THE CLOUD DIVIDEND: Part One

The economic benefits of cloud computing to business and the wider EMEA economy

France, Germany, Italy, Spain and the UK

Report for EMC

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Foreword

I am delighted to welcome the first ever study of the economic impact of cloud computing in the large EU economies.

The study shows how cloud computing is likely to make Europe more efficient and productive and how, in turn, this is likely to generate jobs and enhance Europe's economic growth.

The current economic crisis in Europe has its origins in the massive adjustments that the world economy has to make to absorb the emerging economies. This is presenting European economies with new challenges of a kind that have not previously been faced. In the past, economic competitiveness has been largely about competing with economies with a similar cost model. Now, for the first time, Europe is competing with economies that currently pay themselves (on an hourly basis) about a tenth of what we pay ourselves. Even after differential inflation and likely exchange rate adjustments, it is likely that, in 10 years time, the cost ratio is still going to be around five to one. But, if we intend to pay ourselves five times as much as the Chinese or Indians, we are going to have to work extremely smartly to be competitive.

We will have to use all of the available technological advances in order to achieve this. Obviously, cloud computing is only one of many ways in which we in Europe can improve our efficiency, but our study shows that it is especially important. The study shows that cloud computing could improve the efficiency of an average employee by an average of 2.1%, while also reducing the amount of investment tied up in underutilised IT capacity.

The jury is out on how the European economy and the euro will cope with the strains from the economic crisis and the picture changes from day to day. By the time this is read, it may be that the issues are resolved and that the euro has either adapted or the system has evolved to cope with the strains. But the underlying economic analysis is clear - those European economies facing major structural adjustments can only hope to stay afloat by boosting exports. And this they can only do against a background of economic growth in the stronger European economies.

Growth cannot hope to be achieved from consumer spending, which will lag behind current economic circumstances. And it cannot be based on public spending as so often in the past - public spending in Europe is already very high by international standards and even sustaining it at its current levels in the long term would require tax levels that would themselves make our economies uncompetitive. Other than exports, therefore, economic growth in Europe in the coming years will also have to depend on investment.

Here again the study shows that cloud computing can play two important roles. First, as a driver of enhanced productive performance, investment in cloud computing is likely to play an important role in re-establishing the competitiveness of Europe’s international trading position, hence boosting export growth.

Second, Europe's economic recovery will be boosted by business investment in cloud computing. In the 1930s depression, business investment was held back for years by the fact that a large amount of plant and machinery was mothballed and needed to be brought back into use before businesses thought about buying new capital equipment. Today, the position is different. Large swathes of capital equipment are IT-based and become obsolete after a few years. So, as businesses go into recovery mode they will need to make up the backlog of IT underinvestment and take advantage of the latest opportunities for technological advancement. Such investment could well be one of the

most powerful engines of economic recovery - already the latest data for Germany, the strongest of the European economies, shows how important business investment is in returning the economy to healthy growth.

Cloud computing will, therefore, as one of the major means of maximising the bang for buck in modern IT investment, need to be a key driver of European business investment which will, in turn, drive the economy forward. This study illustrates the increase in corporate profitability that results from cloud computing adoption, which drives investment through the re-investment of retained profits, but also stimulates domestic demand, through the spending of greater amounts of shareholder dividends and wages in the wider economy. This, in turn, supports growth and employment.

What this study shows is that, not only is cloud computing an important issue from the micro perspective of boosting the efficiency of individual companies' IT investment and, hence, general corporate productivity, but also that, especially in the present uncertain economic climate, it will also be a critical macroeconomic factor that is crucial for boosting Europe's economic growth. As such, the study is an important contribution outlining one of the most important ways that European economies can revive and emerge from the economic crisis.

Douglas McWilliams
Chief Executive Officer

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Authorship and acknowledgements

This report has been produced by the Centre for Economics and Business Research Ltd (Cebr), an independent economics and business research consultancy established in 1993 providing forecasts and advice to City institutions, government departments, local authorities and numerous blue chip companies throughout Europe. The study was led by Oliver Hogan, Cebr Managing Economist, with modelling and analytical support provided by Shehan Mohamed, Cebr Economist. Contributions were also made by Douglas McWilliams, Cebr CEO, and Richard Greenwood, Cebr Managing Economist.

This study was commissioned by EMC and has utilised a combination of data that are available in the public domain and of proprietary data provided by EMC based on the its own research and on its joint research with business and research partners. However, the report does not necessarily reflect the views of EMC.

London, December 2010

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Executive summary

This is a summary of the report on and results of an independent study to quantify the economic benefits of cloud computing to business and to Europe's five largest economies (in alphabetical order, France, Germany, Italy, Spain and the UK). The study was undertaken by Centre for Economics and Business Research Ltd (Cebr) on behalf of EMC, a global commercial technology company, providing systems, software and services to its business clients.

We find that, across the five economies as a whole, widespread adoption of cloud computing has the potential to generate over **€763 billion of cumulative economic benefits over the period 2010 to 2015**. This is 1.57% of Cebr's estimates of the total cumulative GDP of the five economies over the same period. The breakdowns between the individual economies and between the different components of the aggregated benefits, a discussion of which follows, are shown in Table 1 below

Table 1[1]

EMEA: Cumulative Economic Benefits 2010-2015

	France	Germany	Italy	Spain	UK	EMEA
	€ mil	€ mil	€ mil	€ mil	€ mil	€ mil
Business development opportunities	24,599	32,642	23,995	16,866	29,555	127,657
Business creation	51,377	69,507	43,305	30,939	20,026	215,153
Net total cost savings *of which:*	26,323	37,740	28,463	22,008	26,206	140,740
– IT CapEx savings	*28,653*	*36,378*	*30,461*	*23,013*	*36,176*	*154,682*
– IT OpEx savings (FTEs / productivity)	*13,818*	*18,139*	*14,533*	*10,396*	*16,943*	*73,829*
– IT OpEx savings (power & cooling)	*11,107*	*14,345*	*11,821*	*8,510*	*10,566*	*56,349*
– additional cloud services expenditure (PAYG) *	- *27,255*	- *31,122*	- *28,353*	- *19,910*	- *37,481*	- *144,120*
Indirect GVA	60,450	81,351	55,007	40,737	42,202	279,747
Total Economic Benefit	**162,749**	**221,239**	**150,770**	**110,550**	**117,989**	**763,297**
Direct and Indirect employment ('000s)	**469.4**	**789.4**	**455.8**	**392.5**	**289.0**	**2,396.2**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

Source: Cebr analysis

By 2015, annual economic benefits are predicted to be **in excess of €177 billion**. This is shown in Table 2 below and constitutes a 23.2% share of the cumulative benefits over a six-year time horizon. This is to be expected in light of, not only increasing levels of cloud computing adoption in the latter years, but the progressive shift of increasing numbers of workloads to the cloud by those who have and do adopt it.

We also find that widespread cloud computing adoption has the potential to support significant direct and indirect job creation which, across the five economies, we predict to be in excess of **2.3 million net new jobs on a cumulative basis over the period 2010 to 2015**. Cloud computing adoption is expected to yield **annual net new jobs of 446 thousand** across the five economies by 2015.

[1] EMEA, as used in this report, is the acronym used by EMC Corporation to refer to the UK, France, Germany, Italy and Spain, a subset of the company's global presence.

The remainder of this executive summary will describe the principal drivers of the differences that have arisen, based on our study, in the relative performance of the five economies in harnessing the economic benefits of cloud computing. The sources of these differences can be best described in terms of the methodology used to undertake the macroeconomic quantification that is the principal contribution of this report.

The foundation for such a macroeconomic quantification lies, however, in the characteristics of cloud computing and the operational benefits offered by its adoption, benefits which are potentially available to businesses in all sectors and industries. The characteristics of and the operational benefits available from cloud computing provide, therefore, the starting point for the study.

Table 2

EMEA: Economic Benefits in 2015

	France	Germany	Italy	Spain	UK	EMEA
	€ mil	€ mil	€ mil	€ mil	€ mil	€ mil
Business development opportunities	7,287	8,780	6,855	4,633	8,371	35,926
Business creation	8,989	12,166	7,468	5,390	3,523	37,537
Net total cost savings *of which:*	7,744	11,439	8,700	6,154	7,790	41,826
– IT CapEx savings	*8,978*	*10,761*	*9,140*	*7,142*	*10,972*	*46,992*
– IT OpEx savings (FTEs / productivity)	*4,359*	*5,374*	*4,392*	*3,131*	*5,140*	*22,394*
– IT OpEx savings (power & cooling)	*3,513*	*4,267*	*3,567*	*2,567*	*3,239*	*17,154*
– additional cloud services expenditure (PAYG) *	*- 9,106*	*- 8,962*	*- 8,399*	*- 6,686*	*- 11,561*	*- 44,714*
Indirect GVA	13,380	17,238	12,078	9,010	10,300	62,006
Total Economic Benefit	**37,400**	**49,624**	**35,101**	**25,186**	**29,984**	**177,295**
Direct and Indirect employment ('000s)	**87.8**	**142.4**	**84.2**	**74.0**	**57.6**	**446.0**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

Source: Cebr analysis

Quantifying business-level economic benefits of cloud computing

There are many definitions of cloud computing but there is broad acceptance of the one provided by the US National Institute for Standards and Technology (NIST). NIST defines cloud computing as

> *"a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."*

Cloud computing-based IT offerings must, in order to be counted as such, involve the abstraction from buyers of hardware ownership and control, buyers incurring infrastructure costs as variable operating expenditures on a pay-per-use basis with no contractual obligations and infrastructure capacity that can be scaled up or down dynamically and immediately.

Some of the most important benefits are widely reported to include reduced IT capital expenditure (CapEx) and reduced or re-deployed IT staff headcount, improved business scalability in response to client demands through elastic provisioning of IT, faster time-to-market for new goods and services,

paying only for computing capabilities that are required and used, and lower barriers to entry to markets due to reduced fixed costs of entry.

These benefits tend to differ according to which of three broad categories of cloud computing (deployment) models are adopted, these being private, public and hybrid cloud computing. Table 3 below shows that 35.1% of the cumulative macroeconomic benefits across the five economies could arise from the adoption of private cloud computing. The largest share, 39.3%, is expected to be attributable to the adoption of hybrid cloud computing, while pure public cloud is projected to account for the smallest share at 25.6%.

Table 3

EMEA: Cumulative Economic Benefits 2010-2015, by Cloud Model

	Private	Hybrid	Public	EMEA
	€ mil	€ mil	€ mil	€ mil
Business development opportunities	41,230	58,534	27,893	127,657
Business creation	72,214	72,352	70,587	215,153
Net total cost savings *of which:*	68,644	62,041	10,055	140,740
– IT CapEx savings	*32,493*	*75,249*	*46,940*	*154,682*
– IT OpEx savings (FTEs / productivity)	*20,531*	*32,728*	*20,570*	*73,829*
– IT OpEx savings (power & cooling)	*15,620*	*24,822*	*15,907*	*56,349*
– additional cloud services expenditure (PAYG) *	-	*- 70,758*	*- 73,362*	*- 144,120*
Indirect GVA	85,784	107,055	86,908	279,747
Total Economic Benefit	**267,872**	**299,983**	**195,443**	**763,297**
Direct and Indirect employment ('000s)	**754.2**	**842.8**	**799.2**	**2,396.2**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

Source: Cebr analysis

The aforementioned benefits to business are already a reality for early cloud computing adopters, which have made and are expected to continue to make the technology increasingly attractive. This will, in turn, make cloud computing service offerings progressively cheaper as economies of scale take hold and service offerings increasingly mature.

The first stage of our three-stage methodology involved identifying and understanding the aforementioned benefits, and capturing them in a framework reflecting the drivers of the economic success of any business. In other words, we expressed the operational benefits to business in terms of cost savings, efficiency improvements and new potential revenue-generating opportunities. This is the subject of section 3 of the main report.

The second stage of our methodology involved the review and distillation of the available sources of research and analysis of current and prospective rates of cloud computing adoption. We established baseline adoption assumptions and developed upside and downside cloud adoption scenarios to reflect the key barriers to and drivers of increased adoption in the future. This is the subject of section 4 of the main report.

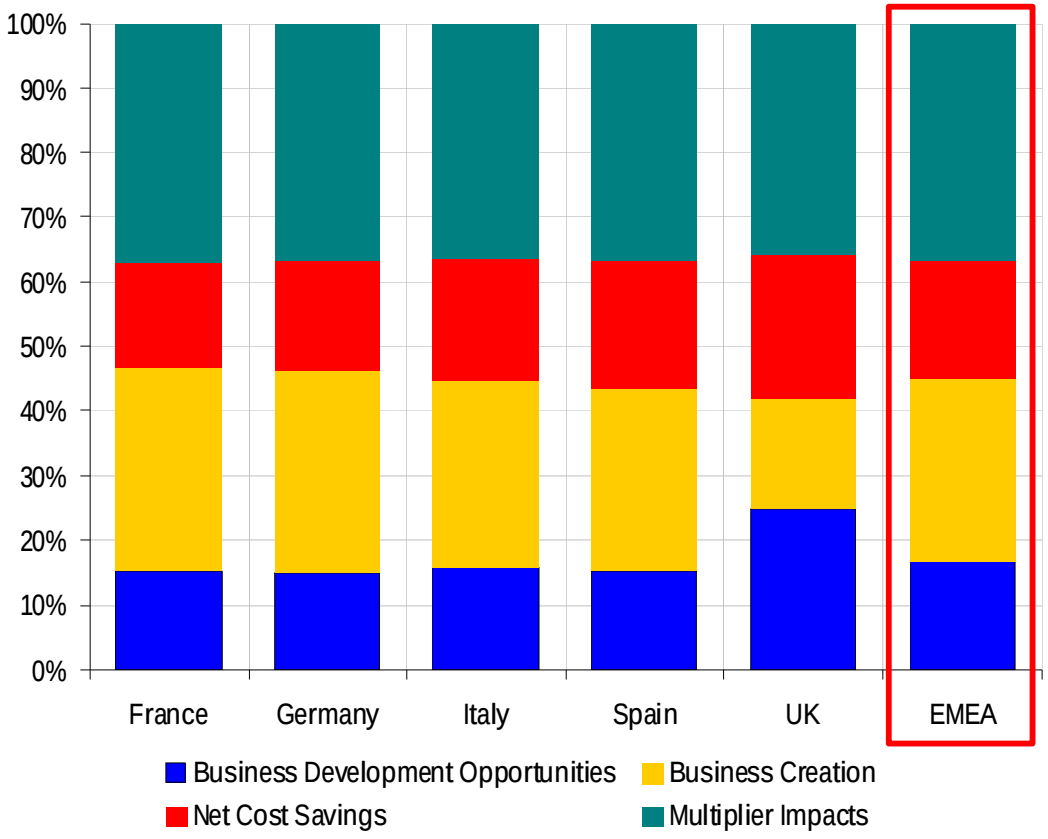
The third and final stage involved the quantification exercise used to translate the business-level benefits and assumed current and prospective adoption rates into macro-level benefits for each of and across the five economies.

Constituent benefits and differences in relative country performance

High-level analysis

From Table 1 above and Figure 1 below, it can be seen that, for the five economies as a whole, the greatest share of the cumulative macroeconomic benefits flow from the business creation and multiplier impacts of cloud computing. This is, likewise, the case in the individual countries except the UK, where the revenue-generating impact of new business development opportunities produced a larger share of the benefits than business creation.

Figure 1: Percentage contributions of the individual categories of cloud computing benefits, EMEA and individual countries

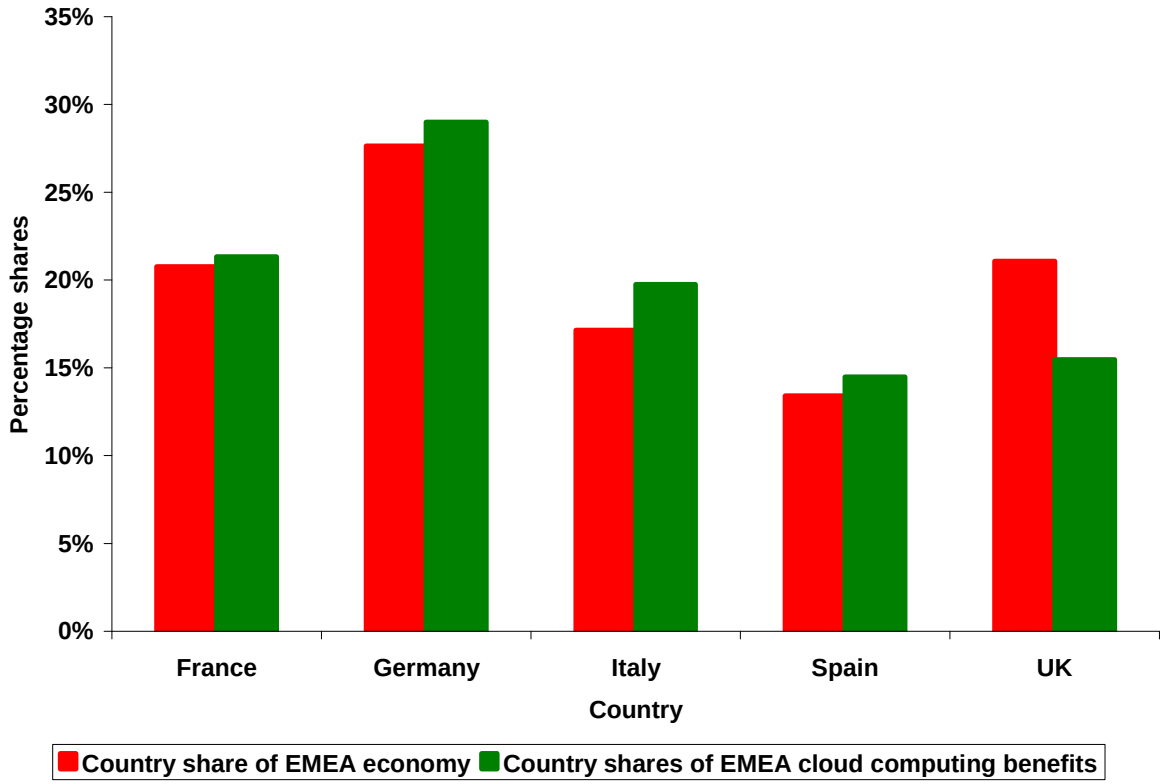


Source: Cebr analysis

Figure 2 below illustrates each nation's share of the aggregate cumulative economic benefits from cloud computing across the five economies relative to each nation's share of aggregate cumulative GDP of the same five economies.

The UK is the only country to show a disproportionately smaller share of the cloud computing benefits than the size of its economy might suggest. Italy is the best performer, where we predict a 19.8% share of cloud computing benefits relative to its 17.1% share of the combined economy of the five countries.

Figure 2: Percentage national shares of EMEA-wide cloud computing benefits relative to national shares of EMEA GDP



Source: Cebr analysis

Table 4 shows that, while Spain ranks fifth in terms of its absolute share of the aggregate economic benefits of cloud computing, the smallest of the five economies is the biggest beneficiary in relative terms. On this relative measure of performance, Spain is followed by Italy, then Germany, France and the UK.

Table 4: GDP and absolute and relative cloud computing benefit rankings

Country	GDP rankings	Cloud computing benefit rankings (Based on absolute share)	Cloud computing benefit rankings (Based on relative share*)
France	2	2	4
Germany	1	1	3
Italy	4	3	2
Spain	5	5	1
United Kingdom	3	2	5

*Source: Cebr analysis * Relative share means the absolute share of the benefits divided by the country's share of the combined GDP of the five economies*

In what follows, we describe the sources of differences between the benefits predicted for each of the five economies. These are considered separately for each of the constituent elements of the overall benefits of cloud computing featured in Figure 1 and Table 1 Table 3 above.

Analysis of the cost saving benefits of cloud computing

Cost-saving benefits are, for each of nine aggregate industry sectors, modelled as percentage cost savings on IT budgets. These are, in turn, modelled as percentage shares of total turnover. The forecasts of total turnover of aggregate industry sectors are driven by the broad macroeconomic outlook for the economy in question. This drives the monetary value of the IT budgets to which the cost-savings rates are applied. Therefore, for example, the more optimistic outlook for Germany will drive greater cost savings for any given levels of adoption than in Spain, where the broad outlook is relatively weak.

Cost-saving benefits are driven by general cloud computing adoption rates but also the rates of adoption of each of the cloud models relative to the others. Each of the private, public and hybrid models is assumed to have different levels of cost saving potential, with hybrid ranking the highest, followed by public and then private. Thus, for example, the UK is expected to achieve higher levels of hybrid cloud adoption than any of the other countries, which will drive higher levels of cost savings for any given general adoption levels.

Differences in relative country performance also arise from the patterns of adoption across the aggregate industry sectors that are assumed to make up these economies. For example, the UK and Germany are assumed, by 2015, to have relatively high rates of cloud adoption in their banking, financial and business services sectors. Because this is the most important sector for all of the five economies, but especially for the UK and Germany, the value of cost savings in these countries can be expected to be higher than in the other countries for any given levels of cloud adoption.

Because different sectors are associated with different levels of IT spend as a proportion of their total turnover, higher adoption in the higher IT-spend sectors will also drive greater levels of benefits for some countries relative to others. For example, banking, financial & business services is one of the highest IT-spenders, so high adoption in this sector, such as is expected in the UK, will produce greater levels of benefits.

Business development opportunities

Differences in the revenue-generating benefits arising from business development opportunities are modelled to be driven by different levels of adoption in the sectors which hold the greatest potential gains from more effective seasonal demand management and from efficiency improvements from IT scalability.

In terms of handling short-term peaks in seasonal demand, the manufacturing and banking, financial & business services sectors, which typically experience volatile spikes in economic activity throughout the financial year, show the greatest potential for benefits in this area. Thus, for example, the UK is expected to achieve much higher rates of cloud computing adoption in banking, financial & business services than in any other nation, while Italy is expected to achieve higher levels of adoption in its manufacturing sector. But the banking, financial & business services sector is much more important as a contributor to UK national output than the manufacturing sector is to Italy's, which drives differences the relative performance of the countries in harnessing this category of benefits.

In terms of enterprise scalability as a result of the elasticity of cloud computing IT services, the greatest potential benefits are available in banking, financial & business services and distribution,

retail & hotels. Both sectors are highly important contributors to all five national economies, so countries with early adoption in these sectors will see bigger scalability benefits earlier.

Manufacturing, transport & communications and government, health & education also show significant potential. Most of these sectors are, however, relatively less important for the wider economy, thereby reducing their impact on aggregate benefits.

France and Spain, for example, are expected to experience very high levels of cloud computing adoption in energy & utilities, but this will result in relatively little additional benefit compared to countries where very high adoption is experienced in banking, financial & business services, because the latter is so much more important than the former in contributing to national economies.

Business creation benefits

There are two sources of difference between countries here. First, the number of new SMEs expected to enter markets in the various national economies but, second, and more importantly, the differences in average levels of SME productivity (having controlled for size).

Thus, German SMEs are the most efficient from the five economies and significantly more efficient than in any other country. Because Germany is predicted to achieve fairly high levels of new business entry, it can expect to capture much larger business creation benefits than in other countries.

Compare this to the UK, where new entry is expected to be comparatively low which, combined with relatively inefficient SMEs, results in much lower business creation benefits than in Germany for instance. Italy, on the other hand, is expected to achieve very high levels of new entry, but its SMEs are the least efficient from the five economies, resulting in lower business creation benefits than if similar levels of new entry were experienced in, for example, Germany.

Multiplier benefits

Multiplier benefits arise from the indirect and induced economic activity that arises from the culmination of the cost-saving, business development and business creation impacts of cloud computing. This required assumptions about the proportions of total revenues that different industry sectors tend to spend on intermediate inputs, as opposed to salaries and wages or as profits to the business to be re-invested or to be paid in dividends to shareholders. These were calculated at the aggregate industry sector level but were assumed to be common across the five economies.

Therefore, differences arise only to the extent that the cost saving, business development and business creation benefits are different. In other words, differences here can be related back to the culmination of the various drivers of the differences that arise in the other categories of cloud computing benefits.

Business creation is the strongest driver of multiplier impacts, which probably explains why, for example, the UK's expected multiplier impacts represent a lower share of total benefits than in any of the other five countries.

Employment impacts

Employment impacts also arise from the indirect and induced economic activity that arises from the culmination of the cost-saving, business development and business creation impacts of cloud computing. Like multiplier impacts, differences in relative country performance can be related back to the culmination of the various drivers of the differences that arise in the cost saving, business development and business creation constituents of the overall benefits of cloud computing.

The key additional assumptions (calculated at the aggregate industry sector level and assumed to be common across the five economies) included those related to the average levels of pay of employees in different industry sectors, which is used to gauge the number of jobs that can hope to be created for a given aggregate increment of output, GVA and, therefore, of total available wages.

These jobs can, at least in the short run, be considered as a net impact. The extent to which they would constitute a net long run impact depends on the extent to which cloud computing can reduce the types of distortion that prevent the economy reaching its full productive capacity. Such distortions include things like imperfect competition, significant economies of scale, imperfect and incomplete information etc.

However, if the structural features of the economy lead employment back to its (pre-cloud) equilibrium level, then any temporary boost in the workforce will vanish over time.

