the previous section: production sharing in the French pharmaceutical industry primarily involves other large euro area countries. Outside the euro area, the industry's main partners are the UK, Switzerland and the USA. China and Poland are also important partners in pharmaceutical GVCs.

C5   International sharing of pharmaceutical production within global value chains in 2014

(%, x-axis: French VA re-exported to France over total re-exported French VA; y-axis: share of foreign VA re-exported to original country over total re-exported foreign VA)
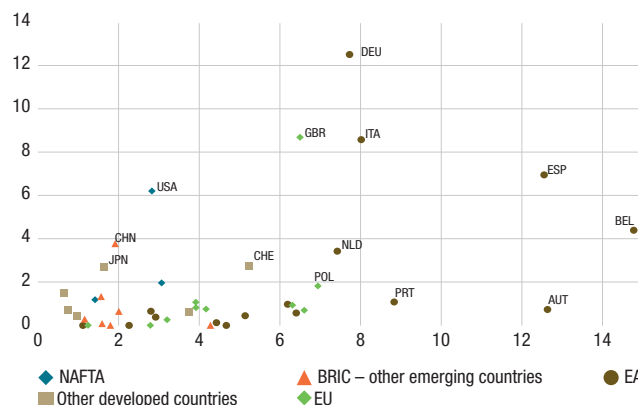
Source: Calculated from WIOD tables.
How to read this chart: 12.5% of German pharmaceutical value added re-exported by France is subsequently re-imported into Germany, while 7.7% of French pharmaceutical value added exported by Germany is re-imported into France.

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Methodological appendix

The indicators used in the study are calculated from the most recent version of the World Input-Output Tables (WIOT), published in November 2016 by the WIOD project. The WIOT are harmonised for 56 industries and 44 countries plus an observation for the rest of the world based on residuals. They are published for each year between 2000 and 2014. The tables in the appendices detail the countries and sectors covered by the data.

Calculating indicators for trade in value added and international production sharing

The calculations draw on the basic IOT equation: $x = Ax + f = L_f f$. with x being the vector $(i*k, 1)$ of global output of country i sector k, A the matrix $(i*k, i*k)$ of technical factors and f the vector $(i*k, 1)$ of final demand. The second part of the equation uses the Leontief matrix $(i*k, i*k)$, with $L_f = (I - A)^{-1}$. Using this methodological framework and a vector $(1, i*k)$ of sector value added enables various indicators to be calculated for trade in value added.[1]

The domestic value added exported by country i sector k and absorbed by global final demand is calculated based on the following equation: $dvaxsfd_{ki} = v^{ik} L_f f^{-i}$, with v^{ik} being the vector of value added and f^{-i} the vector of global final demand. The same methodology is used to break out the value added contained in pharma exports: the value added of country i sector k contained in the exports of sector k' is calculated using the following equation: $ovacxs_{ik, k'} = v^{ik} L_f e^{k'}$, where $e^{k'}$ denotes the exports of sector k'.

The paper uses two different indicators to measure international production sharing. The first measures domestic value added contained in the exports of a sector in a foreign country: the value added of country i contained in the exports of country j sector k is calculated using the following equation: $vadrX_{ijk} = v^i L_f e^{jk}$, with v^i being the vector of value added of country i and zero otherwise and e^{jk} denoting the total gross exports of country j sector k. The second production sharing indicator shows re-imported domestic value added and measures the value added of country i contained in imports from country j sector k. The calculation is performed using the following equation: $vadrM_{ijk} = v^i L_f e^{jki}$, where e^{jki} denotes the exports of j sector k to i.

