

DOES E-INNOVATION INFLUENCE PERFORMANCE DIFFERENTLY? THE CASE OF VARYING LEVELS OF SMALL AND MEDIUM ENTERPRISES IN REGIONAL AUSTRALIA

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Purpose of your paper: Previous studies on the performance-innovation nexus among small and medium enterprises (SMEs) did not disaggregate, but generalized the same results to all levels of performance. Researchers implicitly assumed that the performance-innovation relationship is uniform across the relationship continuum for high, mid-level and low performing SMEs. In this study, we disaggregated performance into the lower, median and upper percentiles by employing quantile regression. Our findings indicated that the factors influencing performance differ from one level of performance to the other. Digital readiness did not significantly impact on the firms irrespective of their performance level but the best performers were influenced by e-business index. It was interesting to note that firms with ICT strategy, predominantly in the non-agricultural industry, scored lower on the index. The major contributions of this study are that the performance-innovation relationship differ by levels of performance and Solow's productivity paradox exists at the firm level. We recommend that rural policies should target low performing firms and researchers should adopt quantile regression in elucidating the differences in the performance-innovation nexus.

Key words: Performance–innovation nexus, Quantile regression, ICT strategy, productivity paradox

Introduction

Innovative business practices, particularly e-commerce facilitated by ICT and Internet services, have revolutionized the global economy but little is known about its impact on performance (Fillis et al., 2004; Sawhney and Zabin 2001). Consequently, the Internet and ICT in general are now major drivers of economic globalisation and a source of innovation with significant investment in related infrastructures and human capital (Gereffi 2001). There has been diverse uptake of digital technology in different industries with the agricultural sector being among the laggards (ABS 2014). However, the investment may not be sufficiently justified by the output. This little or negative return to ICT investment is referred to as Solow's productivity paradox (Dehning et al., 2005).

In Australia, SMEs account for 60% of employment and they constitute 99.7% of Australian firms but their startups have been declining with a consequent implication for job creation (Australian Government, 2015). Brody and Pureswaran (2015) noted that the potential impact of digital technology is enormous in the agricultural sector but farmers spend only about 1% of capital expenditure on it in contrast to their counterparts in other industries. Despite the fact that SMEs are major sources of economic growth, researchers are yet to sufficiently focus on the performance-innovation nexus as it relates to investments in ICT, Internet and innovation (e-innovation) in regional Australia (Gadenne and Sharma 2009; Xayavong et al., 2015). Where such studies exist, the outcomes are mixed and they focus on high-tech sectors at macro-scale (Parida et al., 2012).

Coad and Rao (2008), in a previous edition of this journal, examined R & D innovation in high-tech firms and concluded that innovation may have a positive or negative impact on performance and that the minor contribution of innovation to firm growth may result from the difficulties in measuring innovation. The issue of measurement challenges in performance-innovation studies have been well recognised by other researchers (Brynjolfsson, 1993).

SYNOPSIS

Insuring a better disability system part 2: transition to full scheme

Sarah Johnson

Key words: National Disability Insurance Scheme, disability, insurance based approach, monitoring

Purpose of your paper: To provide an update on the National Disability Insurance Scheme as it transitions from trial to full scheme.

Synopsis:

At the previous Actuaries Summit in May 2015 we discussed the role of the NDIS as a new type of insurance model in an area traditionally treated as welfare. At that stage, the Scheme was two years into its trial period and operating in six trial sites.

Two years on, the NDIS has entered a period of rapid growth with the transition to full scheme commencing on 1 July 2016. From supporting 30,000 participants during trial, the Scheme is expected to include 460,000 participants by 2019-20. The geographical spread of participants will also expand rapidly as participants phase into the Scheme.

This talk will give an update on Scheme experience, including participant numbers and characteristics, and committed supports. Actuarial monitoring of the Scheme, and the tools used to ensure financial sustainability, will also be discussed.

We will also consider some of the challenges to operating in such a dynamic and constantly changing environment, and how the NDIA is responding to those challenges.

SYNOPSIS

THEY NEED TO SMILE A BIT MORE: PERCEPTIONS OF ACTUARIES FROM OTHER PROFESSIONALS IN NON-TRADITIONAL AREAS

Julia Lessing and Alice Truong

Key words: human services, social services, wider fields, non-traditional areas, outcomes measurement, measuring social value

Purpose of your paper: Can actuaries use their skills to help our community's most vulnerable people? Is the actuarial brand valuable outside the financial services world? This presentation explores some examples about how actuaries have used their skills outside the financial sector and shares some insight into how other professionals see the value of the actuarial skillset.

