

Cloud computing and modelling of cash flows essay sample

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This paper does a revenue-neutral cash flow modelling for fractional cloud computing adoption. The aim is to find out a mathematical fraction, other things being equal, for which the Net Present Value (NPV) maximizes with respect to cloud adoption. The impact of both deferred capital expenses and reduced operating expenses on NPV are treated in the model. The paper posits that the revenue generation and growth of the firms under consideration are independent of the way the IT resources are managed between cloud vs. traditional. In addition to NPV modelling, the paper also examines the fraction of the total product /solutions options that can be moved to the cloud today from the total universe of IT assets by running a statistical analysis of data collected from a vendor sample space. Keywords: Cloud Computing, Fractional Cloud Adoption, Revenue-Neutral NPV Modelling, Capital vs. Operating Expenditure Introduction Huge capital outlays for setting up 3600 Information Technology (IT) infrastructure have always been a deterrent for firms, particularly new ventures, from the optimal capital utilization point of view. Firms would prefer to use up their precious high-cost initial seed capital to build assets that drive their revenue growth. In such a capital constrained scenario, any option of deferring capital investment will ease out the initial cash flow pressures and help in better Net Present Value (NPV) modelling.

Modern business paradigms like leasing, asset co-ownership and infrastructure outsourcing are all aimed at easing out the upfront capital investment problem. The 'pay-as-you-use' cloud computing model is another business model which gives firms the option to partly convert their immediate capital expenses to deferred annual operating expenses. With

state of the art innovations, cloud computing has today made possible the migration of applications, software, storage and even platform management to the ethereal cloud, thereby giving a multi-vector capital investment downsizing. Over and above the aforementioned deferred capital expenses gains, cloud adoption also offers the possibility of lowering the total IT operating expenses. This reduction of operating expenses with higher cloud adoption has a gainful impact in the calculation of the present value of future cash flows and acts as one more modelling component in the NPV modelling. This paper splits the total IT operating expenditure into non-cloud related operating expenses and cloud related operating expenses.

The paper also posits that there is an unknown risk component associated with cloud adoption and its monetization will critically determine the NPV modelling. The key mathematical variable used in the paper is α which is a fraction varying from 0 to 1 and is, in a behavioral sense, an indicator of the willingness of the market to adopt more and more of available Copyright © 2012 IESS. Cloud Computing and Modelling of Cash Flows for Full vs. Fractional Adoption of Cloud 113 cloud technology and practices. $\alpha = 0$ indicates one extreme of the cloud deployment spectrum – zero acceptance of cloud as a solution. At the other extreme is $\alpha = 1$ which indicates a deployment of all possible and available cloud options. The movement of α is a reflection of the consumer / market acceptance of a new technology platform. NPV modelling is done as a function of this fraction α . As mentioned in the abstract, the paper posits that the revenue cash flows and the growth of the firm are independent of the way in which its IT assets are

managed since for all firms (except IT firms) technology infrastructure is only a supporting cost element.

In addition to NPV modelling, the paper also determines the fraction (δ) of the products and solutions options that can actually be moved to the cloud today from the total universe of IT assets. This fraction has been arrived at by the statistical analysis of data collected from a vendor sample space. The survey was conducted from cloud platform vendors as well as Software as a Service (SaaS) vendors. The authors chose the vendor sample space over the buyer sample space with the assumption that current cloud/SaaS vendors would be more abreast with technology mobility to cloud than the buyers. Literature Survey Academics have reviewed the emerging area of Cloud Computing along various vectors. This section reviews some of the work that has been already done in three related areas – definitions of cloud, economics of cloud adoption and risk factors associated with cloud computing. One of the earliest definitions of cloud has been provided by Prof. Ramnath K Chellappa as a ' computing paradigm where the boundaries of computing will be determined by economic rationale rather than technical limits alone' [1].

The paper by Vaquero et al provides a more complete definition of cloud and associates various systems and stakeholders involved with cloud [2]. M. Ambrust et al refer to Cloud Computing as a symbiosis of both applications delivered as services over internet and hardware/systems software in the datacenters that provide those services [3]. Coming to the economics of Cloud Computing, Hosseini et al predict that the decision to migrate existing

systems to cloud platforms can be complicated since the evaluation of the cost-benefit trade off and the measurement of associated risk in cloud computing adoption is not straight forward [4]. Another paper by Beaty et al talks about building a viable business case on cloud migration by modelling on cost of transformation, ROI and payback period [5]. J. C. Pucciarelli et al write about Cloud being too important to be left to IT Departments alone because it's as much about business' agility as it's about IT cost takeout [6]. M. Klems et al aver that the valuation of Cloud Computing services must take into account its costs as well as the costs resulting from the underlying business model [7].