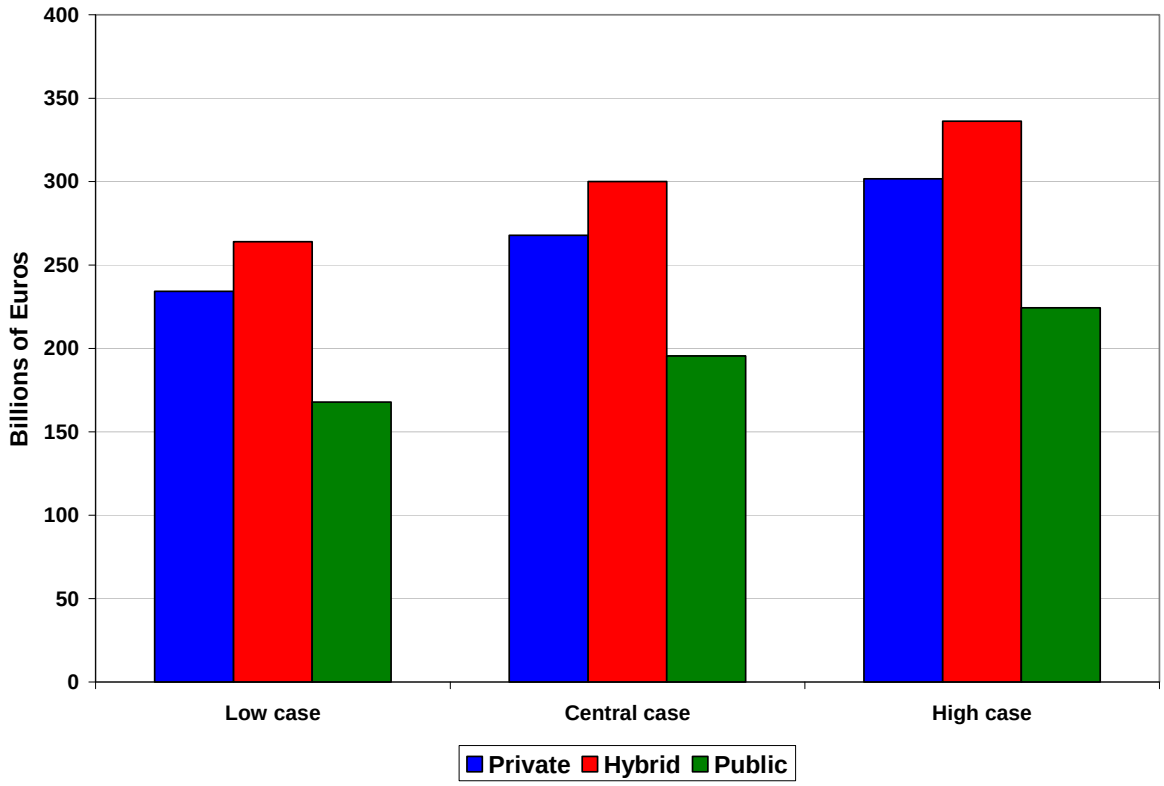
Sensitivity analysis

We also carried out a sensitivity analysis of the aggregate cumulative economic benefits of cloud computing, involving testing upside and downside scenarios around our baseline assumptions of cloud computing adoption rates.

Figure 3 below, which illustrates the results of this analysis for each of the cloud model types, reflects (in the set of bars on the left-hand side) the impact of a 5% reduction in adoption rates. This downside scenario would reduce the aggregate cumulative benefits across the five countries by 14.6% relative to the baseline results (the central bars).

This downside scenario reflects the risk of at least one, if not more, of a number of developments, including deteriorating perceptions about the security- and resilience-related aspects of cloud computing solutions, reduced or slower than expected adoption of virtualisation as the stepping stone to cloud computing, country-specific inhibitors such as a lack of adequate growth and development of national infrastructure, industry sector-specific inhibitors such as the new Basel requirements, which could affect adoption in the banking, financial and business services sector or continued skills shortages in terms of the ability of enterprise IT staff to take on virtualisation or cloud computing adoption projects.

Figure 3: Differences in cloud computing benefit levels by cloud model under upside and downside adoption scenarios relative to the base case



Source: Cebr analysis

Figure 3 also reflects (in the right-hand set of bars) the impact of a 5% increase in adoption rates. This upside scenario produced an 11.5% increase in the aggregate cumulative benefits relative to the baseline results.

This downside scenario reflects the risk of at least one, if not more, of a number of developments, including greater realisation by or convincing of potential cloud adopters of the cost saving benefits of cloud computing, particularly if the economic recovery turns out to be slower than expected, greater willingness on the part of potential cloud adopters to engage in hardware resource pooling and relinquish enterprise control of IT assets, dramatic improvements in the perception of the service quality and security levels associated with cloud computing, more pressing needs to consider enhanced enterprise flexibility and agility (again potentially in response to a slower than expected economic recovery), reduced IT management complexity and the potential to free up valuable strategic resources or a healthy investment climate for cloud computing that drives innovations to address cloud security issues.

High-level review of the projected benefits

Concerning adoption rates

The current and prospective cloud computing adoption rates used in our baseline predictions do not appear out of line with present levels of adoption of virtualisation technologies, viewed as a stepping stone to cloud computing especially for large enterprises, or with the fact that cloud computing service offerings have been in existence for over ten years, largely through the software-as-a-service model. However, there is also an in-built assumption about levels of internal adoption of cloud once

the business as a whole has decided to adopt cloud computing. We assume a progressive shift of business workloads into cloud infrastructure, beginning with a 20% shift of workloads in 2010 to a 100% shift by 2014.[2]

Cebr is not a 'technology specialist' and can only rely, for its adoption rate assumptions, on the opinions and research of experts in the IT / cloud computing field. While our assumptions have been through a number of iterations arising from Cebr's engagement with various technical teams from EMC Corporation, they may well be too cautious or overly optimistic. The extent to which they are will determine whether our predictions will, by 2015, constitute under- or over-estimates. What we hope to have provided, however, is a basis on which the economic sensitivities can be understood should cloud computing not, for example, take-off as quickly as expected.

Business development benefits

Business development benefits are modelled as incremental revenues estimated to be achievable from effective seasonal demand management and from efficiencies related to IT scalability. However, the proportion of the total incremental revenues achievable from these improvements is assumed to be proportionate to the size of IT budgets relative to total turnover. This may not be representative, at least in some cases, of the importance of IT in rapidly responding to opportunities to earn more revenues. In other cases, IT may be a relatively insignificant factor.

The extent, therefore, to which we have underestimated the general importance of IT in business' ability to respond rapidly to new revenue opportunities, will determine the extent to which our predictions of the business development benefits of cloud computing will be underestimates.

Unmeasured benefits

We have not attempted to quantify a number of the other potential positive benefits of cloud computing. These include new and multilateral network effects and the positive externalities arising from the reduced energy consumption that results from the reduced need to power and cool underutilised IT infrastructure capacity. One study that we reviewed as part of the study suggested that ICT is responsible for 2% of carbon emissions in Europe, so we would expect reduced energy consumption by some proportion of this 2% total.

The quantification of the value of these externalities would be no easy task and, in any case, would be subject to a great deal of uncertainty. Such a quantification was well beyond the scope of this study but, to the extent that they are ignored, our estimates of the aggregate economic benefits of cloud computing can be considered conservative.

[2] As far as we could make out, neither are these assumed rates of internal adoption inconsistent with current or prospective rates of adoption of virtualisation technologies.

1 Introduction and background

Cebr was appointed by EMC to undertake a study to quantify the economic benefits of cloud computing. What follows is a report on the independent analysis conducted by Centre for Economics and Business Research Ltd (Cebr).

This is the first ever study of the economic impact of cloud computing in the EMEA area and provides an important contribution to the debate about the best ways for EMEA economies to revive and emerge from the economic crisis. [3]

1.1 Whither cloud computing?

The current macroeconomic climate and the financial turbulence of the last 18 months are forcing the hand of all enterprises to scrutinise their entire cost base and expenditure profile. This includes pressure to reduce IT costs and improve IT efficiency. The current objective of IT managers is, therefore, to spend less time and budget on maintaining or renewing current infrastructure and more on new initiatives that can reduce costs and improve business value.

Cloud computing is becoming an increasingly viable option, a technological advance that has the potential to revolutionise the IT investment model, providing a viable option for IT decision-makers looking to find ways to reduce infrastructure costs in the context of the economic recovery and their ageing base of server installations. Cloud computing offers reduced IT environment complexity by packaging traditionally separate components into converged solutions that arrive pre-integrated and ready-to-use.

At a high level, cloud-adopting enterprises benefit from lower costs, faster times to market and opportunities for the creation of new sources of value. By reducing the fixed costs associated with business set-up and increasing corporate profitability, cloud computing raises the incentives for new business creation, thus boosting entry into and competition in markets throughout the economy. This can result in high margins being competed away and an expansion of economy-wide output.

The culmination of these benefits, in turn, drives investment through the re-investment of retained profits and stimulates domestic demand, through the spending of greater amounts of shareholder dividends and wages in the wider economy. This, in turn, further supports growth and employment.

1.2 Purpose and objective of the study

EMC[2] expressed its interest in the potential appeal of a robust quantification of the economic benefits of cloud computing to a wide audience, including elevation of the question of its adoption for inclusion on the wider CEO agenda as well as the CIO agenda.

This can be achieved by discussing cloud computing in terms of its potential impact on hard economic variables. This was the purpose of the study on which this report is based. The approach is different to previous attempts to better understand the market for, or to raise the profile of, cloud

[3] EMEA, as used in this report, is the acronym used by EMC Corporation to refer to the UK, France, Germany, Italy and Spain, a subset of the company's global presence.

computing. Our study is not, therefore, an attitudinal survey. Neither is it primarily a market sizing exercise nor a detailed look at barriers or drivers to adoption.[4]

Rather, our study is an attempt to robustly quantify the potential value of cloud computing to the businesses that adopt it and how the aggregate contribution of cloud computing to the wider economy can be expected to increase (on an annual and cumulative basis) over the next 5 years as rates of adoption increase as anticipated. The valuation extends to the five EMEA economies, consisting of the largest EU economies, namely (in alphabetical order) France, Germany, Italy, Spain and the United Kingdom.

1.3 Summary of methodology

We developed a spreadsheet model that is designed to calculate the aggregate economy-wide impacts of cloud computing. We first modelled the economic benefits of cloud computing (the "cloud dividend") for the UK economy. Once the structure of the model was finalised for the UK, we adapted it for the macroeconomic structure and characteristics of each of the other four EMEA economies, namely France, Germany, Italy and Spain.

We adopted a three-stage approach to the study. These were:

1. *Identify and quantify the benefits of cloud computing to business*: this required an understanding of the benefits of cloud computing at the level of individual business activities and processes and to capture those benefits in a framework reflecting the drivers of the economic success of an enterprise, namely exploiting opportunities to enhance the sources and levels of revenues and to achieve greater efficiencies and cost savings.

2. *Determine current and prospective rates of adoption of cloud computing*: this required an understanding of the major drivers of and inhibitors to achieving widespread adoption of cloud computing and to decide on appropriate cloud computing adoption forecasts. In undertaking this step, we distinguished between three cloud computing deployment models, namely private, public and hybrid clouds. We have not developed our own forecasts. Rather our assumptions are based on the data and forecasts produced by technology specialists through expert reviews and analyst reports.

3. *Calculate the aggregate economy-wide benefits of cloud computing:* this involved refining and using the information from the first two stages to estimate the sum of the benefits across the whole economy. The (large and SME) enterprise-level benefits and the adoption rates were calculated and aggregated separately for each of the 9 industry sectors that constitute each of the five EMEA economies.[5] However, while the aggregation of the enterprise-level benefits is important, at the aggregate level, these benefits feed 'multiplier' (indirect and induced) impacts in terms of employment and contributions to national economic output.

1.4 Structure of this report

This report is structured as follows:

[4] The results of and reports on these approaches provide, nonetheless, a valuable source of information for our study. These reports are, therefore, referenced throughout the text.

[5] The aggregated industry sector breakdown corresponds with the breakdown used as the basis for reporting official statistics on the UK economy by the UK Office for National Statistics (ONS).

- Section 2 considers the methodology used to calculate the macroeconomic benefits of cloud computing. While this constitutes the third stage of the study, we place it at the front of the report to acknowledge the fact that this is, primarily, a macroeconomic impact assessment.

- Section 3 considers the methodology used to understanding of the operational business benefits of cloud computing and to express these as either cost savings or revenue opportunities.

- Section 4 deals with the issue of adoption of cloud computing, our understanding of the key drivers and inhibitors and a distillation of the data and forecasts produced by technology specialists through expert reviews and analyst reports, which we used as the basis for the private, public and hybrid model adoption forecasts that we used in our economic model.

- Sections 5 to 9 present the results for each of the five EMEA economies, beginning with France, then Germany, Italy, Spain and the United Kingdom.

2 Methodology for quantifying the macroeconomic benefits of cloud computing

This section provides an outline of the methodology employed by Cebr to calculate the aggregate economy-wide benefits of cloud computing. Although this is the last in a three-stage approach, it is this macroeconomic quantification that is the primary contribution of this report and the wider study on which it is based. It was appropriate, therefore, to set out early on in the report the methodology used to undertake this macroeconomic quantification. This is the purpose of this section.

The section is structured as follows:

- Subsection 2.1 provides an outline of the macroeconomic model developed by Cebr for the purposes of quantifying the economy-wide benefits of cloud computing.
- Subsection 2.2 considers the quantification of the economy-wide benefits from enterprise-level cost savings delivered by cloud computing.
- Subsection 2.3 considers quantification of the economy-wide benefits from enterprise-level business development opportunities delivered by cloud computing.
- Subsection 2.4 considers the economy-wide benefits from the business creation impact of cloud computing;
- Subsection 2.5 describes how we quantified multiplier impacts that arise from all of the above.
- Subsection 2.6 provides a brief outline of the cloud computing benefits that we did not attempt to quantify.

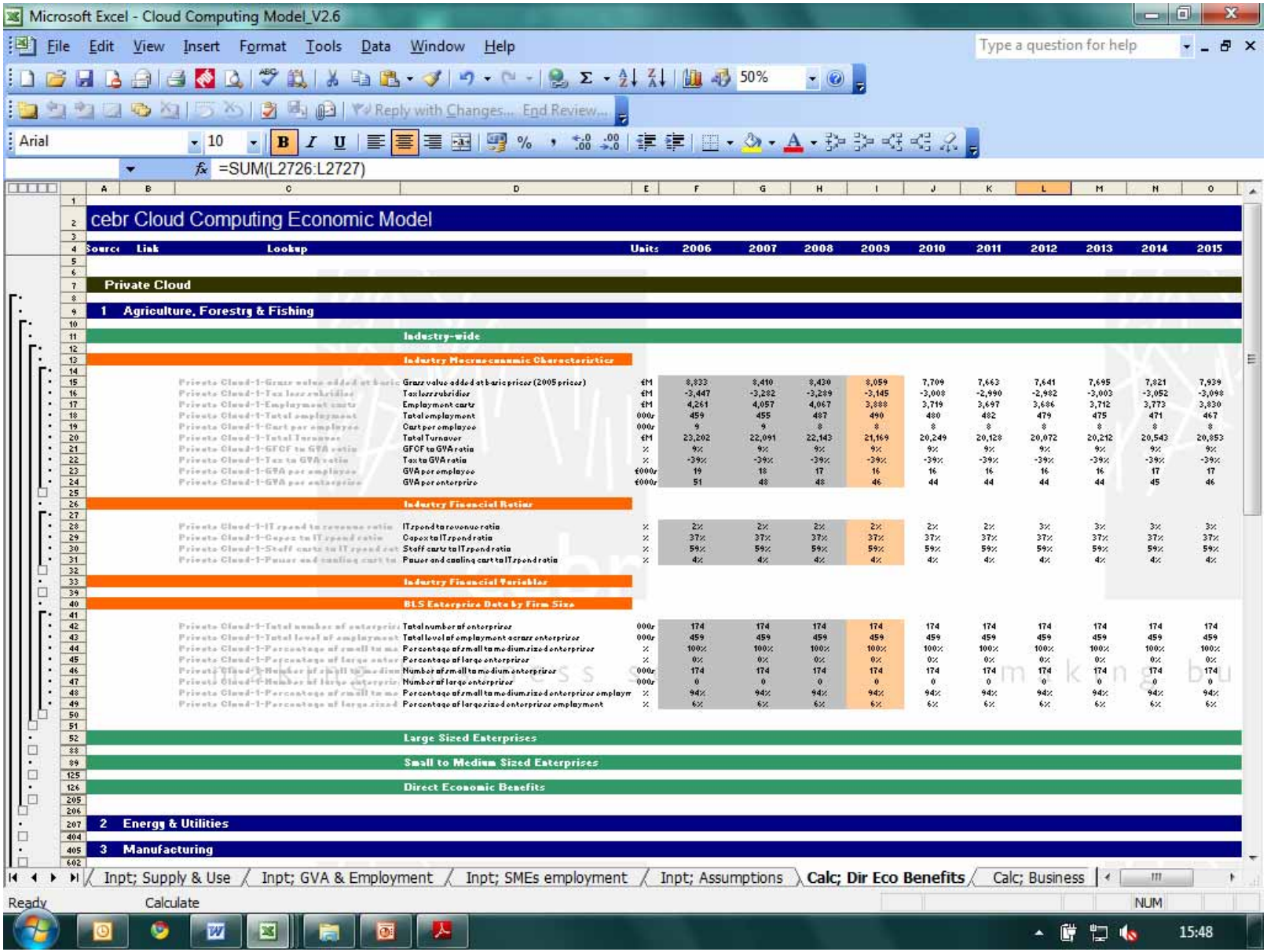
2.1 The macroeconomic model

The model used to quantify the macroeconomic impact of cloud computing was designed to use the information from the first two stages to estimate the sum of the benefits across the whole economy. These earlier stages, as outlined in subsection 1.3, involved analysing and developing appropriate assumptions about: (1) enterprise-level cost savings, efficiency improvements, business development opportunities and business creation benefits arising from cloud computing; and (2) cloud computing adoption rates. These are the subject of, respectively, sections 3 and 4.

We developed a spreadsheet model to calculate the aggregate economy-wide impacts of cloud computing. This involved, first, modelling the economic benefits of cloud computing (the "cloud dividend") for the UK economy and, once the structure of the model was finalised for the UK, adapting it for the macroeconomic structure and characteristics of each of the other four EMEA economies, namely France, Germany, Italy and Spain.

A sample screenshot of the model is provided on the following page.

The macroeconomic model also captures the country-specific drivers of cloud computing benefits. These include the forecasts for the rate of cloud adoption, the macroeconomic conditions for growth and employment and industry-specific enterprise data for SMEs and large enterprises.


Microsoft Excel - Cloud Computing Model_V2.6
File Edit View Insert Format Tools Data Window Help
Type a question for help
50%
Reply with Changes... End Review...
Arial 10
=SUM(L2726:L2727)
cebr Cloud Computing Economic Model
Source Link Lookup Units 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Private Cloud
1 Agriculture, Forestry & Fishing
Industry-wide
Industry Macro-economic Characteristics
Gross value added at basic prices (2005 prices) £M 8,833 8,410 8,430 8,059 7,709 7,663 7,641 7,695 7,821 7,939
Tax less subsidies £M -3,447 -3,282 -3,289 -3,145 -3,008 -2,990 -2,982 -3,003 -3,052 -3,098
Employment costs £M 4,261 4,057 4,067 3,888 3,719 3,697 3,686 3,712 3,773 3,830
Total employment 000s 459 455 487 490 480 482 479 475 471 467
Cost per employee 000s 9 9 8 8 8 8 8 8 8 8
Total Turnover £M 23,202 22,091 22,143 21,169 20,249 20,128 20,072 20,212 20,543 20,853
GFCF to GVA ratio % 9% 9% 9% 9% 9% 9% 9% 9% 9% 9%
Tax to GVA ratio % -39% -39% -39% -39% -39% -39% -39% -39% -39% -39%
GVA per employee £000s 19 18 17 16 16 16 16 16 17 17
GVA per enterprise £000s 51 48 48 46 44 44 44 44 45 46
Industry Financial Ratios
IT spend to revenue ratio % 2% 2% 2% 2% 2% 2% 3% 3% 3% 3%
Capex to IT spend ratio % 37% 37% 37% 37% 37% 37% 37% 37% 37% 37%
Staff costs to IT spend ratio % 59% 59% 59% 59% 59% 59% 59% 59% 59% 59%
Power and cooling cost to IT spend ratio % 4% 4% 4% 4% 4% 4% 4% 4% 4% 4%
Industry Financial Variables
BLS Enterprise Data by Firm Size
Total number of enterprises 000s 174 174 174 174 174 174 174 174 174 174
Total level of employment across enterprises 000s 459 459 459 459 459 459 459 459 459 459
Percentage of small to medium sized enterprises % 100% 100% 100% 100% 100% 100% 100% 100% 100% 100%
Percentage of large enterprises % 0% 0% 0% 0% 0% 0% 0% 0% 0% 0%
Number of small to medium enterprises 000s 174 174 174 174 174 174 174 174 174 174
Number of large enterprises 000s 0 0 0 0 0 0 0 0 0 0
Percentage of small to medium sized enterprise employment % 94% 94% 94% 94% 94% 94% 94% 94% 94% 94%
Percentage of large sized enterprise employment % 6% 6% 6% 6% 6% 6% 6% 6% 6% 6%
Large Sized Enterprises
Small to Medium Sized Enterprises
Direct Economic Benefits
2 Energy & Utilities
3 Manufacturing
Inpt; Supply & Use
Inpt; GVA & Employment
Inpt; SMEs employment
Inpt; Assumptions
Calc; Dir Eco Benefits
Calc; Business
Ready
Calculate
NUM
15:48

The quantification of the economy-wide benefits of cloud computing involved aggregating the individual benefits identified and quantified in section 3 below, given current Cebr forecasts for the future macroeconomic landscape in each of the five EMEA countries and the assumed adoption rates for each aggregated industry sector in each country.

2.2 Economy-wide benefits from the enterprise-level cost savings delivered by cloud computing

The starting point in the task of aggregating the enterprise-level cost savings arising from cloud computing was to establish estimates of the amount that firms in each of the aggregate industry sectors spend on their total IT budgets as percentages of their total revenues, as well as on the various components of their IT budgets. This provided monetary IT budget levels to which the cost savings rates developed in the first stage of the study (and which is the subject of section 3 below) could be applied. This, in turn, involved a number of steps.

First, we inferred the levels of IT spend as a percentage of total revenues from our reading and cross-checking of various analyst and consultancy reports.[6] This was done separately for each of the aggregated industry sectors that constitute the macroeconomy, with the proportions ranging from about 1.8% in the construction sector to 5.4% in the banking, financial and business services sector. These proportions were assumed to be common across the five EMEA economies.

We note, however, that national economy-wide (cross-sector) weighted average IT spend as a proportion of total revenues (GDP at the aggregate level), where the weights represent the relative importance of the aggregated industry sectors to the wider economy, differ between countries. For example, the average is high for the UK at 5%, which is driven by the relative importance of its service-based industries to the wider economy, especially the banking, financial and business services sector and the distribution, retail and hotels sector, which are heavier IT-spend sectors.

For example, while the banking, financial and business services sector is just as large, if not bigger (at least following the strengthening of the Euro relative to Sterling) in Germany than in the UK, the German economy is proportionately much more heavily dependent on its manufacturing sector, which tends to involve lighter IT-spend. This has the effect of dragging down the economy-wide weighted average IT spend as a proportion of total turnover.

Second, we established assumptions about the capital and labour cost ratios incorporated into IT budgets. Specifically, the percentage of IT budget spent on IT capital expenditure (CapEx) was estimated based on Gartner data dating back to 2006.[7] The rationale for choosing data points from 2006 was to capture the last year of 'normal' levels of economic activity before the financial crisis and subsequent recession. At the sectoral level, IT capital spend as a share of total IT budgets ranged from 19% in banking, financial and business services to 47% in energy & utilities and distribution, retail & hotels.

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[6] These included "IT spending creating value", Pricewaterhouse Coopers, June 2008 and Gartner's IT Key Metrics Data from the period 2005-2006.

[7] Our assumed levels of capital and labour costs as a percentage of total IT budgets most closely reflect those found in "IT spending, its history and future", Gartner 2006.

The labour cost share of total IT budgets were inferred from the same source as the capital shares. Our assumptions involve, therefore, labour cost shares ranging from 49% in energy & utilities and distribution, retail & hotels to as high as 77% in banking, financial & business services.

Third, we estimated the percentage of IT budgets spent on power and cooling using ONS' Input-Output tables. These provide estimates of the amount of inter-industry spend on intermediate consumption at the 123-industry level. The relevant intermediate spend was on energy required to power and cool servers and data centres.

Because IT spend by an enterprise is expressed as proportions of GDP (total turnover), growth in the monetary values of IT budgets is driven by increases in GDP. Multiplying these monetary IT spends by the compound of the cost savings rates established in the first stage and the adoption rates established in the second stage, gave us monetary values (by industry sector and country) for the savings on each of the three components of IT spend (CapEx, labour costs and power & cooling costs).

Note that, while the cost savings rates are common across countries and industry sectors, the adoption rates are idiosyncratic to the country and the industry sector. Furthermore, the first established different cost savings rates (for each category of IT spend) for each of the three cloud computing models. The greatest cost savings rates apply to hybrid cloud adoption, while the lowest result from private cloud adoption. However, most the total available cost savings are, nonetheless, achievable with private cloud. The greatest differences between the costs savings rates associated with the different cloud models is in the area of IT CapEx.

We also note that the relative position of the different cloud models in terms of the overall levels of cost savings achievable incorporates appropriate amounts of additional new spend on 'pay-as-you-go' cloud services. These are higher under public cloud than hybrid cloud, which is why the overall level of cost savings achievable under hybrid clouds exceeds those assumed to be achievable for public cloud.

