

## **Risk, Financial Modeling and Cloud Computing: A New Approach**

Anastassios Gentzoglani

University of Sherbrooke, Sherbrooke, Quebec, Canada

J1K-2R1

anastassios.gentzoglani@USherbrooke.ca

**Abstract.** Cloud Computing (CC) has been on the rise. Its pervasiveness has tremendous effects on both CC users and CC providers as well as on governments. The latter purports to regulate the industry to increase its security and users' confidence. Recent theoretical advances such as *Shannon's channel* and "rational inattention" may explain the remarkable rise of this industry. But the switch from a CAPEX to an OPEX model that CC entails has significant impacts on firm valuation and wealth creation. Contrary to previous claims in the literature, it is argued here that this shift in management strategy may increase firms' risks rather than reduce them. To effectively reduce risks, firms should use more sophisticated pricing mechanisms such as decoupling which breaks the link between valuation and risk for both CC users and CC providers.

**Keywords:** cloud computing, CAPEX, OPEX, rational inattention, pay-as-you-go, decoupling, risk

### **1. Introduction**

Lately, cloud computing (CC) has been on the hype for a number of reasons. For the users, particularly business firms and other organizations, it is a new convenient platform to make business at lower costs. For the developers and vendors of these technologies, CC is a new strategy to increase market shares, strengthen financial might and develop strategies that make them less vulnerable to other innovations and emerging business models. For consumers, the benefits of CC are not clear-cut. The issues of security are looming large and may make them more reluctant to go shopping on-line but if the cost savings of the firms implementing CC are passed on to consumers (or at least part of them) the lower prices may incentivize them to buy more. For governments and regulatory agencies, CC raises a number of important policy questions as they are summarized by the European Union's (EU) vice president for the Digital Agenda, Neelie Kroes. To quote, "Freedom of expression, the protection of privacy and personal data, net neutrality and the preservation of an open internet - these and other issues are fundamentally public policy issues"<sup>[1]</sup>. Self-regulation is not appropriate and heavy-handed regulation is viewed as a more compelling alternative. To quote Kroes again: "Who will be liable if something goes wrong in the cloud and data is lost or compromised? Which rules and which jurisdiction will apply? These are not questions that 'codes of conduct' on their own can answer in a satisfactory way." (Ibid)

Although 'codes of conduct' are not enough to provide answers to security and other policy concerns, the industry is growing quite fast without waiting the government to intervene and regulate it. Because of space limitations, this paper does not deal with all the above mentioned policy issues. Rather it focuses on the financial aspects of CC and the implications it has on firms' costs and strategies that may be adopted to strengthen their competitive position. Traditional theoretical arguments associated with the advantages for being first- or second-movers may be used to explain the race for CC but recent theoretical advances – “rational inattention”- arguments are more convincing than the traditional ones. But the fundamental question remains: does CC really bring the financial benefits that it promises? This paper addresses these issues.

The following section defines and presents the CC industry. By using recent statistical data, it gives a picture of the global CC industry and its main characteristics. Its organizational structure, its level of competition and the characteristics of demand and supply of CC services are essential statistical data that allow a researcher to surmise on the concentration of this industry and its degree of competition. The conduct of individual firms depends on the main structural characteristics of the industry and this determines ultimate performance. The technical characteristics of new technologies, particularly the CC, may be attractive in terms of convenience, cost, and other characteristics but users may not be able to rip the benefits of these technologies if there is not enough competition among CC providers. Section 2.2 analyses the effects of CC on firms' investment costs and their financial position. Users, firms and other organizations use various financial models to evaluate the costs and benefits of their investments in physical infrastructure. CC frees investment funds that can be used by the users of CC in best alternative projects with higher returns. If the cost of building an in-house computing reserve or storing capacity is higher than the savings realized by avoiding investment in such capacity, from a financial point of view, CC is a good financial strategy. The paper concludes that CC adoption implies a shift in management strategy from CAPEX to OPEX and this may increase firms' risks rather than reducing. Other pricing mechanisms such as decoupling may be used to break this relation.