Synopsis:

As a consulting team of actuaries working primarily outside the financial services industry, we are often asked questions such as:

- How can actuaries use their skills in the human services industry?
- How do you gain credibility if your clients don't know what actuaries can do?
- What are the actuarial standards you use in human services?

Our presentation steps through some examples about the work we've been involved in outside the financial sector. We believe there is a lot of potential for the actuarial profession to contribute in the human services space, and we will discuss some areas where we think further work is required.

We will also include the results of a survey of our human services clients and colleagues, where we asked a series of questions about what they think about actuaries, and whether they have helped them with their business problems.

Is private health insurance affordable in Australia?

Barry Leung

Key words: private health insurance, regulations, claims inflation, affordability

Purpose of your paper:

There has been a lot of media recently on the affordability of private health insurance and the likely impact of the increasing costs and potential flow through effects on the Australian health funding system. This paper aims to explore the impact of recent regulatory changes and other factors that affect the premium of health insurance, how it translates into the affordability of health insurance in Australia.

Synopsis:

55% of Australians have some form of health insurance in Australia as at 30 June 2016. It is an important component of the health funding system - 57% of all elective surgeries are funded by health insurance¹. It is also one of the most regulated industries, with significant support from the government including the private health insurance rebate, lifetime health cover provisions, and the Medicare Levy Surcharge arrangements for high income earners who do not take out health insurance.

Recently, questions have been raised on the affordability of health insurance – now and into the future. In January 2016, the Health Minister asked all health funds to provide additional information regarding possible premium increases for 2016 in an attempt to ensure consumers get the best deal. In her media release, the Minister noted:

“Feedback from the Government's consultations on private health insurance showed consumers have strong concerns about the affordability of their premiums; hardly surprising given premiums have increased at a rate of around 6 per cent per year for the past five years.”

Given the current debate on health insurance and its sustainability, it is timely to investigate what defines the “affordability” of health insurance policies, and understand the drivers of health insurance premium that consumer actually pays.

The aim of the paper is to:

1. Attempt to define an “affordability” measure for health insurance policies
2. Identify factors that drive health insurance premium and the contribution of each factor to the growth in premium payable by consumers over the last few years
3. Identify the impact of recent regulatory changes on premium paid by consumers
4. Project the future “affordability” of health insurance based on the measures identified above

SYNOPSIS

Fair's Fair? – An update on intergenerational equity

Richard Lyon

Key words: Intergenerational equity, cohort, macro economy, tax, welfare

Purpose of your paper: To further the Institute's capacity to contribute to public debate on matters relating to intergenerational equity

Synopsis: This paper follows on from the 2016 paper *Lies, Damned Lies and the 2015 Intergenerational Report* by Lyon & Amidharmo, in which the authors challenged actuaries to undertake research and thought leadership in relation to intergenerational equity.

The paper will report on the results of my investigations into cohort equity, using published national statistics.



SYNOPSIS

DATA DRIVEN PUBLIC POLICY: AN ACTUARIAL JOURNEY IN MATERNAL HEALTH

Jananie William

Maternal health, Health system costs, Public health, Public policy, Adverse birth outcomes, Classification and regression trees, Generalized linear models, Generalized linear mixed effects models, Administrative data, Australian Longitudinal Survey for Women's Health, Data linkage, External data.

Purpose of your paper: We use an actuarial approach to identify the risk factors of Australian maternal health costs, with a focus on women who experience adverse birth outcomes. We demonstrate the benefits of using actuarial techniques on a large linked dataset and highlight how the results can be used to inform public policy.

Synopsis: We use an actuarial approach to identify the risk factors of maternal health system costs in Australia, with a focus on women who experience adverse birth outcomes. There is a paucity of research in this area but the few international studies that report on maternal health costs found that they were significant and needed to be addressed. To date, however, no such studies have been conducted with Australian data. For the purpose of this study we define adverse birth outcomes as: premature birth, low birth weight, congenital conditions, stillbirth and neonatal deaths.