2.3 Economy-wide benefits from the enterprise-level business development opportunities delivered by cloud computing

Calculating aggregate economy-wide benefits associated with enterprise-level business development opportunities involved establishing macro indicators that could be used as proxies for the revenue opportunities provided to firms by cloud computing. We decided on two macroeconomic indicators, with one capturing the improved responsiveness to unpredictable short-term demand peaks that result from cloud computing and the other capturing the shorter time-to-market and elastic scalability benefits.

Business development gains can be captured through the effective management of seasonal peaks and other fluctuations in demand during the financial year. By being able to respond readily to upturns in economic activity, firms can increase their revenues and profitability.

The ability to rapidly scale the business up or down with cloud computing technologies allows firms to grow or shrink organically without the need to invest in additional IT capital. Furthermore, cloud technology will reduce the time-to-market for firms' products and services, thereby removing at least some of the barriers to entry for existing firms seeking new markets.

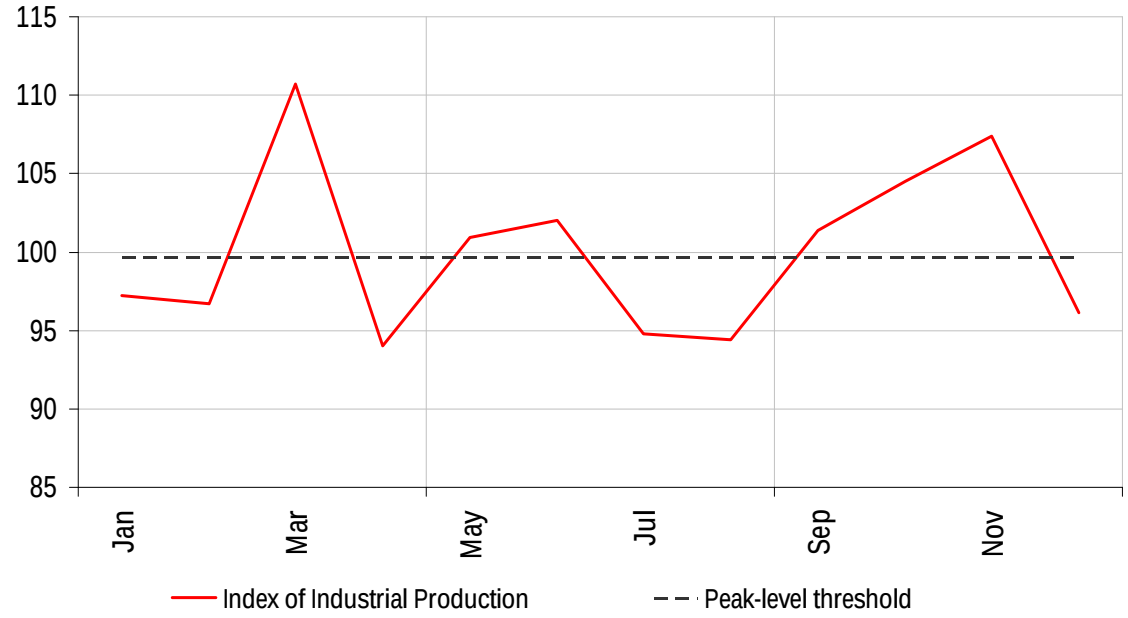
Management of seasonal peaks

The macro indicator used to proxy the revenue opportunities due to the ability to better manage unpredictable short-term demand peaks was a measure of potential incremental output that could be captured through efficient management of seasonal peaks.

To do this, we used the leading economic indicators of output for each industry in order to analyse where seasonal peaks in demand occur. We then used a standard tool used in airport capacity planning to define peak thresholds in each industry sector, which we established as the top tenth percentile of annual output.[8] Peak demand was defined as output that exceeded those thresholds.

To illustrate this methodology, Figure 4 below shows the leading economic indicator of output used for the manufacturing industry sector, that is, the Index of Production.

Figure 4: Non-seasonally adjusted index of production and peak level threshold (2006 index)



Source: Office for National Statistics, Cebr Analysis

Output above the peak threshold we took as indicative of an upturn in output as a result of seasonal demand variations. This provided the basis for calculating the opportunity cost, in terms of revenue loss, to a firm of not being able to scale-up and respond to these seasonal variations. We used bespoke leading economic indicators of output for each aggregate industry sector. These are listed in Table 5 below.

[8] The airport capacity planning tool to which we refer is known as the '30th – 40th busiest day rule, whereby the 30th – 40th busiest day of the year is taken as representative of the peak demand for airport landing slots. For our purposes, this produced a peak threshold defined as top 10th percentile of annual demand.

Table 5: Leading economic indicators of non-seasonally adjusted output by broad industry sector

Industry	Leading economic indicator of output	Source
Agriculture, Forestry & Fishing	Index of production	Office for National Statistics
Energy & Utilities	Electricity, Gas and Water supply index of output	Office for National Statistics
Manufacturing	Manufacturing Output Index	Office for National Statistics
Construction	New Dwellings Starts	Housing and Communities National Housing Statistics
Distribution, Retail & Hotels	Distribution, Retail and Hotels Index of Output	Office for National Statistics
Transport & Communications	Transport, storage and communication Index of Output	Office for National Statistics
Finance & Business Services	Trading volumes	London Stock Exchange
Government, Education & Health	Central government expenditure	Office for National Statistics
Other Services	Central government expenditure	Office for National Statistics

The ability, however, to deal efficiently with seasonal demand variations depends on a range of factors, not just IT flexibility and scalability, for example, increasing headcount in the particular area of production where greater responsiveness is required. We, therefore, scaled the levels of output above the peak thresholds by the share of IT budgets in total revenues for each industry sector. This IT budget to total revenue ratio was used as a proxy for the amount of peak output that can be captured through IT scalability. We believe this to be a conservative assumption which, if this is the case, means our calculations of this particular type of business development opportunity constitute underestimates.

For the purposes of our economic model, we estimated the potential output that can be captured from more efficient management of seasonal demand through cloud computing as a percentage of total annual output. The results are presented in Table 6 below.

Table 6: Peak seasonal output to be captured by cloud technology as percentages of annual output

Industry	Potential seasonal output to be captured by cloud technology
Agriculture, Forestry & Fishing	0.07%
Energy & Utilities	0.07%
Manufacturing	0.15%
Construction	0.05%
Distribution, Retail & Hotels	0.06%
Transport & Communications	0.07%
Finance & Business Services	0.11%

Industry	Potential seasonal output to be captured by cloud technology
Government, Education & Health	0.04%
Other Services	0.05%

Source: Cebr Analysis

Table 6 shows that the largest proportional gains from effective seasonal management of demand accrue to the manufacturing and the banking, finance & business services sectors. These sectors typically experience volatile spikes in economic activity throughout the financial year. The smallest gains accrue to government, education & health and construction.

Note that, while the largest opportunity cost is in manufacturing, this is a mid-level IT spender with a low IT CapEx to total IT budget ratio, which will effectively result in a scaling down of these benefits. Banking, finance & business services show the second highest opportunity cost but this industry sector is a high IT spender. Countries with early adoption in these sectors will, nonetheless, see bigger seasonality benefits earlier.

Short time-to-market and elastic IT scalability

Cloud computing technologies facilitate investment in IT architecture which enables businesses to grow organically without the requirement to invest in additional IT capital. Furthermore, cloud technology will reduce the time-to-market of firms' products and remove barriers to entry for existing firms seeking new markets. We quantified these effects separately for SMEs and larger firms.

SMEs

Cloud computing technologies could be vital to SMEs in the early stages of growth and development, enabling them to invest in an IT architecture that can be scaled-up as the enterprise grows, without the need for additional capital outlays. Furthermore, IT scalability enables SMEs to enter new markets more rapidly by shortening times-to-market, thereby generating further revenue-creating opportunities.

According to a study by UK Department for Business, Innovation and Skills (BIS), the productivity of SMEs is, in general, approximately 5% less than large enterprises. We believe that IT scalability can play a vital role in addressing this 'productivity gap'. By weighting this productivity gap by the same proxy used above for the amount of these benefits that can be reasonably attributed to cloud computing IT scalability (that is, the IT budget to total revenues ratio), we expressed the potential productivity gains as a percentage of total annual output that could be captured in this manner. The results are shown in Table 7 below.

Table 7: SME productivity gains from IT scalability, annual growth in productivity

Industry	Potential SME productivity benefits of IT scalability as a percentage of total annual output
Agriculture, Forestry & Fishing	0.13%
Energy & Utilities	0.14%
Manufacturing	0.20%
Construction	0.10%
Distribution, Retail & Hotels	0.27%
Transport & Communications	0.20%
Finance & Business Services	0.28%
Government, Education & Health	0.17%
Other Services	0.20%

Source: Cebr Analysis

The table shows that SMEs in the retail and banking, financial & business services sectors will be amongst the chief beneficiaries of IT scalability.

Note that the largest productivity gap closure is offered by banking, financial & business services and distribution, retail & hotels, so countries with early adoption in these sectors will see bigger scalability benefits earlier. Manufacturing, transport & communications and government, health & education also show significant potential. Most of these sectors are, however, relatively unimportant to the broader economy, thereby reducing their impact on the aggregate economic benefits.

Large enterprises

The role of cloud computing technologies in large enterprises will help to consolidate existing market positions and create new revenue-making opportunities through the offer of products with a significantly reduced time-to-market. Over the ten years prior to the start of the recession (1997 to 2007), labour productivity growth in the UK economy as a whole has averaged 0.9% annually.

For large enterprises, we have, therefore, scaled the long-run 10-year average productivity growth rate for each industry by the IT budget to total revenue ratio. The purpose of this was, again, to proxy the amount of these additional benefits that can be reasonably attributed to IT scalability. The results for large enterprises are presented in Table 8 below.

Table 8: Large enterprise productivity gains from IT scalability, annual growth in productivity

Industry	Potential large enterprise productivity benefits of IT scalability
Agriculture, Forestry & Fishing	0.0%
Energy & Utilities	0.0%
Manufacturing	0.0%

Industry	Potential large enterprise productivity benefits of IT scalability
Construction	0.0%
Distribution, Retail & Hotels	0.1%
Transport & Communications	0.2%
Finance & Business Services	0.1%
Government, Education & Health	0.0%
Other Services	0.0%

Source: Cebr Analysis

The largest potential benefits of IT scalability to large enterprises occur in the transport & communications industry sector. Where Table 8 shows a zero value, for instance, the UK's production industries, especially the manufacturing and energy sectors, we found no productivity improvements or a trend decline in productivity over the period from 1997 to 2007. These sectors were, consequently, assumed to have nothing to gain from IT scalability.

2.4 Economy-wide benefits from the business creation benefits delivered by cloud computing

The reduction in the fixed costs of entry, combined with the increased profitability of firms already in the market, provides significant opportunities for entrepreneurs and incentives for new start-up businesses to enter markets. New firms enhance competition in the marketplace and contribute to increases in national economic output.

The value of these benefits to the national economies was estimated by undertaking an industry sector-specific assessment of business productivity for small and medium-sized enterprises. Cloud computing enables SMEs to function more productively and, therefore, add more value to the economy. Table 9 below shows the average rates of SME business productivity for each of the five EMEA countries.

Table 9: SME productivity pre- and post-cloud computing adoption

Country	Productivity index pre-cloud computing	Productivity index post-cloud computing
France	205.0	205.4
Germany	340.6	341.3
Italy	102.7	102.8
Spain	108.5	108.8
United Kingdom	130.7	131.2

Source: Cebr analysis

There are three key drivers of aggregate business creation benefits: (i) the initial productivity of SMEs; and (ii) the level of net cost savings and business development opportunities by SMEs who have already adopted cloud; and (iii) the number of firms that are created, as estimated by Etro.[9]

2.5 Economy-wide multiplier impacts

The potential cost saving and revenue-raising benefits arising from cloud computing is modelled as an increase the economy-wide GVA of firms. This additional GVA is used in any one or more of the following ways, the aggregate effect of which is known as the multiplier impact:

- Paid in bonuses or salary / wage increases for employees, in which case the money is, after saving a certain amount, spent on goods and services in the wider national economy. The additional economic activity supported as a result is known as the 'induced' impact.

- Paid in shareholder dividends, in which case the money is also either saved or spent in the wider economy. This also provides an induced impact.

- Retained in the business for re-investment, in which case the money is spent on goods and services from domestic companies who supply intermediate inputs. The additional value generated in these intermediate sectors and the additional jobs supported as a result is known as the 'indirect' impact. There are also induced impacts arising from spending of additional employee wages and shareholder profits in relevant intermediate sectors.

The main source of multiplier impacts, however, is the benefit associated with business creation. This is modelled as an increase in gross value added (GVA). This additional GVA can be used by companies to support more jobs and / or pay more profits to shareholders. The additional economic activity supported as a result of spending these additional wages and profits on final goods and services in the wider national economy produces additional induced impacts.

However, in order to generate the additional GVA from business creation, there will also have been additional expenditure on the inputs required to produce that GVA. The additional value generated in these intermediate sectors and the additional jobs supported as a result is known as the 'indirect' impact. There are also induced impacts arising from spending of additional employee wages and shareholder profits from these intermediate industries in the wider national economy.

Multiplier benefits are proportional to the levels of total net cost savings, business development and business creation benefits achieved as a result of cloud computing. Key assumptions in calculating them include consumption to savings ratios and assumptions about the appropriate split between intermediate consumption (payments to other industries), wages (payments to employees) and profits (payments to shareholders).

2.6 Employment impacts

Employment impacts also arise from the indirect and induced economic activity that arises from the culmination of the cost-saving and business development impacts, but also the direct employment impacts resulting from business creation. The key additional assumptions included those related to

[9] See "The Economic Impact of Cloud Computing on Business Creation, Employment and Output in Europe", Federico Etro, 2009, forthcoming in *Review of Business and Economics.*

the average levels of pay of employees in different industry sectors, which is used to gauge the number of jobs that can be expected to be created for a given aggregate increment of output, GVA and, therefore, of total available wages.

These jobs can, at least in the short run, be considered as a net impact. The extent to which they would constitute a net long run impact depends on the extent to which cloud computing can reduce the types of distortion that prevent the economy reaching its full productive capacity. Such distortions include things like imperfect competition, significant economies of scale, imperfect and incomplete information etc.

However, if the structural features of the economy lead employment back to its (pre-cloud) equilibrium level, then any temporary boost in the workforce will vanish over time.

2.7 Non-measured benefits: Externalities

There are other positive effects of cloud computing. First, cloud computing is likely to the creation of new and multilateral network effects. These network externalities are the effects that one user of a good or service has on the value of that same good or service to other people. Network externalities imply an increase in the value of the product or service and more and more people use it. For example, the more people that own telephones, the more valuable the telephone is to each owner.

There are also positive externalities from the reduced energy consumption that result from the reduced need to power and cool underutilised IT infrastructure capacity. In Europe, Etro notes that ICT is responsible for 2% of carbon emissions in Europe, so we would expect reduced energy consumption from lower power and cooling requirements to reduce carbon emissions by a portion of this 2% total that reflects the obviated need to power and cool this underutilised capacity.

The quantification of the value of these externalities would be no easy task and, in any case, would be subject to a great deal of uncertainty. Such a quantification was well beyond the scope of this study but, to the extent that they are ignored, our estimates of the aggregate economic benefits of cloud computing can be considered conservative.

3 Identification and quantification of the benefits of cloud computing to business

This section sets out our methodology for identifying and quantifying the expected benefits of cloud computing to business. As outlined in subsection 1.3 and section 2, this required us to develop an understanding of the benefits of cloud computing at the level of individual business activities and processes and to capture those benefits in a framework reflecting the drivers of the economic success of an enterprise, namely exploiting opportunities to enhance the sources and levels of revenues and to achieve greater efficiencies and cost savings. In undertaking this step, we distinguished between large enterprises and small and medium enterprises ("SMEs").

This section is structured as follows:

- Subsection 3.1 begins by considering the key characteristics of cloud computing and why it makes sense for business to adopt it, in terms of the operational benefits it provides.
- Subsection 3.2 describes how we translated the operational benefits to business into relevant savings on IT costs and budgets.
- Subsection 3.3 describes how we translated the operational benefits to business into business development and new revenue-generating opportunities.
- Subsection 3.4 describes how we translated the operational benefits to business into new business creation benefits.

3.1 Characteristics of cloud computing and operational benefits for business

While there are many definitions of cloud computing, most will, according to some[10], be "self-serving" variations of that provided by the US National Institute for Standards and Technology (NIST). NIST defines cloud computing as

> *"a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."*

This definition requires computing services to be accessible across networks, but not necessarily across the public Internet, which facilitates the ideas of private, as well as public clouds.[11] The definition also implies computing resources that are pooled and reusable, that can be rapidly reconfigured and are accessible without intervention from IT personnel.

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[10] See "The Responsible Cloud", Enterprise Management Associates (EMA) Research Report, January 2010.

[11] Private cloud infrastructure is operated for a sole enterprise or organisation, can be on- or off-premise, and can be run by the enterprise or organisation itself or on its behalf by an IT service provider. Public cloud infrastructure is made available to all potential users, including the general public, and is owned by an organisation selling cloud services. Public clouds are generally off-premise, unless the premises in which one or more users are located is owned by the cloud service provider, which EMA (2010) notes might occur in the case of an enterprise reselling its own spare capacity. Prominent example of public IT cloud service offerings include Google Apps, Amazon's Elastic Compute Cloud (EC2) and Microsoft Azure. Hybrid cloud infrastructure is a composition of a private and a public cloud that is independent but bound together by standardised or proprietary technology that allows data and application portability, such as cloud-bursting for load-balancing between clouds. Hybrid clouds are expected to be the most popular form of cloud computing adoption, providing an essential transition stage for enterprises and organisations with significant existing IT deployments.

Cloud computing can be summarised as hardware-based IT services that offer compute, network and storage capacity.[12] To be considered a cloud computing model, the IT offering must involve:

(i) abstraction from buyers (be they enterprises, public bodies or consumers) of hardware ownership, control and architecture, which can be located anywhere geographically and is run in multi-tenancy mode (that is, multiple users accessing the infrastructure simultaneously);

(ii) buyers incurring infrastructure costs as variable operating expenditures on a pay-per-use basis with no contractual obligations; and

(iii) infrastructure capacity that can be scaled up or down dynamically and immediately.

These characteristics imply a broad range of benefits for business enterprise and other organisations that adopt cloud computing. These are:

- reduced IT capital expenditures due to hardware abstraction from users;
- reduced spend on IT headcount or more valuable re-deployment of staff elsewhere in IT departments or elsewhere in the business;
- rapid access to faster computing capabilities without the need for intervention by the providers of the services being accessed and without having to "wait in line" for IT department assistance;
- improved IT capacity utilisation through pooled resources that serve multiple users;
- improved business scalability in response to client demands through computing capabilities that can be elastically provisioned, that is, increased when users wish to scale up and released when users wish to scale back down;
- rapid rollout of on-demand resources resulting in faster time-to-market for new goods and services and quicker returns on investment;
- pay-per-use model so that users incur only the costs of the computing capabilities that they need and use; and
- lower barriers to entry to markets due to reduced fixed costs of entry.

Having identified the operational benefits for business, the next step was to capture those benefits in a framework reflecting the drivers of the economic success of an enterprise, namely exploiting opportunities to enhance the sources and levels of revenues and to achieve greater efficiencies and cost savings.

This framework, in turn, provided the mechanism through which the operational benefits to business could be quantified in monetary terms. The quantifications of the cost saving, revenue generation and business creation benefits, in turn, provided the basis for the macroeconomic assessment in Section 4 and are the subject of the following three subsections.

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[12] The distinction between clouds and cloud services can be important. Clouds refer to the underlying IT infrastructure, which must satisfy all three key requirements to be considered a 'true' cloud. Prominent examples include Amazon Web Services (AWS), Google App Engine and Windows Azure. Cloud services, on the other hand, need only comply with the first and third key requirements to be counted as such. We note that cloud services do not necessarily need to be provided over a cloud infrastructure. This is the basis for some 'software-as-a-service' cloud models (see section 4 below), examples of which include Gmail, ZOHO and salesforce.com .

3.2 Cost-saving benefits of cloud computing

Cloud computing technologies result in cost savings to firms' IT budget which, in turn, drives increases profitability. There are three methods by which firms can make cost savings. These are:

- *IT capital expenditure*: by eliminating server and storage costs and replacing these with pay-as-you go cloud computing capabilities, firms can reduce their net IT capital spend.
- *IT labour costs*: by outsourcing IT services, firms can reduce their IT headcount and/or redeploy staff into more productive areas of IT departments such as application development.[13]
- *IT power and cooling costs*: by eliminating the need to power and cool server and data centres, firms can save a substantial amount on energy bills.

The adoption of cloud computing technologies are, however, anticipated to require new IT spend on cloud services, particularly when using hybrid and public cloud computing models. These expenditures must also be taken into account.

We address each of these sources of enterprise-level cost savings in turn in what follows.

Capital expenditure savings

The levels of potential IT capital expenditure savings from the adoption of cloud computing technologies were developed based on our interpretation of proprietary research provided by EMC. This research included an analysis of the levels of cost savings available for each of the private, hybrid and public cloud computing models. This analysis was based largely on an analysis of the financial industry sector.

Capital expenditure cost savings can be associated with the benefits accruing from hardware and software consolidation, as well as a reduction in server and storage costs. For the private cloud computing model, Cebr has inferred the following capital expenditure cost savings available from private cloud adoption:

- an overall 20% reduction in the costs of external IT services through hardware consolidation and standardised application frameworks;
- an overall 2% reduction in software maintenance costs achieved through software consolidation;
- an overall 18% reduction in server and storage costs through reduced hardware maintenance; and
- an overall 44% reduction in network hardware costs due to server consolidation and reduced facilities and fabric maintenance.

By weighting the above cost savings by the corresponding proportionate shares of these different elements in total IT capital expenditure budgets, we were able to estimate weighted capital expenditure rates of cost saving for the private cloud computing model. These weighted average cost savings rates were calculated on an equivalent basis, but using distinct data from the proprietary research provided by EMC, for each of the hybrid and public cloud computing models. These weighted average rates of capital expenditure cost savings are:

[13] Note that this applies equally to the IT vendors through which many enterprises outsource IT service provision.

- 17.3% of total IT capital expenditure budgets in a private cloud computing environment;
- 31.1% of total IT capital expenditure budgets in a hybrid cloud environment; and
- 39.9% of total IT capital expenditure budgets in a public cloud environment.

Labour cost savings / productivity improvements

While it may be tempting to immediately associate labour cost savings with redundancies in enterprise IT departments and third-party IT service providers, it is equally valid to associate them with the monetary benefits accruing from productivity gains. Whether they remain in employment with the same company or not, IT staff will effectively be redeployed into more productive areas of an enterprise or service provider, the wider IT industry, such as applications development, or even the wider economy.

The levels of potential IT labour cost savings from the adoption of cloud computing technologies were likewise developed based on our interpretation of proprietary research provided by EMC, which also included an analysis of the levels of cost savings available for each of the private, hybrid and public cloud computing models.

The key drivers of these labour cost savings are hardware consolidation and standardised application frameworks and are assumed, for private cloud adoption, to consist of:

- a 20% reduction in applications development costs due to productivity gains in IT services; and
- an 18% reduction in internal operations, maintenance and support costs.

By weighting the above cost savings by the corresponding proportionate shares of these different elements in total IT labour cost budgets, we were able to estimate weighted capital expenditure rates of cost saving for the private cloud computing model. Weighted average labour cost savings rates were then calculated on an equivalent basis, again using distinct data from the proprietary research provided by EMC, for each of the hybrid and public cloud computing models. These weighted average rates of labour cost savings are:

- 19.1% of total IT labour cost budgets in a private cloud computing environment;
- 24.2% of total IT labour cost budgets in a hybrid cloud environment; and
- 31.2% of total IT labour cost budgets in a public cloud environment.

Power and cooling cost savings

Power and cooling cost savings are the result of hardware consolidation, which eliminates the need to power and cool large server and data centres, thus saving business money on energy bills. The levels of power and cooling cost savings from the adoption of cloud computing technologies were developed on the basis of our interpretation of the same proprietary research provided by EMC.

Our analysis resulted in the following IT power and cooling costs savings rates:

- 44% of total IT power and cooling costs in a private cloud computing environment;
- 61% of total IT power and cooling costs in a hybrid cloud environment; and

- 79% of total IT power and cooling costs in a public cloud environment.

New spend on cloud services

The adoption of cloud computing will, however, require significant new expenditure on cloud services, particularly in the hybrid and public cloud computing environments. Our assumptions for this new IT expenditure on cloud services were again derived from the same proprietary research supplied by EMC. This research suggested that, while new spending on cloud services will be minimal under private cloud computing models, they could be significant in a hybrid or public cloud environment. However, the savings on existing spend are lower in a private cloud environment because much more of the existing spend must be retained.

The new spend on cloud services is, under the hybrid model, expected to include that on a range of content, collaborative and customer relationship management (CRM) applications sourced from software-as-a-service (SaaS) vendors, and ERM, engineering and custom applications sourced from infrastructure-as-a-service (IaaS) and platform-as-a-service (PaaS) vendors for peak demand.[14] For the purposes of our model, we adopted the assumption that a hybrid cloud environment will involve a 6% increase in overall IT expenditure.