## **2. Market Characteristics of the Global Cloud Computing Industry**

### **2.1. Market Structure and Industry Perspectives**

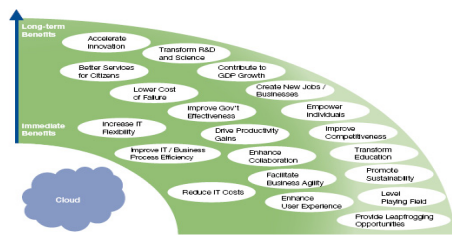
Before presenting the main market characteristics of the CC industry, it is important to define it. The definition helps to delineate its size and to get a better picture of its importance. CC is defined as the use of remote software and applications rather than the use of a proprietary in-house infrastructure and software. These services are offered via the web by highly specialized firms and allow users to have more free space over their own computers and to manage better their IT budgets. Given that CC services are priced on a pay as needed basis, users of CC could achieve lower costs and increase their competitiveness. Investment in in-house infrastructure or software is thus avoided and the firms can use the funds they save for other core projects.

Research from Dubey and Wagle<sup>[2]</sup> and Armbrust et al. <sup>[3]</sup> indicates that firms using the CC can save important sums of money by avoiding investing in up-front on hardware and software equipment. Simply spending on ICT according to their production necessities makes them more competitive. Etro<sup>[4]</sup> uses a macroeconomic model to estimate the benefits arising from the use of CC in a number of EU countries. His findings corroborate the theoretical assertions that CC has a large impact on the cost structure of all sizes of firms and particularly on small and medium size

enterprises (SMEs). Furthermore, CC has a positive impact on the creation of new firms, new products and the creation of jobs. For the whole EU-27, Etro (2009, p. 3) estimates the contribution of CC to be in the order of 0.2% and this implies the creation of a million new jobs and few hundred thousand of new SMEs. Briefly, CC contributes to the wealth creation by stimulating growth through the creation of a dynamic industry structure.

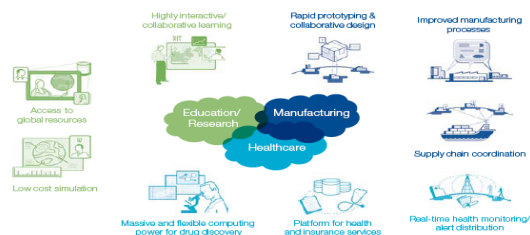
The World Economic Forum<sup>[5]</sup> (2010) has identified a number of industries which could benefit from CC (Figure 1).

Figure 1: Examples of Benefits of Cloud Computing



Source: WEF, 2010, p. 3

Figure 2: Potential Users of Cloud Computing

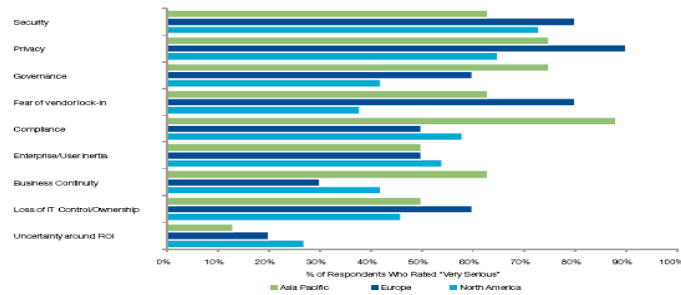


Source: WEF, 2010, p. 3

The number of potential users is usually used to make an estimation of the market potential. Figure 2 indicates the industries and organizations that can potentially use CC. As it can be seen from this figure, CC is potentially quite pervasive.

Figure 3 identifies the main impediments for the development of the CC industry. Although the potential for growth of CC is very high, if nothing is done either by the industry (self-regulation) or the government (light or heavy-handed regulation), this potential may be checked by one or many impediments as they are identified by the WEF (2010).

Figure 3: Major Impediments for the Adoption of Cloud Computing by Region



Source: WEF, 2010, p. 9

The CC industry is dominated by few well-known international firms with headquarters in the USA. Amazon with its web services (AWS) competes with Microsoft and Google and the three of them compete with the traditional infrastructure makers such as AT&T, EMC, Hewlett-Packard, IBM, Oracle and Verizon. Other companies such as RightScale, GoGrid, SalesForce, NetSuite, RackSpace, and Enomaly from Canada, dominate the North America market. These companies face competition from other national companies with strong CC industry such as Germany (Pricewaterhousecoopers (pwc) Report, 2010), England, France, Israel (Israel Trade Report, 2010). There is also a growing number of new start-ups around the world (The Economist, March 2011).