Yet another online commentary, incidentally on Microsoft's Cloud platform called Azure, indicates that there is no clear consensus yet on whether the cost of cloud-based hosting is attractive enough as compared to in-house hosting [8]. Federico Etro mentions about Cloud Computing as a large pool of easily usable and accessible virtualized resources (hardware, development, storage and/or services) which can be dynamically reconfigured to adjust to a variable load scenario allowing for an optimization of resource utilization [9]. Thus, there are various perspectives of cost-benefit analysis for cloud adoption. Moving to the third area of literature survey – the risks and obstacles involved in Cloud Computing, C. Christauskas et al., have talked about fear for safety, internet failure, control loss, dependency and similar exogenous factors that inhibit cloud adoption [10]. P. Saripalli et al have developed a framework called QUIRC for mapping risk as a combination of the probability of a security threat event and its severity, measured as an impact [11]. The two extreme options of pure in-house deployment and pure

cloud based deployment and the various in-between hybrid options that can offer the best of both worlds have been studied by B. C. Tak et al in the context of certain specific applications [12].

This paper builds on the established knowledge framework and proceeds to propose a generic model for assessing the NPV of cloud adoption. 114 Business Management and Information Systems Problem Formulation and Modelling The dependent variable modeled here is the Net Present Value [NPV] of a firm that is into the adoption of cloud practices. The independent variable is the fractional cloud adoption coefficient α . Figure 1 gives the complete set of equations for the NPV Modelling. Equation (1) is the definition of NPV as the difference between the present value of all future cash flows of the firm and the current up front capital investment. It is a judgmental indicator on the prudence of going ahead with the current investment. Equation (2) indicates that the offset in the current investment is driven by the term $\alpha\delta I_{it}$, which is the maximum possible deferrable investment of IT capital expenses due to cloud adoption. In this equation, δ gives the technology limit of cloud migration and α gives the behavioral limit of cloud adoption.

Equation (3) models the Present Value based on the assumption of an annualized perpetual cash flow for the firm and separately brings out the two components of IT operating costs – the traditional in-house operating costs O_{nc} which will continue even after cloud adoption and the cloud related IT operating cost O_c . For simplifying the model, the authors have ignored the revenue growth of the firm (annual growth rate of R). Else the denominator

of equation (3) would have been (rg) instead of ' r ', where g is the annual growth rate. This simplification however does not affect the analysis and interpretation of our results as offered in the next section. Equation (4) is a behavioral equation of Onc with the assumption that the traditional inhouse operating cost would steadily fall with higher cloud adoption because cost elements like maintenance, training, IT staff salary, utilities, supervisory staff salary, hiring, band width and a host of other associated costs would reduce systematically for higher and higher cloud adoption (i. e. as the α value moves from 0 to 1). Irrespective of the value of ' a ', a high value of ' b ' (i. e. a small ' $a-b$ ' value) will indicate a successful strategic reduction of Onc .

Equation (5) explains the behavior of the cloud related IT operating cost Oc . It again has Figure 1. Equations for NPV Modelling Figure 1. Equations for NPV Modelling Cloud Computing and Modelling of Cash Flows for Full vs. Fractional Adoption of Cloud 115 two components – both driven by α – one of which is monetized (Y_k) and the other is currently non-cash, but monetizable (Y_{uk}). Y_{uk} represents the hidden cost element associated with cloud adoption and could include factors as diverse as data security cost, data privacy cost, load variability cost, internet down time cost, loss of control cost, redundancy cost, contract breach costs etc – of which some are exogenous to the firm and some are endogenous. Equation (6) is the final equation for NPV. The second order differential of this equation is negative and hence this equation is a maximizing equation. The first order differential equation is given in equation (7). Equating it to zero will give the value of α for which the NPV function maximizes. The same is given in equation (8).

Analysis and Interpretation Once cloud adoption starts there are two drivers that enable a higher NPV realization. Since the upfront investment comes down (by the factor $\alpha\delta_{lit}$), this is the prime driver for increased NPV with increasing α . Even marketing for cloud adoption plays on this perspective. The second driver is the fall of Onc , which has been modeled to fall from a peak value of 'a' to a reasonably small value of 'a-b' when α moves from 0 to 1. In reality, the actual Onc function is posited to fall as a step function. The equation ' $Onc \approx b\alpha^2 - 2b\alpha + a$ ' with its extreme behavior Figure 2. Plot of Onc wrt α as defined at $\alpha = 0$ and 1 is a good enough approximation. The behavior of both the step function as well as the approximated function is shown in Figure 2. The authors have mentioned in the previous section that the fall in Onc has to be driven by a strategic initiative. It only implies that when higher cloud adoption happens, there has to be a conscious effort to trim down the traditional in-house operating costs.