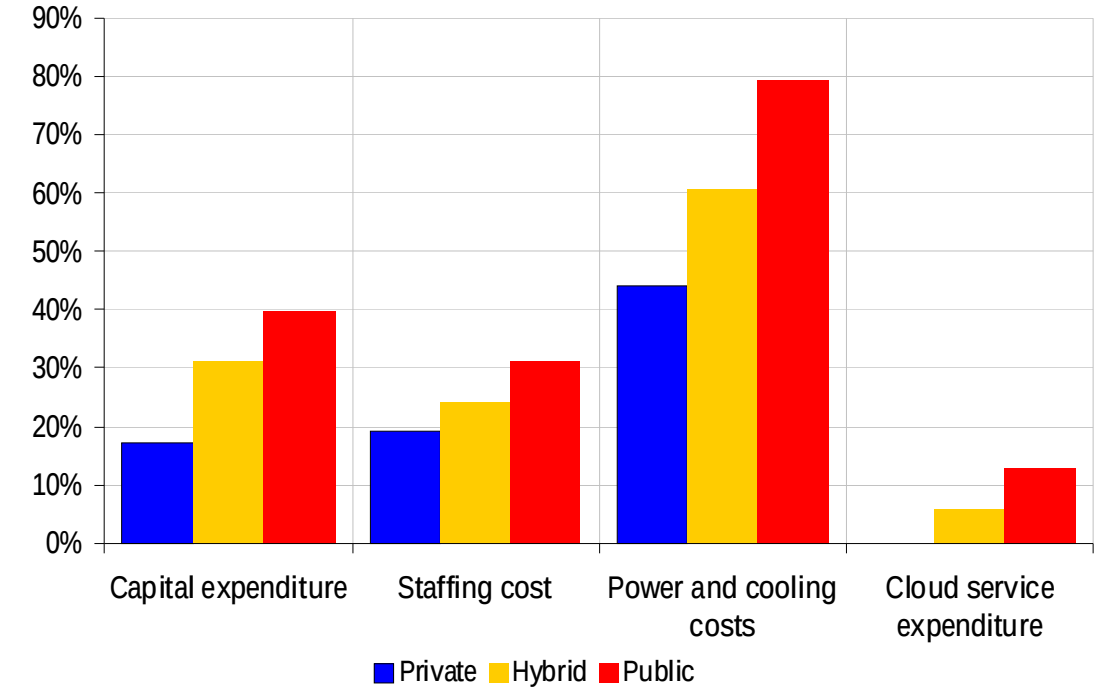
The public cloud environment is expected to involve new spend on content, collaborative and CRM applications and SCM applications sourced from SaaS vendors. Meanwhile, eengineering, operations & manufacturing, data access, analytics and custom applications are expected to remain enterprise applications, but run on infrastructure sourced from IaaS vendors. For the purposes of our model, we adopted the assumption that a public cloud environment would involve a 13% increase in overall IT expenditure.

Summary of cost savings

To summarise, the individual cost saving elements arising from the adoption of cloud computing are illustrated in Figure 5 as proportions of each of the relevant component parts of enterprise IT budgets.

[14] See section 3 of the report for meaning of these various cloud computing concepts.

Figure 5: Savings as a % of component parts of IT budgets



Source: Cebr analysis

3.3 Business development benefits of cloud computing

Cloud computing builds on compute and storage virtualisation technologies, allowing users to rent infrastructure "in the Cloud" as needed, to deploy applications and store data, and to access them via Web protocols on a pay-per-use basis. The elastic scalability of cloud computing that only incurs cost for the user based on actual resource usage fulfils business objectives like shorter time-to-market and responsiveness to unpredictable short-term demand peaks. This, in turn, offers significant opportunities for enterprises to drive growth and profitability in new and existing revenue streams.

Cloud computing technologies result in new business development opportunities for firms, which are captured through more effective management of seasonal peaks and the ability to exploit scalability advantages as they look to grow their business and enter new markets. The fact that firms can grow rapidly without the need for up-front investment in additional IT capability will serve to reduce the time-to-market of firms' products and services and will remove barriers to firms entering new markets at home and abroad.

The 'opportunity cost' of not adopting cloud computing

Klems et al (2009)[15] suggests a methodology that can be employed by firms to undertake cost-benefit analyses of private cloud computing solutions by comparing with the costs and benefits associated with their existing IT solution.

[15] Klems, Markus, Jens Nimis and Stefan Tai (2009), "Do Clouds Compute? A Framework for Estimating the Value of Cloud Computing", FZI Forschungszentrum Informatik Karlsruhe, Germany.

This is based on comparing future revenue streams that result from failing to deliver on certain business objectives, such as shorter time-to-market, customer satisfaction and quality-of-service related service level agreements (SLAs) under a conventional IT solution with the revenue streams resulting from meeting those objectives under a cloud computing solution.[16] For example, if the time-to-market of a new service offering is longer than was built into business objectives, due to slow deployment processes, the resulting deficit can be calculated as a discounted flow of monetary opportunity costs and benefits.

While Klems et al (2009) does not contain sample quantifications, it does provide details and results of case study research on two early cloud computing adopters. The key points for this study from this research are summarised in Box 1.

Box 1

Early adopters of cloud computing from Klems et al (2009)

Klems et al assert that the early adopters of cloud computing are start-ups with high scalability requirements, who turn to cloud computing providers, such as Amazon EC2, in order to roll out web-scale services with comparatively low entry costs. The important drivers of scalability, low market barriers and rapid deployment are clearly illustrated by two examples, namely the New York Times "TimesMachine" project and a Major League Baseball initiative.

NY Times TimesMachine

The objective was to provide access to any NY Times issue since 1851, consisting of 11 million news articles to be delivered in PDF format. They decided to make use of Amazon Web Services Elastic Compute Cloud (EC2) and Simple Storage Service (S3). These are public cloud computing offerings.

The motivation for choosing these services was:

- the simplicity with which the one-time task could be accomplished if performed in the cloud;
- the absence of up-front costs, bar the insignificant expenditures associated with experimenting with feasibility; and
- shorter deployment times and improved time-to-market.

The alternative was to purchase commodity hardware, install it and run the tasks, a process that NY Times considered would have taken weeks or months, with the hardware needing to be sold afterwards or deployed in alternative contexts, which were notable by their absence.

Major League Baseball

MLB Advanced Media runs the MLB websites and wanted to introduce a chat product immediately. However, the company's data centre in Manhattan did not have much free storage capacity or processing power and there was not sufficient time to order and install new machines. The decision was made to access Joynet's public cloud computing offering.

MLB AM declared two main advantages to this approach, namely that:

- the company gained the flexibility to try out new products quickly and turn them off if they weren't

[16] This is based on establishing a "utility computing" (pay-as-you-use) model. The model should define computing units and, thus, provide a metric to convert and compare computing resources between cloud services and alternative infrastructure services. The utility computing model will usually be implicitly defined by the cloud computing provider through a pricing scheme, such as Amazon's EC2 Compute Units ("ECUs"). This vendor-specific model can, in turn, be converted into a more generic utility computing unit, which might be necessary in any case when comparing the cloud computing offers of alternative vendors.

successful, which was noted by Klems et al as highlighting the equal importance of scaling down as scaling up; and

- the company could respond better to seasonal demand spikes, which are typical for websites around major sports events.

Quantifying business development impacts in practice

Cebr does not have access nor could find data that would facilitate the incorporation of the Klems et al approach into our macroeconomic assessment of the business development impacts. We did not, in other words, have values to attach to the benefits that EMEA businesses can expect from cloud computing, namely shorter time-to-market, keeping customers happy and meetings SLAs. We had no choice, therefore, but to develop a top-down methodology to estimate the potential revenue impacts of growing new and existing business opportunities. This was outlined in section 2 above.

3.4 Business creation benefits of cloud computing

The business development benefits of cloud computing are nowhere more demonstrable that for small- and medium-sized enterprises (SMEs). SMEs are the less well-publicised engine of most, if not all, EMEA national economies. The perception that they are not technologically savvy is, however, being challenged by Internet technology advances and especially cloud computing.

SMEs are exploiting the Internet to build increasing scale and presence across national boundaries, through improved automation and information exchange across supply chains, through greater collaboration with customers, suppliers and partners, and through increased transparency and a reduction in the power of middlemen and brokers to take advantage of information asymmetries to exploit less well-informed users.

Boston Consulting Group, in a recent study on the role of the Internet in transforming the UK economy, provided a number of examples illustrating these points.[17] These are reviewed briefly in Box 2 below.

Box 2

Case study examples of cloud computing adoption by UK SMEs

"mydeco"

This is a home design website that rents time on public clouds to do short bursts of processing to keep its index of products up-to-date.

Mendeley

A London-based company that has built its business around research collaboration, a service the company describes as iTunes and LinkedIn for academics. The company has half a million users and performs real-time analytics on more than 40 million crowd-sourced documents, a scale which co-founder Victor Henning says would not be possible with cloud computing.

[17] See "The Connected Kingdom: How the Internet is Transforming the UK Economy", The Boston Consulting Group (BCG), report commission by Google, October 2010.

The fact that cloud computing is provided in a pay-as-you-go manner, so that ICT spend is incurred in direct proportion to production necessities, means that SMEs avoid the large up-front costs associated with ICT hardware and software. This has an impact on the cost structure imposed on potential new entrants across the aggregated industry sectors and, through that, on the production possibilities of all firms, especially SMEs.

Therefore, by drastically reducing the fixed costs associated with IT investments normally associated with business set-up and production, there is a positive impact on entry and competition in sectors where fixed IT spending is important. Etro (2009[18]) notes that the positive association between innovative general purpose technologies, such as cloud computing, and that European policymakers recognise that this association most likely works in both directions.[19] These policymakers are also aware that SMEs play such a vital role in the production structure.

In this manner, cloud computing is predicted by Etro to have a profound effect on the market structure of many sectors and, thus, on global macroeconomic performance.

The economic theory of business creation

Etro characterises cloud computing as an innovation in the hardware / software field and studies the economic impact of this 'cloud' innovation on the economy, which he represents with a standard macroeconomic model that incorporates the endogenous market structures theory, a more recent development in the macroeconomic literature.

The endogenous market structures theory is used to model the impact of the diffusion of the 'cloud' innovation in terms of a reduction in the fixed costs associated with the purchase, maintenance and replacement of IT hardware and software. This has an impact, in turn, on the incentives for firms to invest and expand and for new firms to enter the market, making market structures less concentrated and competition more intense across the aggregated industry sectors that make up the economy. This results in positive induced effects on aggregate production and employment.

Etro's model simulates the impact of a gradual reduction of the fixed costs of entry to show that, even starting from conservative assumptions on the cost reduction process, the diffusion of cloud computing across the European Union (EU-27) will result in the development of "a few hundred thousand" new SMEs which will, in turn:

- provide a positive contribution of about 0.2 per cent to the annual growth rate;
- contribute to the creation of about one million new jobs.

Etro admits that his experiment is highly speculative because the nature of the cost shift (due to cloud computing) can only be conjectured. The reality, in other words, is that it will depend on many future macroeconomic and policy factors and, for this reason, he focused on the "net expected" impact of cloud computing, that is, the expected additional impact above and beyond the unperturbed cyclical behaviour of the macroeconomic variables in his model.[20]

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[18] See "The Economic Impact of Cloud Computing on Business Creation, Employment and Output in Europe", 2009

[19] This is explained by competitive sectors driving IT innovations as firms in those sectors seek ways to outdo their rivals. Meanwhile, the adoption of IT innovations by firms in any sector enhances the productivity of those firms, making them and the market more competitive.

[20] Etro also neglects new network effects and the positive externalities due to the reduced energy consumption that results from no longer having to power and cool server rooms.

The means by which cloud computing leads to business creation

We have demonstrated above how cloud computing can yield significant benefits for existing firms through cost savings and increased revenue-generating opportunities through seasonal demand management and IT scalability. This has the effect of increasing the profitability of existing firms, which sends out a signal to new entrants seeking to compete for existing firms' growing profits. The reduced barrier to entry as a result of not having to incur large IT fixed costs makes entry a real possibility. This has, in turn, the effect of mark-ups being competed away, prices falling and increases in average and total demand and production.

We used the results of Etro's study to estimate that a total of 258,000 new businesses will be generated by 2015 across the five EMEA economies.

Table 10: New business start-ups by 2015

Country	New business start-ups
United Kingdom	35,000
Germany	39,000
France	48,000
Italy	81,000
Spain	55,000

Source: Etro (2009)

Etro attributes differences between countries to differences in the strength of diffusion of SMEs and / or to differences in the rapidity with which ICT adoption has been generally.

Section 2 above explains how we aggregated the economic benefits associated with this new business creation across each of the five EMEA economies.

4 Current and prospective cloud computing rates of adoption

This section reviews current patterns of cloud computing adoption and considers how adoption patterns are likely to evolve over the next 5 years. We develop baseline assumptions for cloud computing adoption and consider upside and downside scenarios, pinpointing the factors that could lead to greater than expected growth in cloud adoption on one hand and, on the other, the factors that could inhibit such growth.

Cebr is not a 'technology specialist', but must attribute its assumptions to experts' views articulated in analyst reports, industry white papers, academic studies and expert views. The adoption rates assumed for the purposes of our economic modelling have, as a result, been through a number of iterations.

The section is structured as follows:

- Subsection 4.1 considers current and prospective patterns of adoption of virtualisation technologies which, for large enterprises at least, provides the necessary bridge to cloud computing.
- Subsection 4.2 considers current patterns of cloud computing adoption.
- Subsection 4.3 considers the key barriers to and drivers of further cloud computing adoption in the future.
- Subsection 4.4 considers prospective patterns of cloud adoption and establishes the basis for our baseline adoption assumptions for the economic modelling.
- Subsection 4.5 considers the potential drivers of downside and upside cloud adoption scenarios and establishes the alternative scenarios that we considered in the economic modelling.

4.1 Virtualisation: the stepping stone to cloud computing

Virtualisation of servers involves the replacement of many small physical servers by one larger physical server, the objective being to increase the utilisation of costly hardware resources such as, for example, CPU. Virtualisation is part of an overall trend in enterprise IT and is believed by the technology industry to provide the foundation for IT automation, dynamic workload mobility and to be a bridge to cloud computing.[21]

Larger enterprises can achieve server utilisation rates that are comparable to those being achieved by cloud providers and are being encouraged by some to focus their attention on the immediate benefits of virtualising server storage, network operations and other critical building blocks. The ESG research cited in footnote 21 found that, out of 1,602 IT professionals from large midmarket (500-999 employees) and 'enterprise-class' (1,000 employees or more) organisations, 74% were now using server virtualisation.

The firms who employ these IT professionals have reaped the benefits of lower IT capital and operating spend and improved IT efficiency through server and data centre consolidation to handle

[21] See "The Evolution of Server Virtualization", Enterprise Strategy Group (ESG) Research, October 2010

workloads like Web applications and file & print services. But 58% of the surveyed organisations have virtualised less than one-third of their servers to date, while two-thirds have had only three years or less experience with virtualisation. Only 19% had more than five years experience, but these more experienced organisations are moving beyond the immediate benefits to improve application provisioning, availability and backup & recovery processes.

While many organisations were still struggling with performance-sensitive workloads like databases and multi-tiered transactional applications, half of the firms represented by the sample of IT professionals surveyed by ESG had virtualised Web-based applications in production environments. But many of these had also virtualised email, corporate portal / collaborative solution and industry-specific applications in production environments.

The challenges that are perceived to be holding back progress in virtualisation rollout include budget constraints, unsupported legacy systems and applications or lack of the requisite skill sets amongst IT staff to handle virtualisation projects. Less prevalent concerns include problems with capacity planning, performance and system tuning. Security concerns were even less prevalent but not non-existent.

Nonetheless, the results of the study led ESG to predict significant virtualisation deployment over the next 2 years, including significant expansion into production environments, increasing from 39% to 58%. The key drivers will be skills advancement and better cross-functional IT cooperation (that is, between those dealing with applications, servers, storage, networking and security).

We note that the ESG research is based on a sample of IT professionals from North American firms. We made the assumption, therefore, that the results reported and predictions made by ESG could also be considered applicable to Western Europe. On this basis, the future adoption of virtualisation in the EMEA countries looks well on track to support the combined rates of adoption of private and hybrid clouds that we adopt as our baseline adoption assumptions.

While more aggressive virtualisation would be very likely to support an upside cloud adoption scenario, less deployment of virtualisation than expected could hold back the adoption of private and hybrid clouds. Less rapid virtualisation amongst midmarket and large enterprises and organisations may, therefore, need to be considered as a risk that could contribute to a downside cloud adoption scenario.

4.2 Current patterns of cloud adoption

Gartner observed that, while IT buyers want agility and low-cost service solutions, cloud computing offerings are a radical shift for the enterprise, and the adoption of new models has proved to be unpredictable at the enterprise level. Here, "slow and steady" has been the norm, due to security, regulatory and compliance concerns.

EMC acquired proprietary data from IDC's 2010 European Services Survey, specifically related to attitudes to cloud computing in the 5 EMEA countries that are the subject of this report. We cannot reproduce this data, but a broad summary is provided in Table 11 below, which are unweighted averages across the aggregate industry sectors which make up our EMEA economies. The sample size for the survey was 673 enterprises across Europe and 513 enterprises within the 5 EMEA countries.

Table 11: Current unweighted average adoption rates by country

Country	Current adoption rates (private, public and hybrid)
United Kingdom	32%
Germany	33%
France	31%
Italy	32%
Spain	37%

Source: IDC 2010 European Services Survey, Cebr analysis

These unweighted average adoption rates are, however, notable by their similarity, bar Spain which appears to be somewhat of an outlier.

Private and hybrid cloud computing deployments are the most popular. The data does not distinguish between different sizes of firm, one of the factors that could have been used to guage the extent to which the respondents are capturing the full benefits of these private and hybrid deployments. Given the aforementioned observation by Gartner, we doubt that this is being achieved just yet.

Neither are the results that surprising when one considers that it is three or four key industry sectors in each EMEA country that are driving the surprisingly high present-day cloud adoption rates found by IDC. These are, for each country:

- UK: manufacturing; distribution, retail & hotels; banking, financial & business services; government, health & education.
- Germany: energy & utilities; manufacturing; distribution, retail & hotels; transport & communications; banking, financial & business services;
- France: energy & utilities; manufacturing; transport & communications;
- Italy: energy & utilities; manufacturing; distribution, retail & hotels; transport & communications; government, health & education.
- Spain: energy & utilities; manufacturing; distribution, retail & hotels; transport & communications; government, health & education.

The existence of such high current rates of cloud adoption is not inconsistent with the fact that software-as-a-service (SaaS) offerings have been available for more than 10 years.[22] Survey research by Enterprise Management Associates (EMA) confirms that, based on a sample of 159 enterprises where cloud deployments are active or planned, SaaS was the most popular cloud computing model, with adoption measured at 67%. This compared with a 43% adoption rate of the infrastructure-as-a-service

[22] SaaS offers users the ability to access the cloud computing provider's applications running in a cloud infrastructure, for example, web-based services for email, CRM, office productivity and file storage. The user neither manages nor controls any aspect of the underlying infrastructure (that is, the networks, servers, operating systems and storage. Neither does the user control application capabilities (with the exception of user-specific configuration settings). SaaS users generally consist of commercial Internet-based software providers and consumers, as well as some more sophisticated IT departments. Google Apps is a prominent example.

(IaaS[23]) model and a 42% adoption rate for platform-as-a-service (PaaS[24]), which EMA found surprising, especially for PaaS which is deemed a less mature service model than SaaS or IaaS.

Joint research by the 451 Group and Tier 1 Research[25] observed that, while some SaaS packages such as Salesforce.com are wildly successful, others have drained resources and delayed early adoption; the example provided being desktop productivity software over the Internet. That being said, the research asserts that the attraction of SaaS remains strong, since the economic model is friendlier and more rational for both providers and customers.

Meanwhile, EMA found that private cloud deployments were significantly more popular than public cloud deployments.

4.3 Drivers of and barriers to growth in cloud adoption

Business drivers of cloud adoption

According to Gartner (2010), time is money and an IT solution like cloud computing that delivers functionality less expensively and with more agility cannot be ignored against the macroeconomic background, that is, recovery from the financial crisis and subsequent recession. Not surprising then that EMA, in its survey of 159 enterprises with active or planned cloud deployments, found that two of the top three key drivers of cloud computing adoption were cost-related.

The fact that reduced IT opex ranked ahead of reduced IT capex as a driver of adoption led EMA to suggest that it is probably the automation, flexibility and agility aspects of cloud computing that are driving adoption, rather than the hardware resource-pooling aspect, but also the motivation to maintain some enterprise control of IT assets (characteristic of the more popular private and hybrid models) by sharing the burden of the risk associated with the up-front investment with cloud computing service providers.

The other of the top three drivers was improved IT service quality, while lower ranking factors included increased enterprise flexibility and agility, better recoverability, reduced IT management complexity and the freeing up of valuable strategic resources.

IDC observed that, in a private cloud environment, the most important driver of cloud adoption by IT decision-makers is availability. For a public cloud environment, the most important driver was lowering the total cost of ownership. While this is consistent with EMA's finding that two of the top three drivers were cost-related, IDC found that, contrary to EMA, lower opex associated with reduced IT headcount was the least important driver.

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[23] IaaS provides the ability of users to access fundamental computing resources (such as networks, processing and storage) where they can run custom or pre-built software, including operating systems, Web servers and applications. User control can extend beyond operating systems and deployed applications to storage and select networking components, like host firewalls. EMA (2010) describes IaaS as the lowest common denominator of cloud computing, with deployment restricted to the virtual servers and low-end infrastructure services, namely storage and network connections. Amazon's Elastic Compute Cloud (EC2) is a prominent example.

[24] PaaS provides the ability for users to access a platform for the deployment of applications that they have created or acquired using programming languages and tools supported by the cloud provider. While users neither manage nor control the underlying cloud infrastructure, they do control the applications deployed, as well as hosting environment configurations. Examples include specific and selected Java Runtime or Development Environments (JREs/JDEs), Integrated Development Environments (IDEs), standard databases, middleware, applications or Web servers. Another prominent example is Windows Azure.

[25] See "Cloudscape: Cloud codex", The 451 Group and Tier 1 Research, October 2009.

Business barriers to growth of cloud adoption

Not only does the raw economics of cloud computing need to make sense before full rollout occurs, there are a range of other factors that have and will impede growth in cloud adoption. These fall into three categories:

- *Technical* relating to confidentiality, security, recovery and reliability (especially for business critical applications);
- *Operational* relating to unsupported legacy applications and software, whether the loss of internal control can be managed effectively and whether the firm will be locked into a single supplier; and
- *Organisational* relating to lack of the requisite skill sets and of cross-functional IT cooperation.

Conference polls taken this year by Gartner[26] suggest that concerns with public cloud computing security and privacy were three times more important than any other concerns, including performance, immaturity and regulatory compliance. Cloud computing tools and infrastructure providers need, therefore, to develop improved security standards to allay the fears of current and prospective clients.

Key threats to cloud adoption by large enterprise-level organisations include, on the public cloud side, the prohibitive cost of current offerings and, on the private cloud side, the up-front investment that could be required to take the virtualisation stepping stone to the cloud. Cloud service providers will, according to Gartner, need to continue to drive down prices through investments in scale and innovation, whilst also improving service quality by improving their SLA uptime rates to reflect those of the customers they are serving.

4.4 Prospective patterns of cloud adoption

Public vs. private cloud adoption

Gartner notes that not all services will evolve to become cloud computing services. This is because some are business differentiators and destined to remain or become more tightly integrated with the business. For such services, efficiency is not the highest priority, rather functionality, customisation and the ability to change. However, other services that hold importance for business but that are standard across businesses are more likely to be outsourced as cloud, with private clouds providing a natural stepping stone while external cloud offerings mature. Such services are more commoditised rather than business differentiators and are most likely to be eventually destined for public cloud computing.

Because it will likely be some time before several public cloud services can meet enterprise requirements, the investment decision for enterprises considering private cloud adoption boils down to a choice between throwing away existing infrastructure investments and migrating quickly, doing nothing while they wait for public cloud services to evolve or evolving gradually. The path with the best prospective return on investment should win.

We note from analyst reports the view that private cloud investments are not just technology changes. They also constitute process, cultural and business interface changes. Private cloud providers

[26] See "Private Cloud Computing Plans from Conference Polls", Gartner, 30 April 2010

(including internal IT departments) can build a service catalogue and service interface with the business and, by moving to a chargeback model, can better understand service needs and costs. This will, in turn, help enterprises make better cloud-sourcing decisions and can provide easier transition to the public cloud. Enterprises are being encouraged to begin soon with the process, cultural and business relationship changes that will help prepare them for the evolution that private and public cloud computing will require.

Private cloud will not, however, make sense to businesses with small amounts of IT equipment. These will find the economies of scale, simplicity and low barriers to entry into public cloud computing compelling, especially where their IT requirements are commoditised (rather than business differentiators). SMEs are, as a result, taking the lead in adopting cloud computing for core revenue-generating and mission-critical systems. IDC predicts that as the value and security of cloud services is demonstrated in these environments and trust models are established, the use of cloud services will become a more viable consideration for more-complex enterprise environments.

Adoption by aggregated industry sector

Gartner notes that, while the financial services and manufacturing industry sectors are the largest early adopters of cloud computing, the communications and high-tech industries are also leveraging cloud in significant volumes, while the public sector is also displaying an interest in the potential of cloud computing. As such, Gartner predicts that the high-tech, the financial services and public sectors will be the most aggressive adopters of cloud services through 2014.