## 2.2. Financial Modeling of Cloud Computing

Three main market segments exist for this industry: software-as-a-service (SaaS); infrastructure-as-a-service (IaaS) and platform-as-a-service (PaaS).

In the SaaS model, applications are built specifically for network delivery. Users have access to them via the Internet. These applications may be provided to a specific company or a group of companies and can be deployed privately or publicly. Amazon Web Services is a good example of publicly available cloud services.

In the IaaS model, services such as CPU, storage and networking are made available over the Internet and this creates opportunities for cost savings in infrastructure.

In the PaaS model, a cloud-hosted environment is offered to develop, deploy and test cloud-SaaS applications. This service may be offered free of charge but the other two services have a fee according to the needs of the users.

Measured in terms of revenues, software-as-a-service (SaaS) segment is much larger than infrastructure-as-a-service (IaaS). In 2010, the SaaS accounted for 70% of the industry revenue and IaaS for 30%. Globally, the CC industry attained the \$12.1 billion cap in 2010 and it grows quite fast. It is expected to grow by 43% in 2011 but this growth rate would not be sustained in the foreseeable future. Estimates indicate that the year-on-year growth rate will be around 13% over the next five years. It is expected though that the share of IaaS will increase to 40% from its actual 30% share. Table 1 shows the size of the industry by 2015 and the share in revenues by category of users.

Table 1: The size of the cloud computing industry measured by total revenue (year 2015)

<b>Users of CC</b>	<b>Percentage</b>	<b>Dollars (billion)</b>
Registered IT Partners	39%	\$14.0 billion
Vendor-driven	36%	\$12.9 billion
Communications service providers	23%	\$8.2 billion
Managed service providers	2%	\$0.5 billion
<b>Total</b>	<b>100%\$</b>	<b>\$35.6 billion</b>

It is clear from table 1 that the size of the CC industry and its future growth are indeed quite significant. Given the potential for growth of CC industry, it is anticipated that it will attract new entrants in the future. Competition would be fierce and many M&A would follow before the industry settles down.

From a theoretical point of view, the CC industry developed as a consequence of the rapid increase in information and its importance for strategic decision-making processes in both large and SMEs. The new theory of “rational inattention” is quite powerful and it can be used to explain the growth of CC industry. In its simplest form, it states that humans have limited cognitive capacities which limit the ability to process all information available, the so-called *Shannon’s channel*. This makes people more selective and forces them to make choices with respect to subjects to which they pay more or less attention. These limits known as “rational inattention” may force decision makers to use external services (cloud services) for some of their basic functionalities. By choosing how much attention to devote to different subjects, firms’ managers choose to maximize their productivity.

Not only is productivity increasing but also CC reduces risk. By deciding to use CC, firms avoid investing in infrastructure and in software and the cost savings can be used to increase investment in core business. CAPEX expenses are converted into OPEX and this has an

important impact on fixed and variable costs of the firm. By reducing its operating leverage, the proportion of fixed costs relative to variable costs, the firm is able to reduce its risk too. This affects the firm's cost of capital (WACC) but also the way to calculate the return on investment and the appropriateness of the project by calculating its Net Present Value (NPV). However, cash flows are affected by the methods of pricing that is used in CC. The pay-as-you-go model used by the CC industry makes cash flows more volatile. Cash flows, particularly after tax cash flows, are important determinants of a firm's future value and a measure of a firm's financial ability to stay afloat and pay its credit holders. The firms by moving from a CAPEX to an OPEX model has to switch its strategy and focus most on the management of operational expenses rather than its balance sheet. This is a great shift in management and firm's strategies.

Further, a business cycle affects unequally the users and the providers of CC. When the economy is in expansion the pay-as-you-go model would increase operating expenses for the users of CC and the revenues for the providers of CC. This boosts profits for the CC providers but the opposite is true when the economy is in contraction (coupling effect). The pay-as-you-go model penalizes them particularly when competition creates rigidities in prices. This creates a need to change the pay-as-you-go model and adopt a pricing strategy reminiscent to the one used by other industries which they were using pricing mechanisms that made them vulnerable during the recent financial crisis. The new pricing model suggested by many that makes decoupling possible is the Straight Fixed Variable (SFV) model. It is beyond the scope of this paper to deal with this issue here. Further analysis of SFV model is needed in the context of CC. This is the subject of a future research.

### 3. References

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