The aims of this research are threefold: to quantify the difference between maternal health system costs of women who experience adverse birth outcomes and those that do not ("cost differentials"), to identify risk factors that drive the maternal health system costs ("cost risk factors") and to use the results to inform maternal health policy. The analysis is split into two separate but related costing studies - hospital and out-of-hospital costing. The costs are considered from the perspective of the government to inform public policy so is specifically focused on how much the government spends in these two areas. In order to focus the hospital costing study on government costs only, the data is split by public and private patient status for comparison purposes. For the out-of-hospital study, Medicare benefits are assessed with an indicator for private health insurance status so differences between private and public patients are also analysed in this study. Considering maternal health costs from the perspective of government specifically excludes all other costs (for example, out-of-pocket costs incurred by individuals, private health insurance costs and all infant costs). The costing studies are also split into three sub-periods of the perinatal period as the drivers of cost are likely to be different for each sub-period. The sub-periods are the antenatal period (the pregnancy period), delivery period (which includes labour and delivery) and the postnatal period (covers one year following the date of delivery).

The data used for both studies is drawn from the Australian Longitudinal Study on Women's Health (ALSWH) and numerous administrative data linked with the survey data. The ALSWH is a national longitudinal survey of over 40,000 women in three age cohorts and provides a richness of information in women's physical and mental health; psychosocial aspects of health (socio-demographic and lifestyle factors); and use of health services. These data also provide excellent coverage of the perinatal period and give important insights into the woman's life. In addition numerous administrative data including Medicare Data for the out-of-hospital study; the NSW Admitted Patient's Data Collection (APDC), the NSW Perinatal Data Collection, Congenital Conditions Registry, Perinatal Death Review, ABS Register of Births, Deaths and Marriages and ABS Mortality Data (Deaths only) for the hospital study is linked with ALSWH to provide information regarding costs and adverse birth outcomes. The data was prepared for linkage by the Center for Health Record Linkage (CHeReL) and an extensive data linkage exercise is undertaken so that the data is fit for the purpose



of actuarial modelling. The final dataset consists of 2520 and 1875 women for the out-of-hospital and hospital study respectively.

We propose a two-phase modelling methodology that adopts actuarial methods from typical insurance claim cost modelling and extends into other statistical techniques to account for the large volume of covariates available for modelling. Specifically, Classification and Regression Trees (CART), Generalised Linear Model (GLMs) and Generalised Linear Mixed Models (GLMMs) are employed on the large linked dataset. Maternal health costs are modelled by considering inflationary effects over time; large and small costs; and frequency (service utilisation) and severity (average cost of service). These techniques have not been applied in previous research in this area and they contribute by providing a more in-depth understanding of the underlying drivers of maternal health costs. In particular, by including a large number of covariates (from both survey and administrative data) within a multivariate statistical analysis, each cost risk factor is considered in the presence of numerous other factors (including adverse births) in order to identify which cost risk factors are the most significant given the impacts of all other factors. This feature, in turn, will identify the most important areas on which to focus policy recommendations to improve the outcomes for these women in a cost-effective manner. The potential covariates are grouped into the six broad categories of demographics, health service use, health behaviours, psychological and physical health, obstetric and reproductive factors and over 200 factors are tested for significance in the models to ensure a complete picture of the maternal health costs is formed.

The results for both costing studies show that the mean maternal health system cost differentials (for adverse births) are substantial; with mean cost differentials of 23% and 27% for hospital and out-of-hospital costs, respectively. Notwithstanding the fundamental differences between our study and previous international studies both in terms of scope and methodology, these amounts are broadly in line with the existing international literature. Adverse births are also a statistically significant cost risk factor (even in the presence of other cost risk factors) in a few key areas: hospital delivery periods for public cases and out-of-hospital delivery and postnatal periods for both public and private cases. The findings of this study show that adverse births are only statistically significant from a cost perspective around the time of the occurrence of the adverse event (that is, during the delivery period and following into the postnatal period). The predicted cost differentials are also lower than the simple mean cost differentials as other cost risk factors also explain the variation in cost. This highlights the importance of considering the cost in a multivariate context as this approach enables a much more nuanced understanding of the actual impact of each risk factor on cost. Conversely, this finding also shows that adverse births are not a significant cost risk factor for a number of different segments (and time periods) too. It is not significant in the antenatal models for both private and public cases in both hospital and out-of-hospital models. In summary, the key cost risk factors vary substantially across hospital costs and out-of-hospital costs, patient status (private or public) and perinatal sub-period. The delivery period is the most notable for hospital costs as over 80% of the costs are incurred in this period. The key risk factors in this period are mode of delivery, private health insurance status, labour onset, diabetes, area of residence, adverse births and smoking status. For out-of-hospital costs, both the antenatal and postnatal periods are important and the key cost risk factors are IVF, specialist use, GP use, private health insurance status, area of residence, adverse births and mental health factors (including anxiety, intense anxiety, postnatal depression and stress about own health). Mental health factors dominated the out-of-hospital study with many of these factors significant in both the antenatal and postnatal period.