1 Cf. Stehrer (2013) and Koopman et al. (2014).

Appendix

TA WIOT countries

Code	Country	Group	Code	Country	Group
AUS	Australia	Other developed countries	IRL	Ireland	Euro area
AUT	Austria	Euro area	ITA	Italy	Euro area
BEL	Belgium	Euro area	JPN	Japan	Other developed countries
BGR	Bulgaria	Other EU	KOR	Korea	Other developed countries
BRA	Brazil	BRICS	LTU	Lithuania	Other EU
CAN	Canada	NAFTA	LUX	Luxembourg	Euro area
CHE	Switzerland	Other developed countries	LVA	Latvia	Other EU
CHN	China (People's Rep.)	BRICS	MEX	Mexico	NAFTA
CYP	Cyprus	Euro area	MLT	Malta	Euro area
CZE	Czech Rep.	Other EU	NLD	Netherlands	Euro area
DEU	Germany	Euro area	NOR	Norway	Other developed countries
DNK	Denmark	Other EU	POL	Poland	Other EU
ESP	Spain	Euro area	PRT	Portugal	Euro area
EST	Estonia	Euro area	ROU	Romania	Other EU
FIN	Finland	Euro area	RUS	Russia	BRICS
FRA	France	Euro area	SVK	Slovak Rep.	Euro area
GBR	UK	Other EU	SVN	Slovenia	Euro area
GRC	Greece	Euro area	SWE	Sweden	Other EU
HRV	Croatia	Other	TUR	Turkey	Other emerging countries
HUN	Hungary	Other EU	TWN	Chinese Taipei	Other developed countries
IDN	Indonesia	Other emerging countries	USA	USA	NAFTA
IND	India	BRICS	ROW	Rest of the world	RoW

TB WIOT sectors

Code CITI rev 4	Industry	Our classification
A01	Crop and animal production, hunting and related service activities	Agrifood and Extractive
A02	Forestry and logging	Agrifood and Extractive
A03	Fishing and aquaculture	Agrifood and Extractive
B	Mining and quarrying	Agrifood and Extractive
C10-C12	Manufacture of food products, beverages and tobacco products	LT manuf.
C13-C15	Manufacture of textiles, wearing apparel and leather products	LT manuf.
C16	Manufacture of wood and of products of wood and cork, except furniture	LT manuf.
C17	Manufacture of paper and paper products	MT manuf.
C18	Printing and reproduction of recorded media	MT manuf.
C19	Manufacture of coke and refined petroleum products	MT manuf.
C20	Manufacture of chemicals and chemical products	HT manuf.
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	Pharma
C22	Manufacture of rubber and plastic products	MT manuf.
C23	Manufacture of other non-metallic mineral products	MT manuf.
C24	Manufacture of basic metals	MT manuf.
C25	Manufacture of fabricated metal products, except machinery and equipment	MT manuf.
C26	Manufacture of computer, electronic and optical products	HT manuf.
C27	Manufacture of electrical equipment	HT manuf.
C28	Manufacture of machinery and equipment n.e.c.	HT manuf.
C29	Manufacture of motor vehicles, trailers and semi-trailers	HT manuf.
C30	Manufacture of other transport equipment	HT manuf.
C31_C32	Manufacture of furniture; other manufacturing	MT manuf.
C33	Repair and installation of machinery and equipment	HT manuf.
D35	Electricity, gas, steam and air conditioning supply	MT services
E36	Water collection, treatment and supply	MT services
E37-E39	Sewerage; waste collection, treatment and disposal activities; Recovery	MT services
F	Construction	LT services
G45	Wholesale and retail trade and repair of motor vehicles and motorcycles	LT services
G46	Wholesale trade, except of motor vehicles and motorcycles	LT services
G47	Retail trade, except of motor vehicles and motorcycles	LT services
H49	Land transport and transport via pipelines	MT services
H50	Water transport	MT services
H51	Air transport	MT services
H52	Warehousing and support activities for transportation	MT services
H53	Postal and courier activities	MT services
I	Accommodation and food service activities	LT services
J58	Publishing activities	MT services
J59_J60	Motion picture, video and television programme production, sound recording and music publishing activities;	HT services
J61	Telecommunications	MT services
J62_J63	Computer programming, consultancy and related activities; information service activities	HT services
K64	Financial service activities, except insurance and pension funding	HT services
K65	Insurance, reinsurance and pension funding, except compulsory social security	HT services
K66	Activities auxiliary to financial services and insurance activities	HT services
L68	Real estate activities	MT services
M69_M70	Legal and accounting activities; activities of head offices; management consultancy activities	HT services
M71	Architectural and engineering activities; technical testing and analysis	HT services
M72	Scientific research and development	HT services
M73	Advertising and market research	HT services
M74_M75	Other professional, scientific and technical activities; veterinary activities	HT services
N	Administrative and support service activities	HT services
O84	Public administration and defence; compulsory social security	HT services
P85	Education	HT services
Q	Human health and social work activities	HT services
R_S	Other service activities	HT services
T	Activities of households as employers	HT services
U	Activities of extraterritorial organizations and bodies	HT services

Note: LT, MT and HT denote Low, Mid and High Technology respectively.

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