The step function indicated in figure 2 is actually the posited outcome of such a strategic initiative to phase out the value of Onc in a step-wise manner. In the absence of such a strategic initiative, the NPV maximization through cloud adoption cannot be completely achieved. Similarly, there are two drivers that reduce the NPV realization with increasing α . The first is the annual cash payout to the cloud vendors for usage (Y_k) and its value will only increase with higher cloud adoption. The second factor represents the nebulous fears about cloud computing (Y_{uk}), some real and some perceptual. All of them can be modeled as a cost (this activity is beyond the scope of this paper). The factor $r\delta_{lit}$ of equation (8) is the opportunity saving from not investing in upfront capital. I_{lit} is the total IT expense and δ_{lit}

is the maximum fraction of IT expense which can be deferred from immediate investment. If that is treated as a notional saving, then $r\delta_{lit}$ is the notional positive cash flow where r is discounting rate driven by weighted average cost of capital (WACC). In the real scenario, this savings is larger than the cash payout term Y_k . So the term $(r\delta_{lit} - Y_k)$ is positive.

The cloud utilization charges Y_k will continue to be small because the cloud vendors have scale, higher capacity utilization, higher risk spread across multiple users, better fixed cost spread and better negotiation for bulk buying of IT assets. The second term in equation (8) is always positive if the risk associated with unknown fears (Y_{uk}) is set to zero (for an argument). This implies that mathematically, the value of α for which the NPV function maximizes is 'greater' than 1. What it implies is two things: 116 Business Management and Information Systems 1. There are no hiccups in NPV increase when α moves from 0 to 1 and the theoretical function gets maximized only beyond $\alpha = 1$. Thus, when the cloud cash payouts (Y_k) are lesser than the opportunity cost of deferred capital ($r\delta_{lit}$) and when it is assumed that the cost associated with unknown fears (Y_{uk}) is set to zero, then any increase in cloud adoption will only increase the NPV realization. 2. NPV maximization occurring at a mathematical point of $\alpha > 1$ probably implies that when more and more technologies start getting migrated to the cloud (i. e. when δ increases from its current value), then there is further scope for increase in NPV with those new adoptions. In order to model the cost associated with unknown fears (Y_{uk}), we need to closely examine the Industry vs. Fear Matrix (for cloud adoption). For different industries/businesses, the fears of cloud adoption would be very different.

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As previously explained, from data security to privacy to intolerance of down time to latency problems, every fear is associated with a cost element. For those industries that are significantly resisting cloud adoption, the cost association of one or more of these risk elements would be significant. This will yield a high Yuk value and thereby the NPV maximization value of α can slip below 1. Hence, if only a fractional adoption of cloud is happening in some sectors, then the cloud vendors have to assuage the fears of Yuk pertinent to that sector. Calculation of δ As part of this paper, the authors have gone ahead and determined the approximate value of δ . Creating a complete classification of IT assets – hardware, networks, firewalls, OS, applications, storage and the associated assets that comprise the IT purchase universe was the first step in determining δ . This was followed by the qualification of this list by running it through senior IT industry professionals who handle solution and product sales.

Finally, a list of 25 fairly independent IT asset classes was arrived at. As per the questionnaire, the percentages across these 25 asset classes add up to 100. The percentage-wise breakup of the total IT capital expenditure (in a non-cloud scenario) split across the pre-determined 25 different IT asset classes was then collected from respondents. The respondents – as previously mentioned – were from the vendor sample space. The respondents were also asked to indicate whether each of these asset classes could be moved to the cloud or not. In financial terms, our question was aimed at determining what all IT assets have the option to move from immediate capital expense to deferred operating expense. A total of 28 responses were received, which were divided into 4 groups of 7 random

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responses each. This was done to check the consistency of the mean values of each asset class across the 4 groups. A Single Factor ANOVA test was then run for each asset class to see if the variances across each of the 4 groups were statistically significant. These were found to be non-significant, implying that the random data had more or less consistent means across the groups.

The decision of movability of an asset to cloud was based on the choice of modal value of the 28 responses received for that asset class (modal value = 1 implies movability to cloud and modal value = 0 implies non-movability to cloud). For most of the asset classes, a modal agreement of more than 22 of the 28 respondents was obtained. The mean respondent value of those asset classes which had a mode of 1 (YES for Cloud) was aggregated to get the final value of δ . The frequency plot of the 28 responses for the δ values is plotted in Figure 3. Figure 3. The δ histogram of 28 responses The value of δ obtained was 0.595.

Cloud Computing and Modelling of Cash Flows for Full vs. Fractional Adoption of Cloud 117 Future Direction of Research The value of δ can be more accurately modeled with a larger sample size, an interactive way of filling up the questionnaire which reduces room for any ambiguities and further subdivision of the predefined asset classes from 25 sets to more finely divided sets. The fall in non-cloud operating expenses (Onc) is only a good approximation with a fitment only at the two extremities. Its step-wise non-linear behavior can be better modeled with field data. Finally, the factor that represents the unknown fears about cloud computing (Yuk) can be modeled

on an industry by industry basis. Some of the authors of this paper are independently working on the same.

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