Gartner analysed revenues from leading human resources (HR) business process outsourcing providers, which suggested that over 30% of the HR BPO market is effectively delivered as a cloud service. Moreover, penetration was observed to be even higher among mature HR sub-processes such as payroll.[27]

More general predictions about the adoption of cloud computing

Gartner expressed the view that, at present, the adoption of cloud services remains unpredictable, but inevitable. By 2013, low-cost IT services are predicted to accelerate innovation and hinder the market growth, as well as depress the capitalisation of traditional vendors. By 2014, at least one cloud-based provider is predicted to crack the top-10 global IT service providers and, by 2015, business process outsourcing contracts will be responsible for managing 20% of global IT spend. [28] Furthermore, 50% of Global 1000 enterprises are predicted to become reliant on external cloud computing services for the top 10 revenue-generating processes.[29]

Gartner also predicts that many enterprises will expand on current virtualization strategies, creating internal private cloud infrastructures and/or platform services over the next three years, and that, as enterprises gain familiarity with cloud concepts and modify applications to run in the private cloud, they will become more comfortable with the use of external cloud-computing services.

Regarding the alternative service models, Gartner predicts that more widespread use of SaaS in companies of all sizes will legitimise the model and broaden adoption. PaaS is an increasingly high profile area but an early-stage market and nascent in commercial terms. While growth is predicted over the next 4 years, those predictions were caveat as highly speculative.

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[27] See "Forecast: Public Cloud Services, Worldwide and Regions, Industry Sectors, 2009-2014", Gartner, 2 June 2010.
[28] See " Predicts 2011: Technology, IT Industrialization and Cloud Computing Clash With Obsolete Traditions for IT Service Buyers and Vendors", Gartner, 16 November 2010.
[29] See "Predicts 2011: Cloud Computing Is Still at the Peak of Inflated Expectations", Gartner, 22 November 2010.

IDC recently surveyed 255 IT decision-makers to guage attitudes to private and public cloud computing. Respondents felt apprehensive about private cloud, with 43% ranking their likelihood of using private cloud below 5 out of 10 over the next three years, while 27% were on the fence about private cloud. The research also suggested that public cloud seems less likely to be broadly adopted than private, with 58% of IT directors ranking the possibility below 5 out of 10. IDC believes, as a result, that public clouds will be less enterprise focused than private clouds.[30]

4.5 Cloud adoption scenarios

Baseline assumptions

Table 11 above presents the current adoption rates assumed from the data relating to attitudes to cloud computing from IDC's 2010 European Services Survey. A similar table is presented below with what we have interpreted the expected rates of adoption in 5 years time. These are also unweighted averages across the aggregate industry sectors which make up our EMEA economies. The relatively high expected adoption rate for the UK is consistent with other IDC research suggesting that the UK, along with Japan, will be the biggest cloud computing adopters after the USA.

Note that, while there are differences between countries in terms of overall cloud adoption, there are also significant differences in terms of the breakdowns between private, hybrid and public cloud computing. However, a common trend is only very modest growth in the adoption of public cloud computing, but significant growth in private and hybrid cloud models.

Table 12: Prospective unweighted average adoption rates by country

Country	Prospective adoption rates (private, public and hybrid)
United Kingdom	56%
Germany	45%
France	48%
Italy	51%
Spain	51%

Source: IDC 2010 European Services Survey, Cebr analysis

However, as noted previously, we doubt that those respondents who indicated current cloud adoption are capturing the full benefits of their cloud deployments just yet. Nor do we believe that those respondents who indicated an intention to move to cloud computing over the next five years intend to immediately shift the entirety of their workloads (including business-critical) onto clouds. For that reason, we have undertaken a progressive scaling of the baseline adoption assumptions that we have derived from the IDC survey results.

This is operationalised by assuming that present-day cloud adopters have shifted 20% of their workloads into cloud in 2010, rising to 40% in 2011, 60% in 2012, 80% in 2013 and 100% by 2014. The result is a gradual journey towards achieving the full benefits that we have calculated as being available from cloud adoption by a business for the entirety of its operations.

[30] See "Worldwide Enterprise Server Cloud Computing 2010 – 2014 Forecast", IDC, April 2010

Scenario analysis

We have considered one upside and one downside cloud adoption scenario, in order to understand the potential impact on the total benefits of cloud computing arising from higher or lower levels of cloud adoption.

The upside scenario involves a 5% increase in adoption across all countries, industry sectors and cloud models. We consider such an upside scenario to be driven by one or more of the following potential developments:

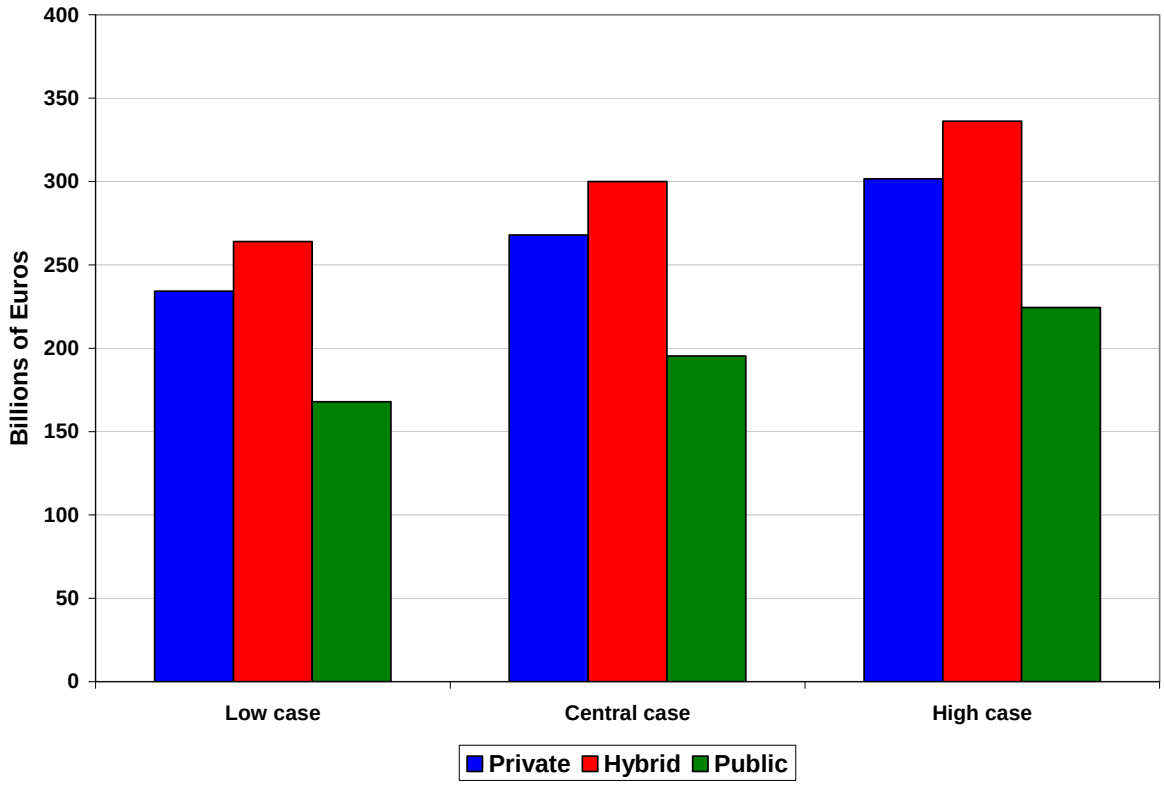
- greater realisation by or convincing of potential cloud adopters of the cost saving benefits of cloud computing, particularly if global-, EMEA- and / or national-level economic recoveries turn out to be slower and more challenging than expected;
- greater willingness on the part of potential cloud adopters to engage in hardware resource pooling and relinquish enterprise control of IT assets, which may or may not be accompanied by a reduced willingness to share the burden of the risk associated with up-front investments with cloud computing service providers;
- dramatic improvements in the perception of the service quality levels associated with cloud computing, as well as in the perception of the security and resilience of cloud computing systems;
- more uncertain and fluctuating macroeconomic recoveries, which further increases the challenges for business and increases their need to consider enhanced enterprise flexibility and agility, reduced IT management complexity and the potential to free up valuable strategic resources;
- a healthy investment climate for cloud computing that drives innovations to address cloud security issues.

The downside scenario involves a 5% decrease in adoption across all countries, industry sectors and cloud models. We consider such a downside scenario to be driven by one or more of the following potential developments:

- deteriorating perceptions about the security- and resilience-related aspects of cloud computing solutions arising from poor performance of trial runs;
- reduced or slower than expected adoption of virtualisation as the stepping stone to cloud computing;
- country-specific inhibitors such as a lack of adequate growth and development of national infrastructure;
- industry sector-specific inhibitors such as the new Basel requirements, which could threaten adoption in the banking, financial and business services sector;
- continued skills shortages in terms of the ability of enterprise IT staff to take on virtualisation or cloud computing adoption projects.

The results of the cloud adoption scenario testing on the projected cloud computing benefits are analysed for each country in the country reports. Figure 6 below shows the impact on aggregated cumulative benefits for the EMEA region under each cloud computing model. This shows that a 5% change, up or down, on our baseline adoption assumptions results in a corresponding 10% to 15% (slightly greater in some instances) increase or decrease in aggregate cloud computing benefits.

Figure 6: Impact on the economic benefits from alternative cloud models under baseline, upside and downside adoption scenarios



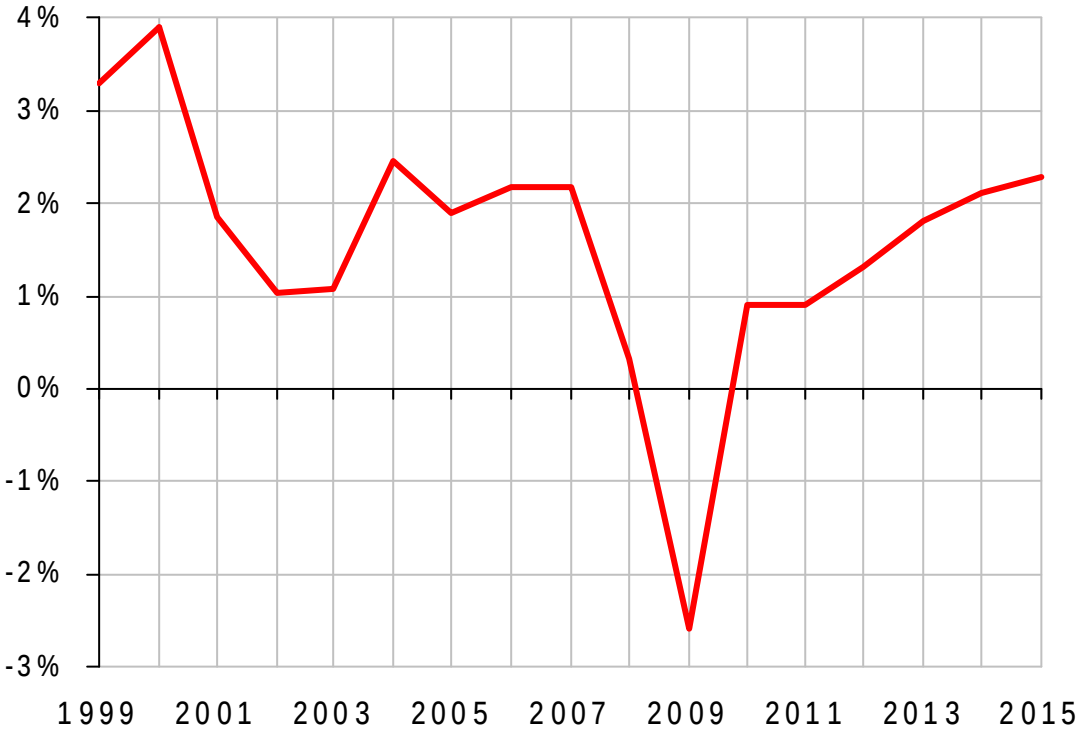
5 France

5.1 Macroeconomic context

French output rose by 0.6% in the second quarter of 2010 compared to the previous quarter, marking the fifth consecutive quarterly expansion. The rebound was fuelled by increased spending on services and a slower decline in spending on manufactured goods, especially cars. Consumer spending and the rebuilding of inventory stocks were key factors driving continued growth.

There is evidence of the return of business investment and job creation marking a certain restoration of confidence. The labour market has also shown signs of stabilisation, raising prospects for increases in consumer spending over the short term. France's economy, like many other European economies, is expected to be boosted by the recovery of its largest trading partner and European neighbour, Germany. Annual growth in France is expected to reach almost 1.0% this year, to remain steady through 2011 and to pick up subsequently.

Figure 7: Cebr forecast of real GDP growth in France 2010-2015



Source: Cebr global macroeconomic model

In the present uncertain economic climate, cloud computing is likely to be a critical macroeconomic factor that will be crucial for boosting France's economic growth. As a driver of enhanced productive performance, cloud computing can play an important part in ensuring that France's international trading position remains competitive, hence boosting export growth. Moreover, as one of the major means of maximising the bang for buck in modern IT investment, cloud computing could also be an important driver of a continued revival of business investment in France that would also, in turn, drive its economy forward.

5.2 Economic benefits of cloud computing

The cumulative economic benefits of cloud computing to the French economy over the period 2010-2015 are shown in Table 13 below.

Our baseline assumptions produce a predicted €162.8 billion of cumulative economic benefits over the 6-year horizon of our forecast. This is an estimated 1.50% of total French GDP over the same period.

Table 13

France: Cumulative Economic Benefits 2010-2015

	Private	Hybrid	Public	Total
	€ mil	€ mil	€ mil	€ mil
Business development opportunities	7,663	11,552	5,385	-24,599
Business creation	17,266	17,301	16,810	51,377
Net total cost savings *of which:*	12,706	12,651	967	26,323
– IT CapEx savings	*5,955*	*14,715*	*7,984*	*28,653*
– IT OpEx savings (FTE / productivity)	*3,729*	*6,425*	*3,664*	*13,818*
– IT OpEx savings (power & cooling)	*3,022*	*5,197*	*2,888*	*11,107*
– additional cloud services expenditure (PAYG) *	-	*-13,686*	*-13,569*	*-27,255*
Indirect GVA	18,505	23,129	18,816	-60,450
Total Economic Benefit	**56,140**	**64,632**	**41,978**	**162,749**
Direct and Indirect employment ('000s)	**146.3**	**162.6**	**160.6**	**469.4**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

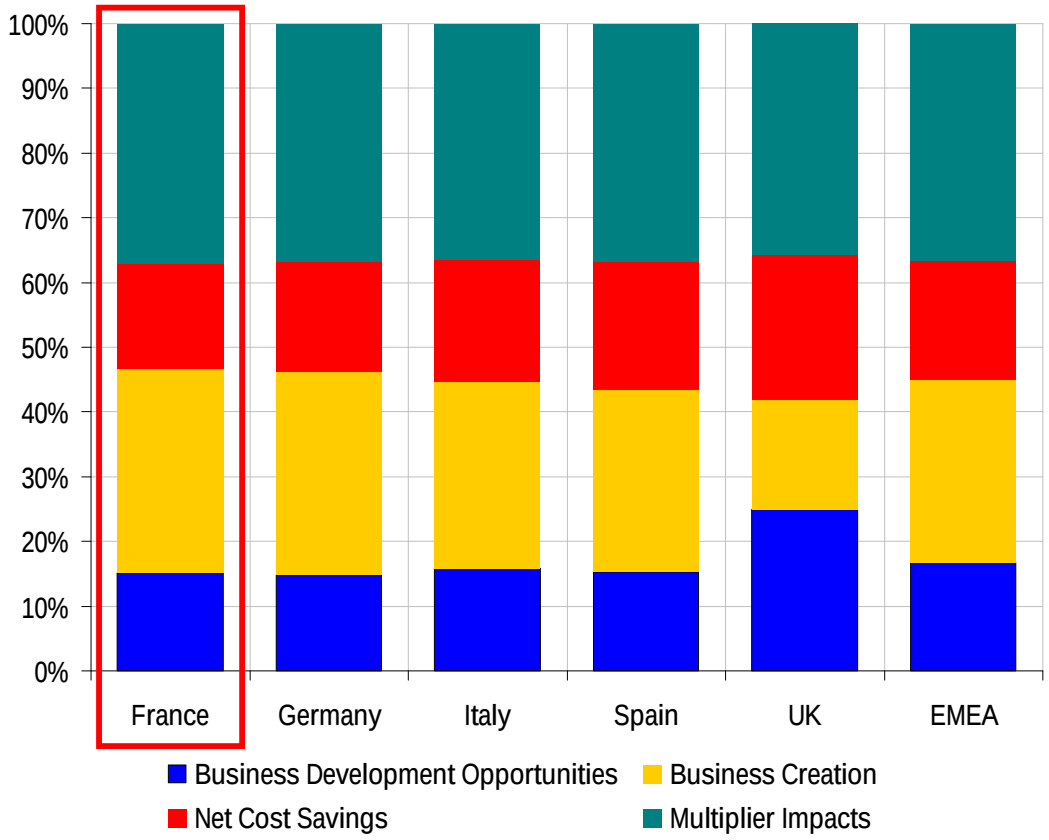
Hybrid cloud adoption is the main driver of France's cloud dividend, accounting for 40% of the total economic benefits. Private cloud adoption accounts for over 34%, while public cloud accounts for 26%.

France's share of the cumulative EMEA benefits is projected to be 21.3% which is smaller than France's 22.3% share of projected cumulative EMEA GDP over the period 2010-2015.

The key contributors to France's cloud dividend are illustrated in Figure 8 below. Net cost savings are a smaller contributor than in either of the other EMEA countries. Similarly, business creation benefits are a larger contributor than in any of the other EMEA countries, bar Germany perhaps.

Business development opportunities are in line with France's continental neighbours as a contributor to the overall cloud dividend but, in the same manner as these other countries, are a smaller contributor than in the UK. The share provided by multiplier impacts is consistent with the relatively important role of business creation.

Figure 8



France is predicted to capture 23.0% of its cumulative benefits in 2015. The annual economic benefit achieved by 2015 is shown in Table 14 below. This lies below the EMEA average of 23.2%, which reflects higher than average present day cloud adoption relative to future adoption.

Table 14

France: Economic Benefits in 2015

	Private	Hybrid	Public	Total
	€ mil	€ mil	€ mil	€ mil
Business development opportunities	2,208	3,203	1,876	-7,287
Business creation	3,019	3,028	2,942	8,989
Net total cost savings *of which:*	3,865	3,438	441	7,744
– IT CapEx savings	*1,818*	*4,153*	*3,007*	*8,978*
– IT OpEx savings (FTE / productivity)	*1,126*	*1,857*	*1,375*	*4,359*
– IT OpEx savings (power & cooling)	*920*	*1,484*	*1,109*	*3,513*
– additional cloud services expenditure (PAYG) *	-	*-4,056*	*-5,050*	*-9,106*
Indirect GVA	3,817	5,175	4,388	-13,380
Total Economic Benefit	**12,910**	**14,844**	**9,647**	**37,400**
Direct and Indirect employment ('000s)	**25.1**	**31.4**	**31.3**	**87.8**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

Note that, while private cloud accounts for over 34% of the cumulative benefits over 2010-2015, on an annual basis this has remained broadly the same by 2015. Similarly with public and hybrid cloud, which contributes, respectively, 25.8% and 39.7% to France's cumulative and annual 2015 cloud dividend.

5.3 Net total cost savings

The cumulative net cost savings arising from cloud adoption in France over the period 2010-2015 is predicted to be €26.3 billion, which is 16.2% of France's cumulative cloud dividend and 18.7% of aggregate cumulative net cost savings across the EMEA.

Hybrid cloud, where the highest cost savings are available, accounts for a broadly equal share of France's cumulative cost saving benefits as private cloud (48.3% and 48.1%, private being the former's share). However, by 2015, 49.9% of annual cost saving benefits is provided by private, while hybrid's share drops to 44.4%.

The prominence of the hybrid model in terms of the cost saving benefits of cloud computing is driven by high future adoption in all of France's four key industry sectors. The prominence of private cloud is driven by high future adoption in the sectors with the highest IT budgets but also by high current adoption in the less IT-intensive sectors.

Public cloud contributes only 3.7% of France's cumulative total net cost savings but, on an annual basis, contributes 5.7% by 2015. This reflects high future growth in only one sector, where that sector is also a relatively low IT spender. Future public cloud adoption is expected to remain relatively low in the sectors with the highest IT spend.

Table 15: Drivers of cost saving magnitudes for France's four key industry sectors

Industry sector	IT spend patterns	Sector ranking	Private adoption (lowest cost savings)	Hybrid adoption (highest cost savings)	Public adoption (mid-level cost savings)
Manufacturing	Mid IT budget Low CapEx / total IT budget	4	High now Mid future	Mid now High future	Low now High future
Distribution, retail & hotels	High IT budget High IT CapEx / total IT budget	3	Mid now High future	High now High future	Low now Mid future
Banking, financial & business services	High IT budget Low IT CapEx / total IT budget	1	Mid now High future	Mid now High future	Low now Mid future
Government, education & health	Mid IT budget Mid CapEx / total IT budget	2	High now Mid future	Mid now High future	Low now Mid future

Source: Cebr analysis

5.4 Business development benefits

The cumulative business development benefits arising from cloud adoption in France over the period 2010-2015 are predicted to be €24.6 billion, which is 15.1% of France's cumulative cloud dividend and 19.3% of aggregate cumulative business development benefits across the EMEA

The drivers of the business benefits are shown in Table 16 below.

Table 16: Drivers of business development benefits in France's four key industry sectors

Industry sector	Sector ranking	Seasonality benefits	Scalability benefits (small firms)	Scalability benefits (large firms)	Overall cloud adoption
Manufacturing	4	High	Mid	None	High now High future
Distribution, retail & hotels	3	Low	High	Low	Mid now High future
Banking, financial & business services	1	Mid	High	Low	Mid now High future
Government, education & health	2	Low	Mid	None	Mid now Mid future

Source: Cebr analysis

The table shows how the principal drivers of the business development benefits are:

- High present-day and future overall cloud adoption in France's fourth largest industry sector, which has high seasonality benefits.
- High future overall cloud adoption in France's third-largest industry sector, which has high scalability benefits.
- High future adoption in France's largest sector, which has high scalability benefits and mid-level seasonality benefits.

5.5 Business creation benefits

The cumulative business creation benefits arising from cloud adoption in France over the period 2010-2015 is predicted to be €51.4 billion. This is 31.6% of France's cumulative cloud dividend and 23.9% of aggregate cumulative business creation benefits across the EMEA

These predictions are driven by two things:

- The amount new SMEs that enter the various industry sector markets, which is assumed to equate to Etro's result for France of 48,000 new SMEs over the medium term, of which the vast bulk are created in wholesale, retail, real estate, renting and business activities. Etro's result for France is driven by a relatively high level of diffusion of SMEs and / or by ICT uptake being generally rapid.
- The average level of new GVA per SME, which is driven by the productivity of existing SMEs and the cost savings and business development impacts described in the previous subsections. France has the second highest level of GVA per SME amongst the five EMEA countries.

5.6 Multiplier benefits

The cumulative multiplier benefits arising from cloud adoption in France over the period 2010-2015 are predicted to be €60.5 billion. This is 37.1% of France's cumulative cloud dividend and 21.6% of aggregate cumulative multiplier benefits across the EMEA countries.

Multiplier benefits are directly proportional to the levels of total net cost saving, business development and business creation benefits achieved through cloud computing. The only other distinguishing assumption between countries was the consumption to savings ratio, used to estimate the amount of additional employee / shareholder spend can be reasonably assumed to be spent in the wider economy in order generate induced multiplier impacts.

5.7 Employment effects

The adoption of cloud computing in France could be expected to generate 469 thousand jobs, which constitutes 19.6% of the total EMEA employment impact. This is smaller than France's predicted share of aggregate EMEA GDP. This poor relative performance may be driven by especially high labour costs and comparatively inflexible labour markets.

These jobs can, at least in the short run, be considered as a net impact. The extent to which they would constitute a net long run impact depends on the extent to which cloud computing can reduce the types of distortion that prevent the economy reaching its full productive capacity. Such distortions include things like imperfect competition, significant economies of scale, imperfect and incomplete information etc.

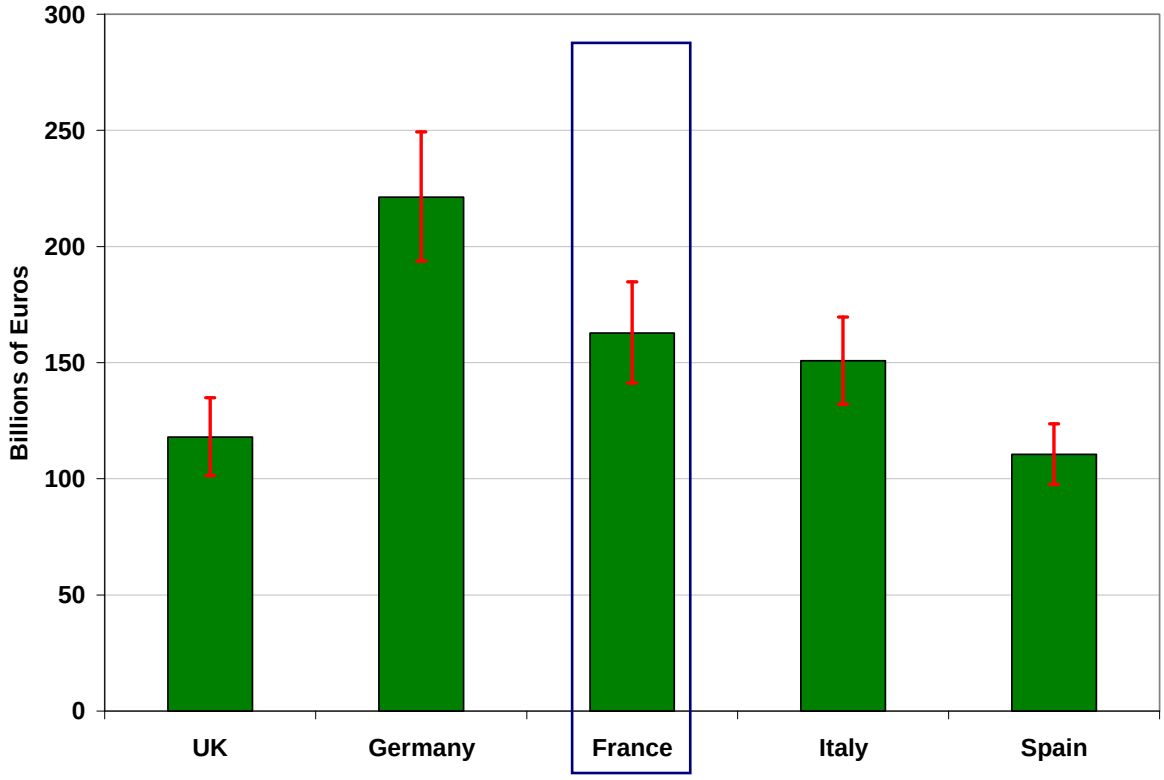
However, if the structural features of the economy lead employment back to its (pre-cloud) equilibrium level, then any temporary boost in the workforce will vanish over time.