The findings of this research provide evidence of a number of key areas where health resources may be directed and each significant cost risk factor warrants further research. For example, the statistical significance of private health insurance status in both the hospital and out-of-hospital study suggests that the government's policies on private health insurance which encourage certain demographics to purchase insurance will impact quite significantly on maternal health costs so the complexity and interactions of the mixed public-private system is an area that is worth exploring further. Additionally,



mental health policy is identified as a priority area for further consideration given the dominance of these factors in many models. Numerous mental health initiatives are recommended based on collaboration with public health experts from ALSWH (Catherine Chojenta and Deborah Loxton) and findings from other studies that consider mental health disorders in the perinatal period. These initiatives include a national universal mental health screening protocol for antenatal and postnatal periods in conjunction with improved screening methods and health services that focus on holistic, proactive early intervention so that mental health problems are detected and treated early. While these recommendations are likely to require increased funding in some areas, the results of this study suggest they are worth exploring further as investing in preventative strategies are likely to reduce costs in the future and improve health outcomes when these women experience major life events such as the birth of a baby.

Finally, this study is the first time actuarial techniques have been applied to maternal health costs, and thus this work is an important example of how actuarial skills are transferrable from traditional areas of actuarial work to non-traditional areas. Many key principles from general insurance have been utilised in this study, namely: the use of exposure as a measure of risk; the use of numerous risk factors to explain cost drivers; inflationary considerations of cost over different time periods; segmentation of costs into different sub-periods; segmentation of costs into small and large; and separate analysis of frequency and severity of costs. This study shows that these types of actuarial techniques which have been used in insurance for decades are successfully transferrable to other disciplines – such knowledge translation offers insights that have previously been unavailable in research on maternal health costs. In addition to this important contribution of actuarial work, the use of the results to inform policy using a substantive evidence base with a focus on risks and collaboration with public health experts is an example of how actuaries can take advantage of their multidisciplinary skill-set in a public policy setting. In summary, this research brings together elements of numerous disciplines and applies a holistic approach to provide important insights into maternal health policy.

SYNOPSIS

Risk Equalisation – Time to Think Differently?

Ellen Bruce, Matthew Crane, Kris McCullough, Jamie Reid

Key words: Health funding, private health insurance, financial sustainability

Purpose of your paper: To examine how thinking differently about risk equalisation will help create a more sustainable private health insurance industry.

Synopsis: As health costs increase due to a range of demographic and other reasons, is Australia's current private health insurance (PHI) system sustainable?

Over 40% of hospital and medical costs pass through risk equalisation, making it central to the sustainability of PHI. Ongoing growth in the risk equalisation pool reduces the incentive for insurers to control claim costs, and makes PHI less attractive for people in good health.

The paper will:

- Estimate the size of the risk equalisation pool in 2030, identifying the drivers of change.
- Comment on the future impact of the risk equalisation pool on the sustainability of the Australian private health insurance model.
- Investigate whether alternative risk equalisation arrangements may be more sustainable.

SYNOPSIS

NEW SOLUTIONS FOR NEW PROBLEMS – AGEING, HEALTH AND RETIREMENT LIKE WE’VE NEVER SEEN BEFORE

Stuart Rodger

Synopsis: It's more than a decade since the "Ageing Population" issue began to move from an "in the future prediction" to a "we need to make policy decisions now" issue in many developed countries. In that time the problems and changes that arise when people live longer have become clearer. We are now reaching a time when the solutions and responses are starting to take shape. Using mainly the Australian examples, this presentation illustrates the way in which markets and societies are starting to adjust to this slow but fundamental change in the way human beings live their lives.

SYNOPSIS

Actuaries working to support public policy –developments in social welfare and beyond *Rosi Winn, Anjali Napoli, Mike Clough*

Key words: investment model, social welfare

Purpose of your paper: To provide information to delegates in relation to the actuarial work being done for the Federal Government to support policy development through the investment model approach to social welfare

Synopsis:

The presentation will:

- Explain what is meant by the investment approach to social welfare and provide some background on why the Federal Government has implemented this approach.
- Provide information on the role of the actuaries in developing the investment approach model
- Provide an overview of the actuarial model
- Discuss how the model is being used to support policy development.

We will also briefly discuss other areas of government where investment approaches are in use or under development

Note: This work is currently confidential, however we anticipate that this will no longer be the case in May 2017. The presentation content will be tailored to reflect the level of information that the Federal Government is prepared to make publically available at the time of the Summit.