5.8 Cloud adoption scenario-testing

Figure 9 below highlights the result of our adoption rate scenario-testing. By reducing our assumed adoption rates by 5% across the board, the downside scenario has the effect of reducing the aggregate cumulative benefits in France by 15.3% relative to the baseline results.

The upside scenario, in which we tested the effect of increasing our assumed adoption rates by 5% across the board produced a 11.9% increase in the aggregate cumulative benefits relative to the baseline results.

Figure 9: Adoption scenario-testing



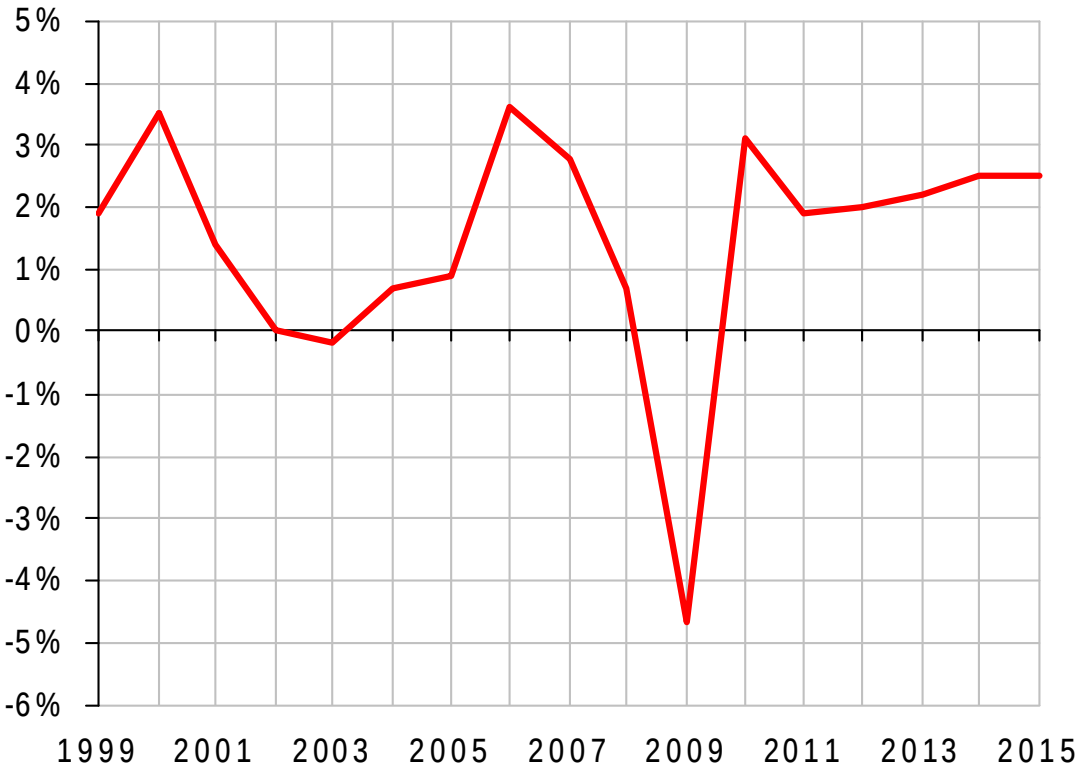
6 Germany

6.1 Macroeconomic context

German economic growth was significantly higher than expected in the second quarter of 2010, growing at 2.2% on the previous quarter. This was the highest quarterly growth rate since German reunification. The sovereign debt crisis in Southern Europe may well have contributed to this strong performance by keeping down the value of the euro and thus boosting German export competitiveness in emerging markets.

However, the German recovery is still relatively fragile, which was reflected in recent consumer and business confidence surveys. The ZEW business confidence index fell significantly to 14.0 in August, down from 21.2 in July and the lowest reported figure since April 2009. However, the continued weak value of the euro over the next few years should place Germany in a good position for a robust export-led recovery, especially if it continues to rebalance its export markets towards the East.

Figure 10: Cebr forecast of real GDP growth in Germany, 2010-2015



While there remains some fragility in the German economy's recovery, the outlook for the largest EMEA economy can safely be said to be most positive out of the five EMEA economies. Nonetheless, in the present uncertain economic climate, cloud computing can still be a critical macroeconomic factor that will be crucial for boosting Germany's economic growth. As a driver of enhanced productive performance, cloud computing can play an important part in helping to ensure that Germany's strong international trading position remains that way. Cloud computing could also be an important driver of business investment in Germany that would also, in turn, drive its economy forward.

6.2 Economic benefits of cloud computing

The cumulative economic benefits of cloud computing to the German economy over the period 2010-2015 are shown in Table 17 below.

Our baseline assumptions produce a predicted €221.2 billion of cumulative economic benefits over the 6-year horizon of our forecast. This is an estimated 1.59% of total German GDP over the same period.

Table 17

Germany: Cumulative Economic Benefits 2010-2015

	Private	Hybrid	Public	Total
	€ mil	€ mil	€ mil	€ mil
Business development opportunities	12,240	14,913	5,488	32,642
Business creation	23,262	23,297	22,947	69,507
Net total cost savings *of which:*	20,480	15,951	1,308	37,740
– IT CapEx savings	*9,436*	*18,692*	*8,249*	*36,378*
– IT OpEx savings (FTE / productivity)	*6,195*	*8,197*	*3,747*	*18,139*
– IT OpEx savings (power & cooling)	*4,849*	*6,488*	*3,007*	*14,345*
– additional cloud services expenditure (PAYG) *	-	*- 17,427*	*- 13,695*	*- 31,122*
Indirect GVA	26,772	30,788	23,791	81,351
Total Economic Benefit	**82,755**	**84,949**	**53,535**	**221,239**
Direct and Indirect employment ('000s)	**256.4**	**277.8**	**255.2**	**789.4**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

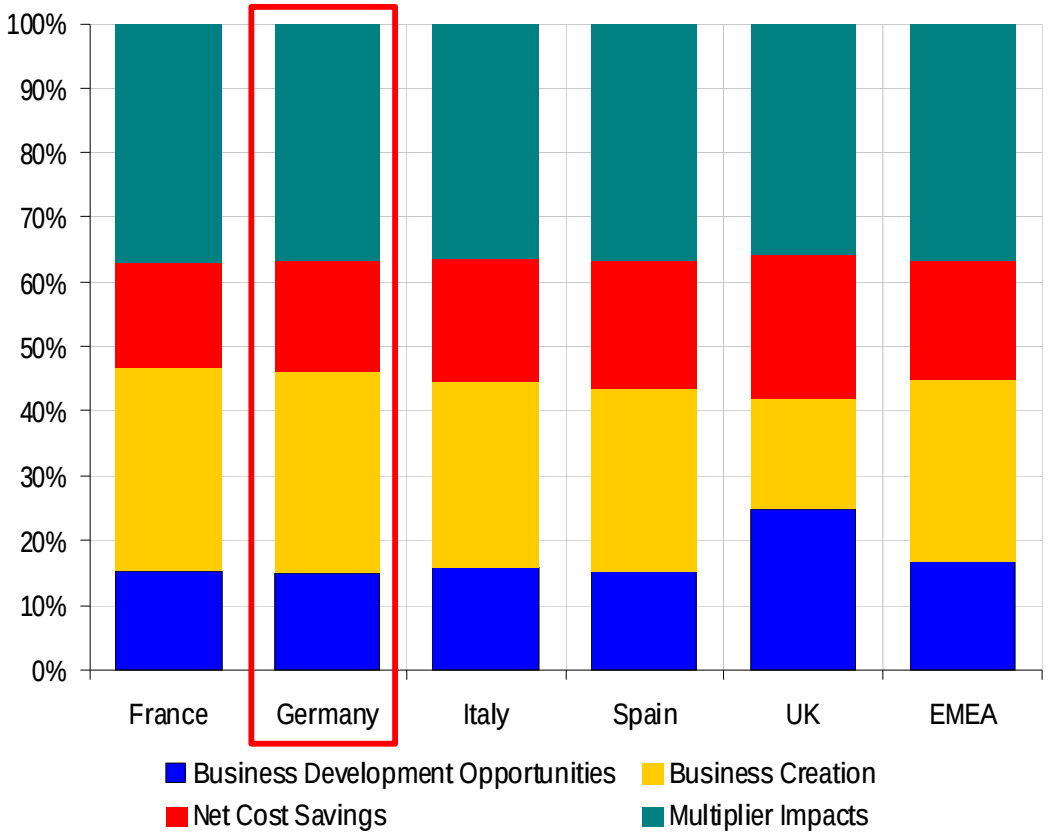
Hybrid cloud adoption is the main driver of Germany's cloud dividend, accounting for 38.4% of the total economic benefits. Private cloud adoption accounts for over 37.4%, while public cloud accounts for 24.2%.

Germany's share of the cumulative EMEA benefits is projected to be 29.0% which is larger than Germany's 28.5% share of our projected cumulative EMEA GDP over the period 2010-2015.

The key contributors to Germany's cloud dividend are illustrated in Figure 11 below. Net cost savings are a larger contributor than in France but a smaller contributor than in either of the other EMEA countries. Business creation benefits are a larger contributor than in any of the other EMEA countries, bar France.

Business development opportunities are in line with Germany's continental neighbours as a contributor to the overall cloud dividend but, in the same manner as these other countries, are a smaller contributor than in the UK. Multiplier impacts are consistent with the relatively important role of business creation.

Figure 11



Germany is predicted to capture 22.4% of its cumulative benefits in 2015. The annual economic benefit achieved by 2015 is shown in Table 18 below. This lies below the EMEA average of 23.2%, which reflects higher than average present day cloud adoption relative to future adoption.

Table 18

Germany: Economic Benefits in 2015

	Private	Hybrid	Public	Total
	€ mil	€ mil	€ mil	€ mil
Business development opportunities	3,376	4,009	1,395	8,780
Business creation	4,072	4,080	4,015	12,166
Net total cost savings *of which:*	6,319	4,247	873	11,439
– IT CapEx savings	*2,919*	*5,169*	*2,673*	*10,761*
– IT OpEx savings (FTE / productivity)	*1,903*	*2,314*	*1,156*	*5,374*
– IT OpEx savings (power & cooling)	*1,497*	*1,813*	*956*	*4,267*
– additional cloud services expenditure (PAYG) *	-	- *5,050*	- *3,912*	- *8,962*
Indirect GVA	5,706	6,702	4,830	17,238
Total Economic Benefit	**19,473**	**19,038**	**11,112**	**49,624**
Direct and Indirect employment ('000s)	**46.3**	**51.4**	**44.7**	**142.4**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

Note that, while private cloud accounts for over 37.4% of the cumulative benefits over 2010-2015, on an annual basis this increases to 39.2% by 2015. Public cloud contributes 22.4% of the annual benefits in 2015, which is lower than its 24.2% contribution to the cumulative total. While hybrid cloud accounts for 38.4% of the cumulative benefits, the share of the annual benefits in 2015 is the same.

6.3 Net total cost savings

The cumulative net cost savings arising from cloud adoption in Germany over the period 2010-2015 is predicted to be €37.7 billion, which is 17.1% of Germany's cumulative cloud dividend and 26.8% of aggregate cumulative net cost savings across the EMEA.

Private cloud accounts for the majority of Germany's cumulative cost saving benefits. By 2015, private cloud will result in 55.2% of annual cost saving benefits and 54.3% share of Germany's cumulative cost saving benefits over the period 2010-2015. This is driven by high future adoption in all four of Germany's key industry sectors and high current adoption in the first and third most significant. The most significant sector, which has high current and future adoption, also records higher IT budgets.

Hybrid cloud accounts for 42.3% of the cumulative cost saving element of Germany's cloud dividend, but this share falls to 37.1% on an annual basis by 2015. This reflects high future adoption in all four key sectors but only high present-day adoption in two of them, but low current adoption in Germany's largest industry sector.

Public cloud contributes only 3.5% of Germany's cumulative total net cost savings but, on an annual basis, contributes 7.6% by 2015. This reflects, predominantly low to mid present-day adoption across the most important industry sectors, with future adoption on reaching mid-level in Germany's third and fourth largest sectors.

Table 19: Drivers of cost saving magnitudes for Germany's four key industry sectors

Industry sector	IT spend patterns	Sector ranking	Private adoption (lowest cost savings)	Hybrid adoption (highest cost savings)	Public adoption (mid-level cost savings)
Manufacturing	Mid IT budget Low CapEx / total IT budget	2	Mid now High future	High now High future	Mid now Low future
Distribution, retail & hotels	High IT budget High IT CapEx / total IT budget	4	Mid now High future	High now High future	Low now Mid future
Banking, financial & business services	High IT budget Low IT CapEx / total IT budget	1	High now High future	Low now High future	Mid now Low future
Government, education & health	Mid IT budget Mid CapEx / total IT budget	3	High now Mid future	Mid now High future	Low now Mid future

Source: Cebr analysis

6.4 Business development benefits

The cumulative business development benefits arising from cloud adoption in Germany over the period 2010-2015 are predicted to be €32.6 billion, which is 14.8% of Germany's cumulative cloud dividend and 25.6% of aggregate cumulative business development benefits across the EMEA

The drivers of the business benefits are shown in Table 20 below.

Table 20: Drivers of business development benefits in Germany's four key industry sectors

Industry sector	Sector ranking	Seasonality benefits	Scalability benefits (small firms)	Scalability benefits (large firms)	Overall cloud adoption
Manufacturing	2	High	Mid	None	High now High future
Distribution, retail & hotels	4	Low	High	Low	Mid now High future
Banking, financial & business services	1	Mid	High	Low	High now High future
Government, education & health	3	Low	Mid	None	Mid now Mid future

Source: Cebr analysis

The table shows how the principal drivers of Germany's business development benefits are:

- High present-day and future overall cloud adoption in Germany's first and second largest industry sectors which have, respectively, mid and high seasonality benefits.
- High future adoption in Germany's first and fourth largest sectors, which each has high scalability benefits.

6.5 Business creation benefits

The cumulative business creation benefits arising from cloud adoption in Germany over the period 2010-2015 is predicted to be €69.5 billion. This is 31.4% of Germany's cumulative cloud dividend and 32.3% of aggregate cumulative business creation benefits across the EMEA.

These predictions are driven by two things:

- The amount new SMEs that enter the various industry sector markets, which is assumed to equate to Etro's result for Germany of 39,000 new firms over the medium term, of which the vast bulk are created in wholesale, retail, real estate, renting and business activities. Etro's result for Germany is driven by a relatively high level of diffusion of SMEs and / or by ICT uptake being generally rapid.
- The average level of new GVA per SME, which is driven by the productivity of existing SMEs and the cost savings and business development impacts described in the previous subsections. Germany has the highest GVA per SME amongst the five EMEA countries, which drives very significant business creation benefits relative to the number of firms created.

6.6 Multiplier benefits

The cumulative multiplier benefits arising from cloud adoption in Germany over the period 2010-2015 are predicted to be €81.4 billion. This is 36.8% of Germany's cumulative cloud dividend and 29.1% of aggregate cumulative multiplier benefits across the EMEA countries.

Multiplier benefits are directly proportional to the levels of total net cost saving, business development and business creation benefits achieved through cloud computing. The only other distinguishing assumptions between countries was the consumption to savings ratio, used to estimate the amount of additional employee / shareholder spend can be reasonably assumed to be spent in the wider economy in order generate induced multiplier impacts.

6.7 Employment effects

The adoption of cloud computing in Germany could be expected to create 789 thousand jobs, which constitutes 32.9% of the total EMEA employment impact. This is larger than Germany's share of Cebr's prediction of aggregate EMEA GDP. This good relative performance is driven by Germany's very productive workforce.

These jobs can, at least in the short run, be considered as a net impact. The extent to which they would constitute a net long run impact depends on the extent to which cloud computing can reduce the types of distortion that prevent the economy reaching its full productive capacity. Such distortions include things like imperfect competition, significant economies of scale, imperfect and incomplete information etc.

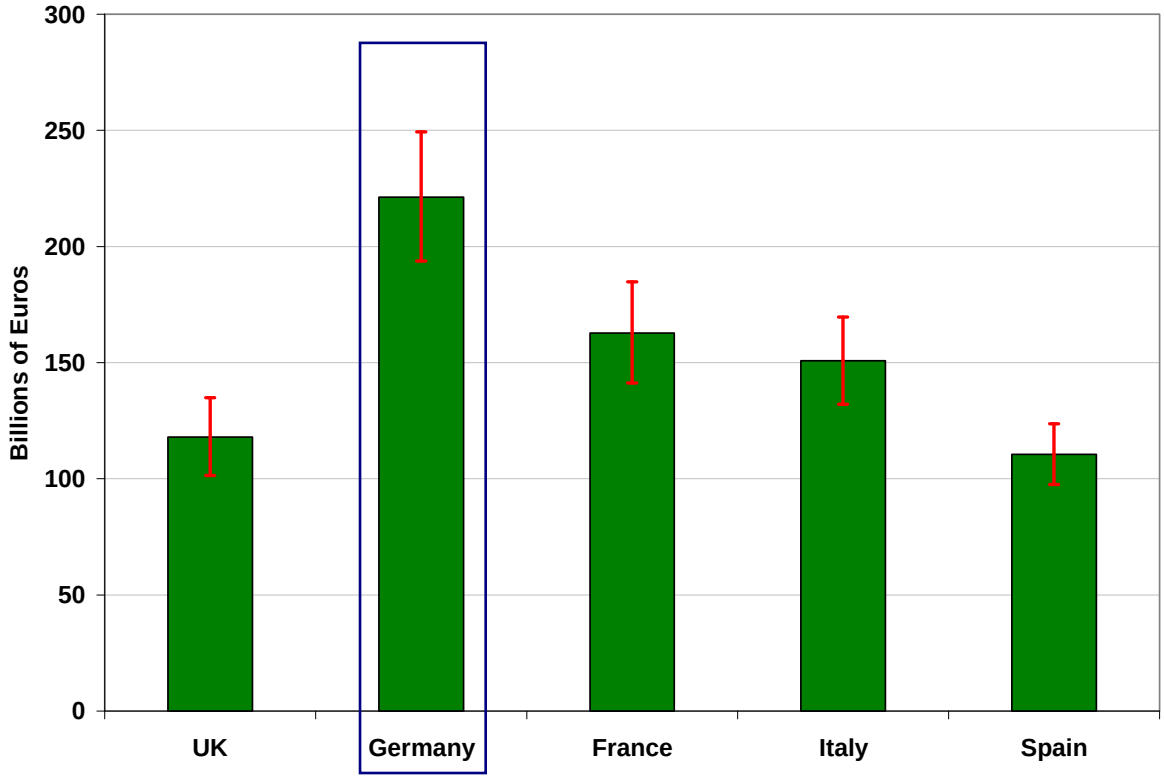
However, if the structural features of the economy lead employment back to its (pre-cloud) equilibrium level, then any temporary boost in the workforce will vanish over time.

6.8 Cloud adoption scenario-testing

Figure 12 below highlights the result of our adoption rate scenario-testing. By reducing our assumed adoption rates by 5% across the board, the downside scenario has the effect of reducing the aggregate cumulative benefits in Germany by 14.2% relative to the baseline results.

The upside scenario, in which we tested the effect of increasing our assumed adoption rates by 5% across the board produced a 11.3% increase in the aggregate cumulative benefits relative to the baseline results.

Figure 12: Adoption scenario-testing



7 Italy

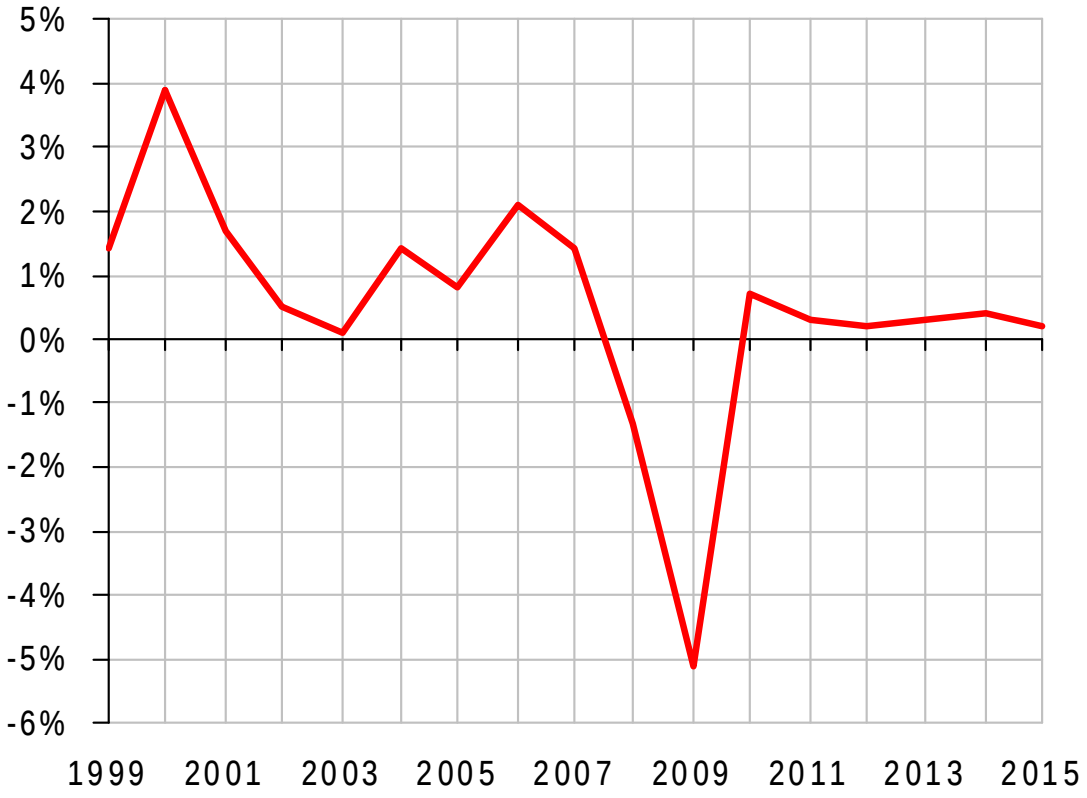
7.1 Macroeconomic context

The Italian economy grew in the first half of 2010, with two successive quarters of 0.4% quarter-on-quarter growth. Weak productivity growth continues to be an issue for Italy, which has not helped its international trade balance. Italy has consistently lost ground on export share with net trade making negative contributions to growth in each of the last seven years.

Government debt is expected to reach 118% of GDP in 2010, making it all the more important for the Italians to undertake a major program of fiscal consolidation through 2012 and 2013 in particular. Growth in domestic demand will remain weaker than pre-recession with impending deep public sector cuts. Furthermore, given the country's productivity gap and little signs of an internal devaluation, we see little to suggest that Italy can jump on the back of an export-led recovery.

We expect, therefore, growth in 2010 to remain well below 1.0%, to fall in 2011 and to remain steady at this lower level through to 2015.

Figure 13: Cebr forecast of real GDP growth in Italy, 2010-2015



In the present uncertain economic climate, cloud computing is likely to be a critical macroeconomic factor that will be crucial for boosting Italy's economic growth, especially given the relatively poor outlook for future growth. Cloud computing could be an important step for Italy in bridging its long-standing productivity gap, which would help to boost its export markets and economic growth.

Cloud computing could also be an important driver of business investment in Italy, which would also help drive its economy forward.

7.2 Economic benefits of cloud computing

The cumulative economic benefits of cloud computing to the Italian economy over the period 2010-2015 are shown in Table 21 below.

Our baseline assumptions produce a predicted €150.8 billion of cumulative economic benefits over the 6-year horizon of our forecast. This is an estimated 1.76% of total Italian GDP over the same period.

Table 21

Italy: Cumulative Economic Benefits 2010-2015

	Private	Hybrid	Public	Total
	€ mil	€ mil	€ mil	€ mil
Business development opportunities	8,092	8,977	6,925	23,995
Business creation	14,564	14,573	14,167	43,305
Net total cost savings *of which:*	15,478	9,302	3,682	28,463
– IT CapEx savings	*7,377*	*11,165*	*11,919*	*30,461*
– IT OpEx savings (FTE / productivity)	*4,431*	*4,931*	*5,171*	*14,533*
– IT OpEx savings (power & cooling)	*3,670*	*3,878*	*4,274*	*11,821*
– additional cloud services expenditure (PAYG) *	-	*- 10,671*	*- 17,681*	*- 28,353*
Indirect GVA	17,226	18,948	18,834	55,007
Total Economic Benefit	**55,361**	**51,800**	**43,609**	**150,770**
Direct and Indirect employment ('000s)	**142.1**	**151.2**	**162.6**	**455.8**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

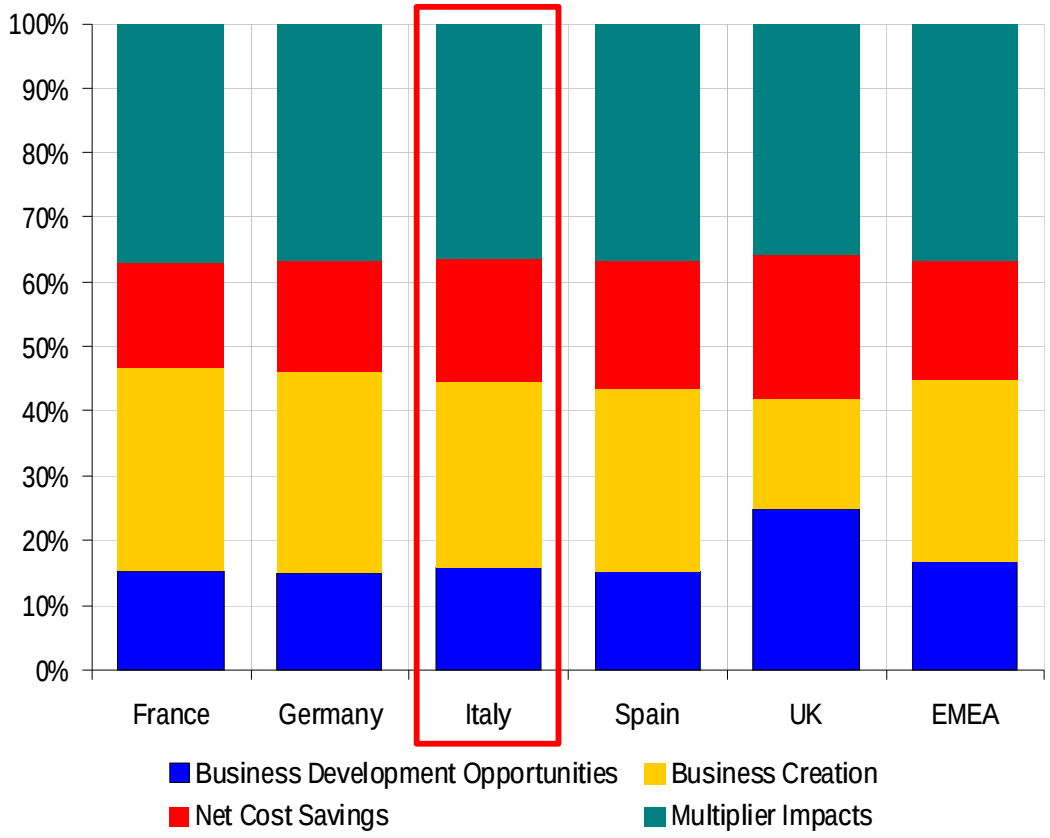
The main driver of Italy's cloud dividend appears to be private cloud adoption, which accounts for 36.7%. Hybrid cloud adoption accounts for over 34.4%, while public cloud accounts for 28.9%.

Italy's share of the cumulative EMEA benefits is projected to be 19.8% which is larger than Italy's 17.6% share of our projected cumulative EMEA GDP for the period 2010-2015.

The key contributors to Italy's cloud dividend are illustrated in Figure 14 below. Net cost savings are a larger contributor than in either France or Germany, but are a smaller contributor than in Spain or the UK. Similarly, business creation benefits are a smaller contributor than in France or Germany but are more substantial as a share of total benefits than in either Spain or UK.

Business development opportunities are in line with Italy's continental neighbours but, in the same manner as these other countries, are a smaller contributor than in the UK. Multiplier impacts are in line with all other countries and with the magnitudes of the business creation benefits.

Figure 14



Italy is predicted to capture 23.3% of its cumulative benefits in 2015. The annual economic benefit achieved by 2015 is shown in Table 22 below. This lies just above the EMEA average of 23.2%, which reflects slightly lower than average present day cloud adoption relative to future adoption.

Table 22

Italy: Cumulative Economic Benefits 2010-2015

	Private	Hybrid	Public	Total
	€ mil	€ mil	€ mil	€ mil
Business development opportunities	8,092	8,977	6,925	23,995
Business creation	14,564	14,573	14,167	43,305
Net total cost savings *of which:*	15,478	9,302	3,682	28,463
– IT CapEx savings	*7,377*	*11,165*	*11,919*	*30,461*
– IT OpEx savings (FTE / productivity)	*4,431*	*4,931*	*5,171*	*14,533*
– IT OpEx savings (power & cooling)	*3,670*	*3,878*	*4,274*	*11,821*
– additional cloud services expenditure (PAYG) *	-	*10,671* -	*17,681* -	*28,353* -
Indirect GVA	17,226	18,948	18,834	55,007 -
Total Economic Benefit	**55,361**	**51,800**	**43,609**	**150,770**
Direct and Indirect employment ('000s)	**142.1**	**151.2**	**162.6**	**455.8**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

While private cloud accounts for over 36.7% of the cumulative benefits over 2010-2015, on an annual basis this rises to 38.6% by 2015. Public cloud contributes 27.2% in of the annual benefits in 2015, which compares with its 28.9% share of the cumulative total. Hybrid cloud accounts for 34.4% of the cumulative benefits, which drops to 34.2% of the annual benefits by 2015.

7.3 Net total cost savings

The cumulative net cost savings arising from cloud adoption in Italy over the period 2010-2015 is predicted to be €28.5 billion, which is 18.9% of Italy's cumulative cloud dividend and 20.2% of aggregate cumulative net cost savings across the EMEA.

Private cloud accounts for the highest proportion of Italy's cost saving benefits. By 2015, 54.4% of the cost savings element of Italy's cloud dividend is due to private cloud, a share which rises to 56.2% on an annual basis by 2015. This reflects high future adoption in all four of Italy's key sectors and mid to high levels of present-day adoption in three of them. Strong adoption in the high IT-spend sectors helps to drive the benefits deriving from private cloud.

Hybrid cloud, where the highest cost savings are available, accounts for 32.7% of Italy's cost saving benefits. By 2015, this will drop to 31.7% of the annual cost saving benefits. This is driven by high present-day and future adoption in Italy's two largest sectors, but only mid-level adoption in the other two. One of these sectors records higher IT budgets (as percentages of total revenues).

Public cloud contributes only 12.9% of Italy's cumulative total net cost savings and, on an annual basis, contributes 12.0% by 2015. While this reflects high present-day and future adoption in two of Italy's key sectors, these 'high' rates are not as high as for private and hybrid cloud. Moreover, the sectors in which high public cloud adoption is predicted are only moderate IT spenders, with low to mid IT CapEx to total IT budget ratio.

Table 23: Drivers of cost saving magnitudes for Italy's four key industry sectors

Industry sector	IT spend patterns	Sector ranking	Private adoption (lowest cost savings)	Hybrid adoption (highest cost savings)	Public adoption (mid-level cost savings)
Manufacturing	Mid IT budget Low CapEx / total IT budget	3	High now High future	Low now Mid future	High now High future
Distribution, retail & hotels	High IT budget High IT CapEx / total IT budget	4	Mid now High future	Mid now Mid future	Mid now Mid future
Banking, financial & business services	High IT budget Low IT CapEx / total IT budget	1	Low now High future	High now High future	Low now Low future
Government, education & health	Mid IT budget Mid CapEx / total IT budget	2	Mid now High future	High now High future	High now High future

Source: Cebr analysis

7.4 Business development benefits

The cumulative business development benefits arising from cloud adoption in Italy over the period 2010-2015 are predicted to be €24.0 billion, which is 15.9% of Italy's cumulative cloud dividend and 18.8% of aggregate cumulative business development benefits across the EMEA.

The drivers of the business benefits are shown in Table 24 below.

Table 24: Drivers of business development benefits in Italy's four key industry sectors

Industry sector	Sector ranking	Seasonality benefits	Scalability benefits (small firms)	Scalability benefits (large firms)	Overall cloud adoption
Manufacturing	4	High	Mid	None	High now V. high future
Distribution, retail & hotels	3	Low	High	Low	High now V. high future
Banking, financial & business services	1	Mid	High	Low	Mid now High future
Government, education & health	2	Low	Mid	None	High now High future

Source: Cebr analysis

The table shows how the principal drivers of the business development benefits are:

- High present-day and very high future overall cloud adoption in Italy's third and fourth largest industry sector, which have, respectively, high seasonality and high scalability benefits.
- High future overall cloud adoption in Italy's most significant industry sector, which has high scalability benefits.
- High present-day and future adoption in Italy's second largest sector, mid-level scalability benefits are available.

7.5 Business creation benefits

The cumulative business creation benefits arising from cloud adoption in Italy over the period 2010-2015 is predicted to be €43.3 billion. This is 28.7% of Italy's cumulative cloud dividend and 20.1% of aggregate cumulative business creation benefits across the EMEA

These predictions are driven by two things:

- The amount of new SMEs that enter the various industry sector markets, which is assumed to equate to Etro's result for Italy of 81,000 new firms over the medium term, of which the vast bulk are created in wholesale, retail, real estate, renting and business activities. Etro's result for Italy is driven by a very high level of diffusion of SMEs and / or by ICT uptake being generally rapid.

- The average level of new GVA per SME, which is driven by the productivity of existing SMEs and the cost savings and business development impacts described in the previous subsections. Italy has the lowest GVA per SME amongst the five EMEA countries.

7.6 Multiplier benefits

The cumulative multiplier benefits arising from cloud adoption in Italy over the period 2010-2015 are predicted to be €55.0 billion. This is 36.5% of Italy's cumulative cloud dividend and 19.7% of aggregate cumulative multiplier benefits across the EMEA countries.

Multiplier benefits are directly proportional to the levels of total net cost saving, business development and business creation benefits achieved through cloud computing. The only other distinguishing assumptions between countries was the consumption to savings ratio, used to estimate the amount of additional employee / shareholder spend can be reasonably assumed to be spent in the wider economy in order generate induced multiplier impacts.

7.7 Employment effects

The adoption of cloud computing in Italy could be expected to generate 456 thousand jobs, which constitutes 19.0% of the total EMEA employment impact. This is greater than Italy's 17.6% share of predicted EMEA GDP and is driven by particularly high levels of business creation predicted by Etro (2009)

These jobs can, at least in the short run, be considered as a net impact. The extent to which they would constitute a net long run impact depends on the extent to which cloud computing can reduce the types of distortion that prevent the economy reaching its full productive capacity. Such distortions include things like imperfect competition, significant economies of scale, imperfect and incomplete information etc.

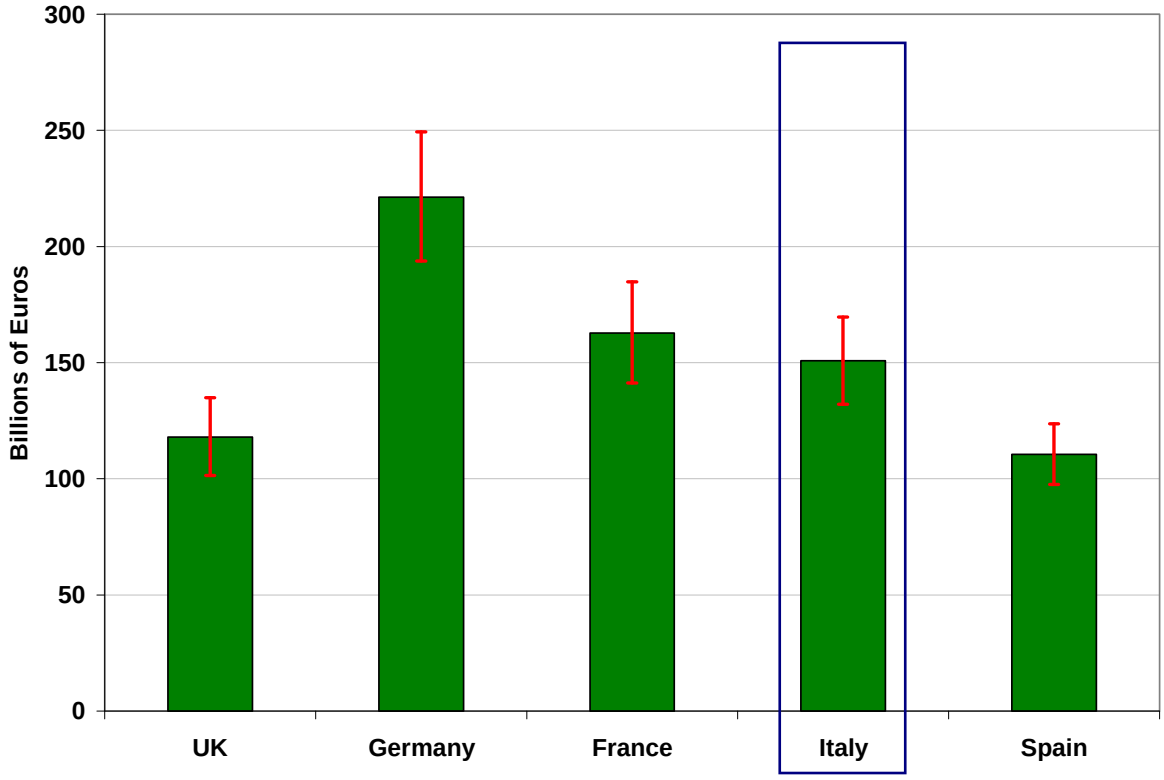
However, if the structural features of the economy lead employment back to its (pre-cloud) equilibrium level, then any temporary boost in the workforce will vanish over time.

7.8 Cloud adoption scenario-testing

Figure 15 below highlights the result of our adoption rate scenario-testing. By reducing our assumed adoption rates by 5% across the board, the downside scenario has the effect of reducing the aggregate cumulative benefits in Italy by 14.1% relative to the baseline results.

The upside scenario, in which we tested the effect of increasing our assumed adoption rates by 5% across the board produced a 11.1% increase in the aggregate cumulative benefits relative to the baseline results.

Figure 15: Adoption scenario-testing



8 Spain

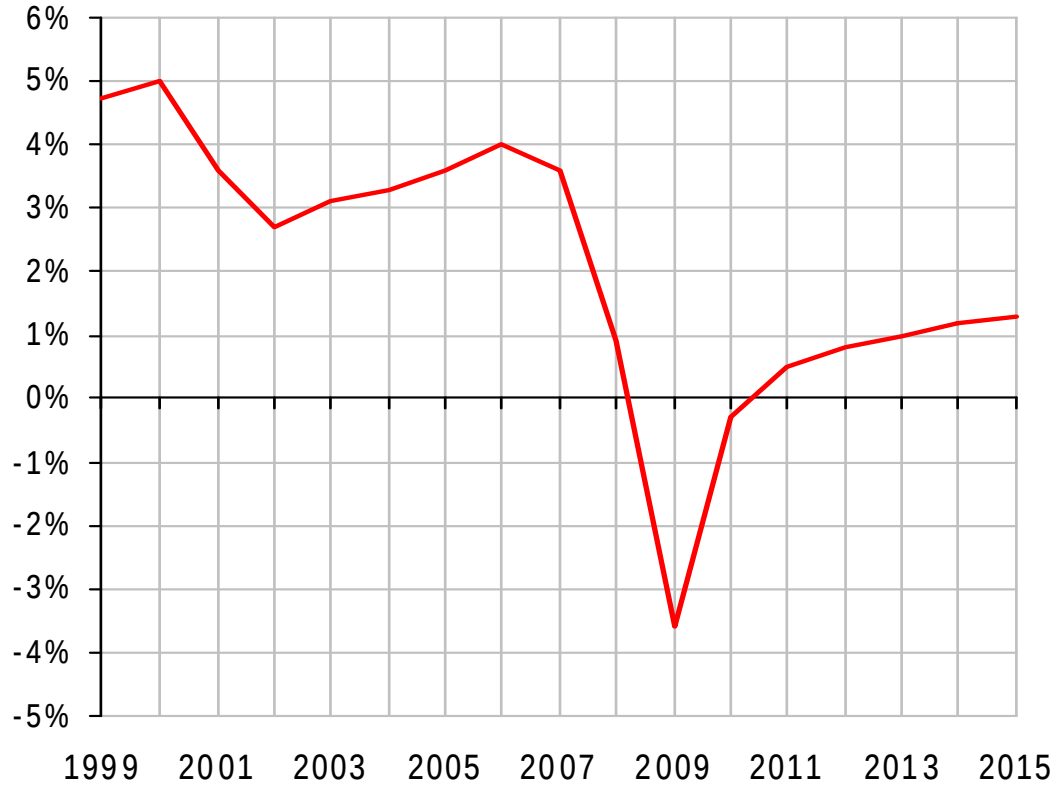
8.1 Macroeconomic context

Spain has taken measures to bring about structural reforms, but the outlook remains tough. The Spanish economy emerged late from recession relative to other large European economies, growing by 0.1% in the first quarter of 2010 on a quarter-on-quarter basis. Further modest growth was observed in the second quarter of 0.2%.

While there is renewed optimism about the stability of Spain's economy with the Government's fiscal austerity package and improvements is labour market flexibility, the prospects for domestic demand remain weak in the short term due to excess capacity in the labour market, with unemployment currently running at 20%. This is exacerbated by a significant property overhang and severe government spending cutbacks.

If there is to be growth over the next five years, it will need to be through an export-led recovery. While internal devaluation will help to increase competitiveness, there are real risks of a double-dip recession for Spain due to the required severity of Government spending cutbacks and the effect that these and the internal devaluation will have on domestic demand. The Spanish economy will, otherwise, be heavily reliant on the state of the global recovery.

Figure 16: Cebr forecast of real GDP growth in Spain, 2010-2015



Source: Cebr macroeconomic forecast

Cloud computing is likely to be a critical macroeconomic factor that will be crucial for boosting Spain's beleaguered economy growth. The indirect business and job creation benefits of cloud

computing could be a very important step in trying to bring down the country's chronic unemployment rate, but also in bridging its productivity gap, which is not as severe as Italy's but is as yet not insignificant. Cloud computing could also be an important driver of business investment in Spain, which would also help drive its economy forward.

8.2 Economic benefits of cloud computing

The cumulative economic benefits of cloud computing to the Spanish economy over the period 2010-2015 are shown in Table 25 below.

Our baseline assumptions produce a predicted €110.6 billion of cumulative economic benefits over the 6-year horizon of our forecast. This is an estimated 1.84% of total Spanish GDP over the same period.

Table 25

Spain: Cumulative Economic Benefits 2010-2015

	Private	Hybrid	Public	Total
	€ mil	€ mil	€ mil	€ mil
Business development opportunities	4,773	8,425	3,668	16,866
Business creation	10,434	10,474	10,031	30,939
Net total cost savings *of which:*	7,714	11,516	2,778	22,008
– IT CapEx savings	*3,662*	*12,299*	*7,052*	*23,013*
– IT OpEx savings (FTE / productivity)	*2,285*	*5,127*	*2,984*	*10,396*
– IT OpEx savings (power & cooling)	*1,767*	*4,244*	*2,499*	*8,510*
– additional cloud services expenditure (PAYG) *	-	*- 10,154*	*- 9,756*	*- 19,910*
Indirect GVA	11,759	16,251	12,726	40,737
Total Economic Benefit	**34,680**	**46,667**	**29,203**	**110,550**
Direct and Indirect employment ('000s)	**121.0**	**139.6**	**132.0**	**392.5**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

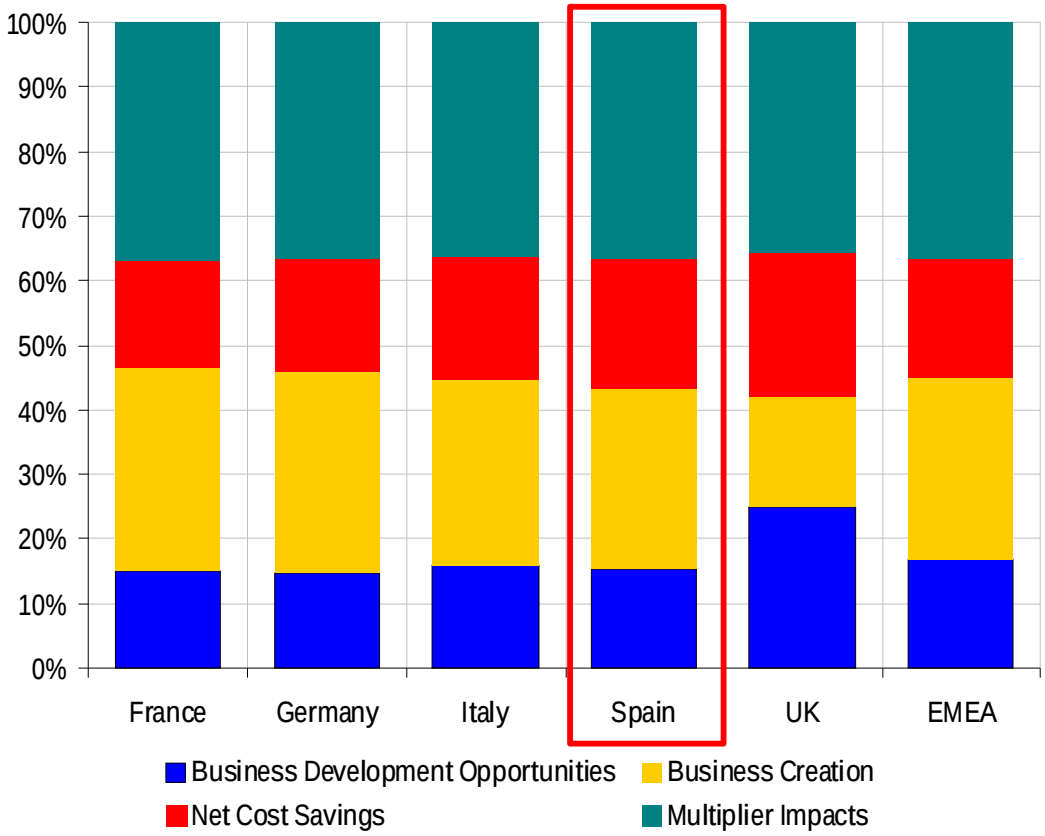
Hybrid cloud adoption is the main driver of Spain's cloud dividend, accounting for 42% of the total economic benefits. Private cloud adoption accounts for over 32%, while public cloud accounts for 27%.

Spain's share of the cumulative EMEA benefits is projected to be 14.5% which is larger than Spain's 12.3% share of EMEA GDP in 2009.

The key contributors to Spain's cloud dividend are illustrated in Figure 17 below. Net cost savings are a larger contributor than in either of the other continental European countries, but are a smaller contributor than in the UK. Similarly, business creation benefits are a smaller contributor than in either of the continental European countries, but a larger contributor than in the UK.

Business development opportunities are in line with Spain's continental neighbours but, in the same manner as these other countries, are a smaller contributor than in the UK. Multiplier impacts are in line with all other countries.

Figure 17



Spain is predicted to capture 22.8% of its cumulative benefits in 2015. The annual economic benefit achieved by 2015 is shown in Table 26 below. This lies below the EMEA average of 23.2%, which reflects higher than average present day cloud adoption relative to future adoption.

Table 26

Spain: Economic Benefits in 2015

	Private	Hybrid	Public	Total
	€ mil	€ mil	€ mil	€ mil
Business development opportunities	923	2,482	1,228	4,633
Business creation	1,812	1,829	1,749	5,390
Net total cost savings *of which:*	1,259	3,706	1,188	6,154
– IT CapEx savings	*581*	*3,915*	*2,645*	*7,142*
– IT OpEx savings (FTE / productivity)	*406*	*1,625*	*1,100*	*3,131*
– IT OpEx savings (power & cooling)	*272*	*1,359*	*936*	*2,567*
– additional cloud services expenditure (PAYG) *	-	- *3,193*	- *3,493*	- *6,686*
Indirect GVA	2,079	3,901	3,030	9,010
Total Economic Benefit	**6,073**	**11,918**	**7,196**	**25,186**
Direct and Indirect employment ('000s)	**20.6**	**27.8**	**25.6**	**74.0**

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

Note that, while private cloud accounts for over 31% of the cumulative benefits over 2010-2015, on an annual basis this has dropped to 24% by 2015. Public cloud contributes 28% in 2015, compared to its 26% contribution to the cumulative total. While hybrid cloud accounts for 42% of the cumulative benefits, this has reached 47% on an annual basis by 2015.

8.3 Net total cost savings

The cumulative net cost savings arising from cloud adoption in Spain over the period 2010-2015 is predicted to be €22.0 billion, which is 19.9% of Spain's cumulative cloud dividend and 15.6% of aggregate cumulative net cost savings across the EMEA.

Hybrid cloud, where the highest cost savings are available, accounts for the majority of Spain's cost saving benefits. By 2015, 60.2% of annual cost saving benefits is captured through hybrid cloud adoption, which is significantly higher than its 52.3% share of Spain's cumulative cost saving benefits over the period 2010-2015. This is driven by mid-level to high present-day adoption in all 4 of Spain's key industry sectors and high future adoption in two of those sectors. One of these sectors records higher IT budgets (as percentages of total revenues) as well a high IT CapEx to total IT budget ratio, CapEx being the area of cost where savings are potentially highest.

Private cloud accounts for 35.1% of the cost savings element of Spain's cloud dividend, but this share falls to 20.5% on an annual basis by 2015. This reflects high present-day adoption but low future adoption in Spain's third and fourth largest sectors, mid-level present-day adoption in Spain's two

largest industry sectors, rising to high in the most important sector and remaining at mid-level in Spain's second largest sector. Nonetheless, these latter two sectors record mid to high IT budgets, but only low to mid IT CapEx to total IT budget ratios.

Public cloud contributes only 12.6% of Spain's cumulative total net cost savings but, on an annual basis, contributes 19.3% by 2015. This reflects, as expected, predominantly low present-day adoption across the most important industry sectors, with future adoption remaining low in Spain's largest sector, reaching high adoption in the second largest sector and mid-level adoption in the third and fourth largest sectors.

Table 27: Drivers of cost saving magnitudes for Spain's four key industry sectors

Industry sector	IT spend patterns	Sector ranking	Private adoption (lowest cost savings)	Hybrid adoption (highest cost savings)	Public adoption (mid-level cost savings)
Manufacturing	Mid IT budget Low CapEx / total IT budget	4	High now Low future	Mid now High future	Low now Mid future
Distribution, retail & hotels	High IT budget High IT CapEx / total IT budget	3	High now Low future	Mid now High future	Low now Mid future
Banking, financial & business services	High IT budget Low IT CapEx / total IT budget	1	Mid now High future	Mid now Mid future	Low now Low future
Government, education & health	Mid IT budget Mid CapEx / total IT budget	2	Mid now Mid future	High now Mid future	Mid now High future

Source: Cebr analysis

8.4 Business development benefits

The cumulative business development benefits arising from cloud adoption in Spain over the period 2010-2015 are predicted to be €16.9 billion, which is 15.3% of Spain's cumulative cloud dividend and 13.2% of aggregate cumulative business development benefits across the EMEA

The drivers of the business benefits are shown in Table 28 below.

Table 28: Drivers of business development benefits in Spain's four key industry sectors

Industry sector	Sector ranking	Seasonality benefits	Scalability benefits (small firms)	Scalability benefits (large firms)	Overall cloud adoption
Manufacturing	4	High	Mid	None	High now V. high future
Distribution, retail & hotels	3	Low	High	Low	High now High future
Banking, financial & business services	1	Mid	High	Low	Mid now High future
Government, education & health	2	Low	Mid	None	High now High future

Source: Cebr analysis

The table shows how the principal drivers of the business development benefits are:

- High present-day and very high future overall cloud adoption in Spain's fourth largest industry sector, which has high seasonality benefits.
- High current and future overall cloud adoption in Spain's third-largest industry sector, which has high scalability benefits.
- High future adoption in Spain's largest sector, which has high scalability benefits.

8.5 Business creation benefits

The cumulative business creation benefits arising from cloud adoption in Spain over the period 2010-2015 is predicted to be €30.9 billion. This is 28.0% of Spain's cumulative cloud dividend and 14.4% of aggregate cumulative business creation benefits across the EMEA

These predictions are driven by two things:

- The amount new SMEs that enter the various industry sector markets, which is assumed to equate to Etro's result for Spain of 55,000 new firms over the medium term, of which the vast bulk are created in wholesale, retail, real estate, renting and business activities. Etro's result for Spain is driven by a relatively high level of diffusion of SMEs and / or by ICT uptake being generally rapid.

- The average level of new GVA per SME, which is driven by the productivity of existing SMEs and the cost savings and business development impacts described in the previous subsections. Spain has the second lowest GVA per SME amongst the five EMEA countries.

8.6 Multiplier benefits

The cumulative multiplier benefits arising from cloud adoption in Spain over the period 2010-2015 are predicted to be €40.7 billion. This is 36.8% of Spain's cumulative cloud dividend and 14.6% of aggregate cumulative multiplier benefits across the EMEA countries.

Multiplier benefits are directly proportional to the levels of total net cost saving, business development and business creation benefits achieved through cloud computing. The only other distinguishing assumptions between countries was the consumption to savings ratio, used to estimate the amount of additional employee / shareholder spend can be reasonably assumed to be spent in the wider economy in order generate induced multiplier impacts.

8.7 Employment effects

The adoption of cloud computing in Spain could be expected to generate 393 thousand jobs, which constitutes 16.4% of the total EMEA employment impact. Spain is also a relatively good performer relative to its 12.3% share of predicted EMEA GDP.

These jobs can, at least in the short run, be considered as a net impact. The extent to which they would constitute a net long run impact depends on the extent to which cloud computing can reduce the types of distortion that prevent the economy reaching its full productive capacity. Such distortions include things like imperfect competition, significant economies of scale, imperfect and incomplete information etc.

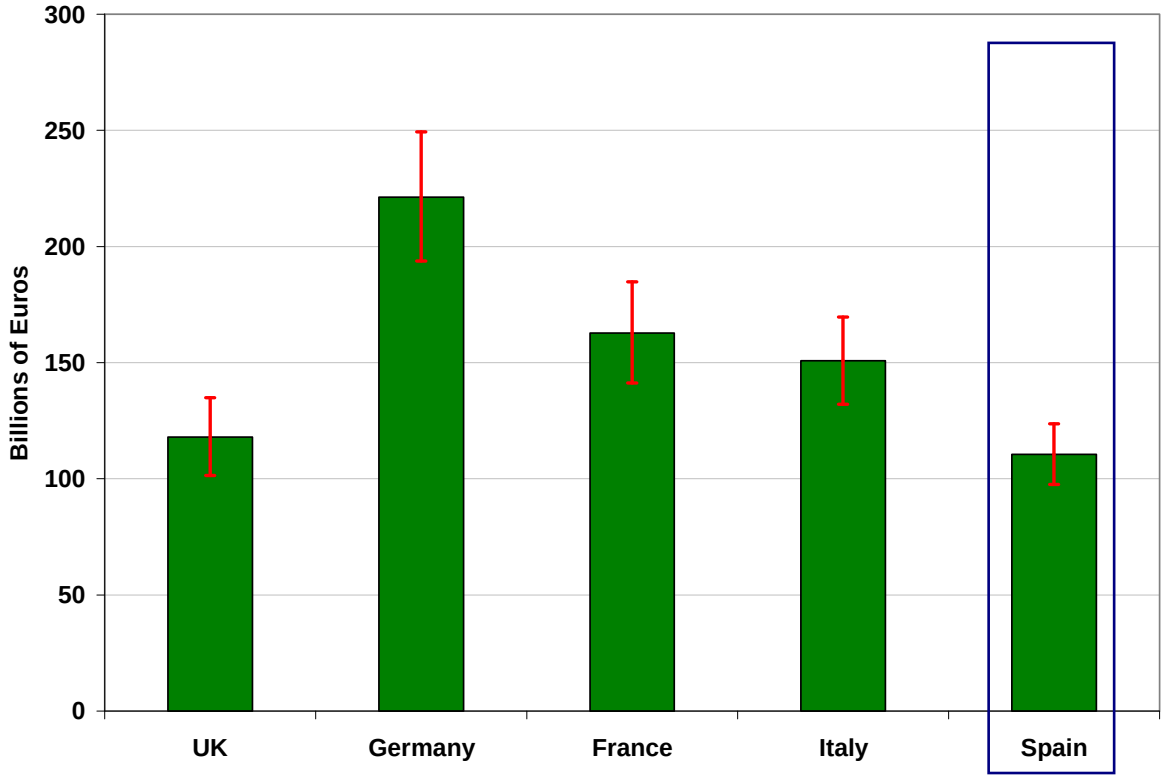
However, if the structural features of the economy lead employment back to its (pre-cloud) equilibrium level, then any temporary boost in the workforce will vanish over time.

8.8 Cloud adoption scenario-testing

Figure 18 below highlights the result of our adoption rate scenario-testing. By reducing our assumed adoption rates by 5% across the board, the downside scenario has the effect of reducing the aggregate cumulative benefits in Spain by 13.3% relative to the baseline results.

The upside scenario, in which we tested the effect of increasing our assumed adoption rates by 5% across the board produced a 10.6% increase in the aggregate cumulative benefits relative to the baseline results.

Figure 18: Adoption scenario-testing



9 United Kingdom

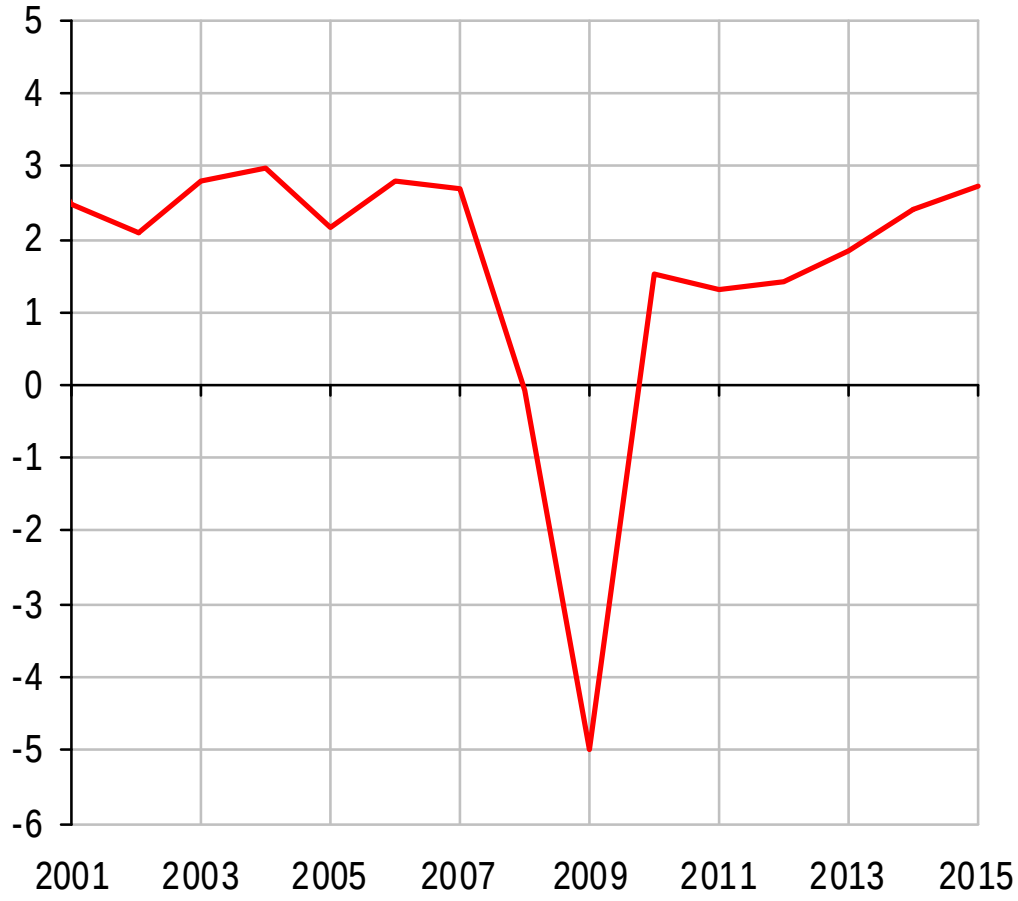
9.1 Macroeconomic context

For the UK economy, Cebr has had to revise down its forecasts due to a lacklustre private sector recovery. However, we do expect growth in 2010 to come in higher than the Office of Budget Responsibility's forecast of 1.2%, due largely to robust quarter-on-quarter growth in the second quarter of this year.

We have revised down our estimates of growth in 2011 and 2012, due to ongoing concerns about the strength of the private sector recovery. We expect that it will take some time for the labour market to return to pre-recession levels. Domestic demand is expected to be particularly weak in 2011, owing to sluggish earnings growth, welfare cuts, the Government's broader fiscal consolidation program (including the recent Comprehensive Spending Review) and above-target inflation.

We do not see any significant growth in domestic demand until at least 2013, so the UK, like many other European nations, will be banking on an export-led recovery over the next couple of years.

Figure 19: Cebr forecast of real GDP growth in United Kingdom, 2010-2015



While there remains some fragility in the UK economy's recovery, the outlook for the second largest EMEA economy is one of the more positive stories. Nonetheless, in the present uncertain economic

climate, cloud computing can still be a critical macroeconomic factor that will be crucial for boosting the UK's economic growth. As a driver of enhanced productive performance, cloud computing can play an important part in helping to bridge the UK's productivity gap, thus helping to recover the UK's net international trading position. Cloud computing could also be an important driver of business investment in UK that would also, in turn, drive its economy forward.

9.2 Economic benefits of cloud computing

The cumulative economic benefits of cloud computing to the UK economy over the period 2010-2015 are shown in Table 29**Error! Reference source not found.** below.

Our baseline assumptions produce a predicted €118.0 billion (£100.6 billion) of cumulative economic benefits over the 6-year horizon of our forecast. This is an estimated 1.26% of total UK GDP over the same period.

Table 29

United Kingdom: Cumulative Economic Benefits 2010-2015

	Private		Hybrid		Public		Total	
	£ mil	€ mil	£ mil	€ mil	£ mil	€ mil	£ mil	€ mil
Business development opportunities	7,221	8,462	12,515	14,667	5,484	6,427	25,219	29,555
Business creation	5,706	6,687	5,724	6,708	5,658	6,631	17,088	20,026
Net total cost savings *of which:*	10,466	12,266	10,769	12,620	1,126	1,319	22,361	26,206
– IT CapEx savings	*5,173*	*6,063*	*15,682*	*18,378*	*10,014*	*11,735*	*30,869*	*36,176*
– IT OpEx savings (FTE / productivity)	*3,320*	*3,890*	*6,867*	*8,048*	*4,271*	*5,005*	*14,458*	*16,943*
– IT OpEx savings (power & cooling)	*1,973*	*2,313*	*4,279*	*5,014*	*2,764*	*3,239*	*9,016*	*10,566*
– additional cloud services expenditure (PAYG) *	-	-	- *16,060*	- *18,821*	- *15,922*	- *18,660*	- *31,982*	- *37,481*
Indirect GVA	9,831	11,521	15,308	17,940	10,872	12,741	36,011	42,202
Total Economic Benefit	**33,224**	**38,936**	**44,315**	**51,934**	**23,140**	**27,118**	**100,679**	**117,989**
Direct and Indirect employment ('000s)	**88.4**		**111.7**		**88.9**		**289.0**	

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

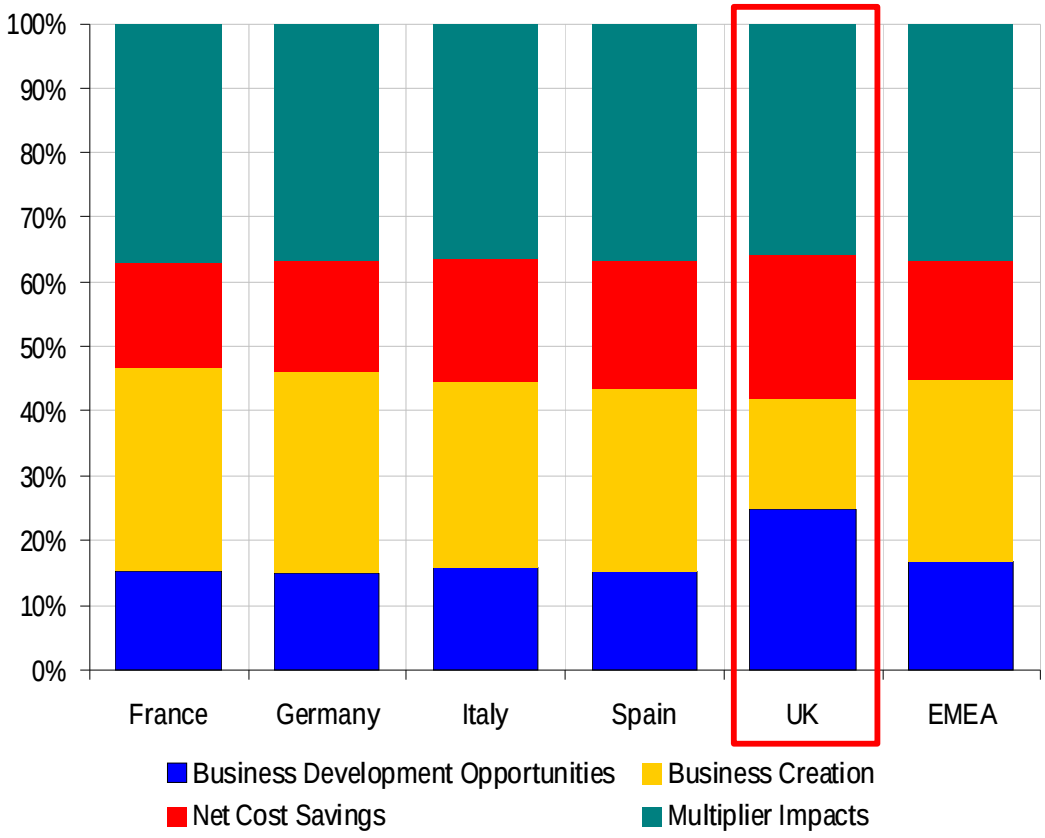
Hybrid cloud adoption is the main driver of the UK's cloud dividend, accounting for 44.0% of the total economic benefits. Private cloud adoption accounts for 33.0%, while public cloud accounts for 23.0%.

The UK's share of the cumulative EMEA benefits is projected to be 15.5% which is quite significantly smaller than the UK's 19.2% share of our projected cumulative EMEA GDP for the period 2010-2015.

The key contributors to UK's cloud dividend are illustrated in Figure 20 below. Net cost savings are a larger contributor than in any of the other continental EMEA countries. Similarly, business creation benefits are a smaller contributor than in any of the other EMEA economies.

The share of the UK's cloud dividend accounted for by business development opportunities is the highest out of all the 5 EMEA economies. Multiplier impacts constitute a slightly smaller share than in the other economies, which largely reflects the relatively small contribution made by business creation.

Figure 20



The UK is predicted to capture 25.4% of its cumulative benefits in 2015. The annual economic benefit achieved by 2015 is shown in Table 30 below. This sits well above the EMEA average of 23.2%, which reflects lower than average present day cloud adoption relative to future adoption.

Table 30

United Kingdom: Economic Benefits in 2015

	Private		Hybrid		Public		Total	
	£ mil	€ mil	£ mil	€ mil	£ mil	€ mil	£ mil	€ mil
Business development opportunities	1,947	2,282	3,674	4,306	1,521	1,783	7,143	8,371
Business creation	1,003	1,175	1,008	1,182	996	1,167	3,006	3,523
Net total cost savings *of which:*	2,918	3,420	3,158	3,701	572	670	6,647	7,790
– IT CapEx savings	*1,435*	*1,681*	*4,720*	*5,531*	*3,207*	*3,759*	*9,362*	*10,972*
– IT OpEx savings (FTE / productivity)	*936*	*1,097*	*2,102*	*2,464*	*1,348*	*1,580*	*4,386*	*5,140*
– IT OpEx savings (power & cooling)	*547*	*642*	*1,328*	*1,557*	*888*	*1,041*	*2,764*	*3,239*
– additional cloud services expenditure (PAYG) *	-	-	- *4,993*	- *5,851*	- *4,872*	- *5,710*	- *9,865*	- *11,561*
Indirect GVA	2,162	2,534	4,000	4,688	2,627	3,079	8,789	10,300
Total Economic Benefit	**8,030**	**9,410**	**11,840**	**13,875**	**5,716**	**6,698**	**25,585**	**29,984**
Direct and Indirect employment ('000s)	**16.1**		**25.1**		**16.4**		**57.6**	

** This category of spend is captured for private cloud through lower firm-level CapEx and OpEx savings. The firm-level CapEx and OpEx savings are higher under hybrid and public cloud, but there can expect to also be incurred new spend on external cloud services*

Note that, while private cloud accounts for over 33.0% of the cumulative benefits over 2010-2015, on an annual basis this has dropped to 31.4% by 2015. Public cloud contributes 22.3% in 2015, compared to its 23.0% contribution to the cumulative total. Meanwhile, while hybrid cloud accounts for 44.0% of the cumulative benefits, this has reached 46.3% on an annual basis by 2015.

9.3 Net total cost savings

The cumulative net cost savings arising from cloud adoption in the UK over the period 2010-2015 is predicted to be €26.2 billion (£22.4 billion), which is 22.2% of the UK's cumulative cloud dividend and 18.6% of aggregate cumulative net cost savings across the EMEA.

Hybrid cloud, where the highest cost savings are available, accounts for the largest proportion of the UK's cost saving benefits. By 2015, 47.5% of annual cost saving benefits is due to hybrid cloud by 2015. This is slightly lower than its hybrid's 48.2% share of the UK's cumulative cost saving benefits over the period 2010-2015. This is driven by high future adoption in all 4 of the UK's key industry sectors and high present-day adoption in two of those sectors.

Private cloud accounts for 46.8% of the cost savings element of the UK's cumulative cloud dividend, but this share falls to 43.9% on an annual basis by 2015. This reflects high present-day adoption in three of the UK's largest industry sector, but high future adoption in only two of them. While one of the sectors that has high future adoption is generally a high IT spender, the ratio of IT CapEx (where the most significant cost savings are available) to total IT budget tends to be low. The sector that involves high IT spend and high IT CapEx to total IT budget ratio has high present-day adoption but only mid future adoption.

Public cloud contributes only 5.0% of the UK's cumulative total net cost savings but, on an annual basis, contributes 8.6% by 2015. This reflects, as expected, predominantly low to mid present-day adoption across the most important industry sectors, with future adoption growing to high levels in only two of these sectors.

Table 31: Drivers of cost saving magnitudes for the UK's four key industry sectors

Industry sector	IT spend patterns	Sector ranking	Private adoption (lowest cost savings)	Hybrid adoption (highest cost savings)	Public adoption (mid-level cost savings)
Manufacturing	Mid IT budget Low CapEx / total IT budget	4	High now High future	Mid now High future	Mid now Low future
Distribution, retail & hotels	High IT budget High IT CapEx / total IT budget	3	High now Mid future	High now High future	Mid now High future
Banking, financial & business services	High IT budget Low IT CapEx / total IT budget	1	High now High future	Mid now High future	Mid now Low future
Government, education & health	Mid IT budget Mid CapEx / total IT budget	2	Mid now Mid future	High now High future	Low now High future

Source: Cebr analysis

9.4 Business development benefits

The cumulative business development benefits arising from cloud adoption in the UK over the period 2010-2015 are predicted to be €29.6 billion (£25.2 billion), which is 25.0% of the UK's cumulative cloud dividend and 23.2% of aggregate cumulative business development benefits across the EMEA

The drivers of the business benefits are shown in Table 32 below.

Table 32: Drivers of business development benefits in Spain's four key industry sectors

Industry sector	Sector ranking	Seasonality benefits	Scalability benefits (small firms)	Scalability benefits (large firms)	Overall cloud adoption
Manufacturing	4	High	Mid	None	High now V. high future
Distribution, retail & hotels	3	Low	High	Low	V. high now V. high future
Banking, financial & business services	1	Mid	High	Low	Mid now V. high future
Government, education & health	2	Low	Mid	None	High now V. high future

Source: Cebr analysis

The table shows how the principal drivers of the business development benefits are:

- High present-day and very high future overall cloud adoption in the UK's fourth largest industry sector, which has high seasonality benefits.
- Very high current and future overall cloud adoption in the UK's third-largest industry sector, which has high scalability benefits.
- Very high future adoption in the UK's largest sector, which also has high scalability benefits.

9.5 Business creation benefits

The cumulative business creation benefits arising from cloud adoption in the UK over the period 2010-2015 is predicted to be €20.0 billion (£17.1 billion). This is 17.0% of the UK's cumulative cloud dividend but only 9.3% of aggregate cumulative business creation benefits across the EMEA

These predictions are driven by two things:

- The amount of new SMEs that enter the various industry sector markets, which is assumed to equate to Etro's result for the UK of 35,000 new firms over the medium term, of which the vast bulk are created in wholesale, retail, real estate, renting and business activities. Etro's result for the UK is driven by relatively low levels of diffusion of SMEs and / or by ICT uptake not being generally rapid.

- The average level of new GVA per SME, which is driven by the productivity of existing SMEs and the cost savings and business development impacts described in the previous subsections. The UK has only the third highest GVA per SME amongst the five EMEA countries.

9.6 Multiplier benefits

The cumulative multiplier benefits arising from cloud adoption in the UK over the period 2010-2015 are predicted to be €42.2 billion (£36.0 billion). This is 35.8% of the UK's cumulative cloud dividend and 15.1% of aggregate cumulative multiplier benefits across the EMEA countries.

Multiplier benefits are directly proportional to the levels of total net cost saving, business development and business creation benefits achieved through cloud computing. The only other distinguishing assumptions between countries was the consumption to savings ratio, used to estimate the amount of additional employee / shareholder spend can be reasonably assumed to be spent in the wider economy in order generate induced multiplier impacts.

9.7 Employment effects

The adoption of cloud computing in the UK can be expected to generate 289 thousand jobs, which constitutes 12.1% of the total EMEA employment impact. The UK is a poor performer relative to its 19.2% share of predicted EMEA GDP, which is driven by relatively poor levels of business creation arising from cloud computing.

These jobs can, at least in the short run, be considered as a net impact. The extent to which they would constitute a net long run impact depends on the extent to which cloud computing can reduce the types of distortion that prevent the economy reaching its full productive capacity. Such distortions include things like imperfect competition, significant economies of scale, imperfect and incomplete information etc.

However, if the structural features of the economy lead employment back to its (pre-cloud) equilibrium level, then any temporary boost in the workforce will vanish over time.

9.8 Cloud adoption scenario-testing

Figure 21 below highlights the result of our adoption rate scenario-testing. By reducing our assumed adoption rates by 5% across the board, the downside scenario has the effect of reducing the aggregate cumulative benefits in the UK by 16.4% relative to the baseline results.

The upside scenario, in which we tested the effect of increasing our assumed adoption rates by 5% across the board produced a 12.5% increase in the aggregate cumulative benefits relative to the baseline results.

Figure 21: Adoption scenario-testing