Learning by doing: the role of financial experience in financial literacy

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Abstract: In this paper, we examine the impact of financial experience on financial literacy. Exploiting a unique feature of New Zealand, whereby domestic students can obtain interest-free student loans and can fully participate in the national retirement scheme while international students cannot, we employ an instrumental variables approach to identify the causal effect of financial experience on financial literacy. We conduct surveys on a sample of 338 business students and find that there is a positive and causal effect of financial experience on financial literacy. Our results have important implications for financial education programmes and may explain why many of these programmes to date have had limited success.

JEL Codes: A20, G00.

Key words: causality, financial experience, financial literacy, instrumental variable analysis

Introduction

Financial literacy can be defined as "the ability of consumers to make financial decisions in their own best interests in both the short- and long-term" (Mandell 2009, 5). This requires people to have a sound understanding of essential financial concepts, such as inflation, compounding interest and diversification of risk. A high level of financial literacy among the population is increasingly necessary as financial markets are becoming more complex

due to a greater diversity and sophistication in financial instruments. In addition, many governments are shifting the responsibility for retirement savings to individuals (Braunstein and Welch 2002; Lusardi, 2008). Hence, individuals need to understand the relationship between risk and return, how to assess risk, the concept of risk diversification and how to monitor the performance of their investments, taking into account fees and related transaction costs. Evidence to date suggests that only a small percentage of the public has the knowledge required to make sound financial decisions [CFS 2001; ANZ 2003; OECD 2005; Colmar Brunton 2006, 2009; Financial Services Authority (FSA) 2006; Lusardi and Mitchell 2011].

The economic consequences of poor financial literacy are enormous, with people having lower provisions for retirement savings and a greater reliance on debt, *inter alia*. Moreover, poor financial literacy is shown to affect the macroeconomic situation of a country, with less capital available for economic expansion, greater inequality in wealth distribution, exacerbated business cycles and reduced workplace productivity (OECD 2005; Mandell and Klein 2009). Government initiatives to improve financial literacy have largely been through financial education programmes. However, evidence suggests that the success of these programmes is limited.

One reason why general financial education programmes have had limited success may be because the relationship between literacy and the decisions that people make is not well understood (see e.g. Hilgert et al. 2003). Most studies find a positive relationship between literacy and decision making. This relationship may have been assumed (implicitly or explicitly) to indicate that financial education can influence financial behaviour and decision making, and may explain the overwhelming belief that financial education programmes can improve financial behaviour. However, the existence of a correlation between financial literacy and financial decision making does not indicate which one causes the other, i.e. we do not know the direction of causality. Arguments can be made for causality running in both directions, where either more financially literate people engage in more financial activity, or where people may learn from their financial experiences and therefore become more literate.

The aim of this paper is to address the causality problem in the relationship between financial literacy and experience. In particular, we examine the role that financial experience plays in improving financial literacy. Using a unique feature of New Zealand, specifically the existence of several financial products limited to permanent residents and citizens, we obtain a strong instrumental variable that allows us to determine the directional impact of financial experience on financial literacy. We conduct a survey containing questions that measure the respondents' financial literacy, financial experience and personal characteristics. In line with

previous literature, we find a positive correlation between financial experience and literacy. However, unlike previous studies, we are able to assert that there is a significant causal effect of experience on knowledge, suggesting that more financial experience leads to greater financial knowledge.

Our findings suggest that people with more financial experience acquire more financial knowledge either through self-education or by becoming more receptive to financial education programmes. This has important implications for policy makers and financial education programmes. Specifically, it questions the efficacy of general financial literacy programmes, suggesting they cannot be relied upon solely to improve financial decision making. Our results indicate that the design of general financial education programmes may need to be re-evaluated and perhaps include experiential components, such as stock market games.

The rest of this paper is structured as follows. The section 'Financial literacy' reviews the literature on financial literacy, its consequences and the evidence on the effectiveness of financial education programmes. The section 'The causality between financial literacy and financial experience' addresses the endogeneity issue between financial literacy and financial experience and discusses the specific instrument we employ in this paper. Section 'Survey and sample' discusses the survey employed and how it was administered. The section 'Results' presents the results for traditional ordinary least-square (OLS) as well as for the instrumental variables approach. Finally, the section 'Conclusions' concludes and provides some implication of our research.

Financial literacy

A considerable amount of research has focused on measuring the level of financial literacy in different countries. In 2005, the OECD published a report that summarised financial literacy surveys that had been conducted in 12 of its member countries. The report noted a low level of financial literacy in all these countries, including the US, UK, Australia, Japan, France, Germany and Italy, among others. Other studies find a similar lack of financial literacy. Lusardi and Mitchell (2011), for instance, examine financial literacy in seven countries: Germany, the Netherlands, Sweden, Italy, Japan, New Zealand and Russia, and find poor levels of financial literacy in all of these countries. In addition, similar results have been found in the UK (Banks and Oldfield 2007), a survey of European individuals (Christelis et al. 2010), the US (Hilgert et al. 2003; Moore 2003) and repeated surveys in Australia (ANZ 2003, 2005, 2008, 2011) and New Zealand (Colmar Brunton 2006, 2009). Mandell (2008) further

reports low financial literacy in five cohorts of high school seniors in the US between 1999 and 2008. Overall, the literature provides compelling evidence for persistent and pervasive problems with the level of financial literacy.

Numerous studies have identified the serious consequences of poor financial literacy, including being more likely to make financial mistakes (Agarwal et al. 2009), saving less (Bell and Lerman 2005) and failing to make plans for retirement (Lusardi 1999; Lusardi and Mitchell 2011). In combination with limited savings, individuals with poor financial literacy tend to rely more on debt (Lusardi and Tufano 2009) and make more use of expensive debts like credit cards and predatory lenders (Hilgert et al. 2003). Those with poor financial literacy also underestimate the effect of compound interest and, therefore, accumulate less wealth (Stango and Zinman 2011), are more likely to be behind in their mortgage repayments or in the process of foreclosure (Hirad and Zorn 2001), are more likely to experience bankruptcy proceedings (Lusardi and Mitchell 2009), and are particularly susceptible to financial crises (Anderson et al. 2004). On the other hand, better financial literacy results in greater stock market participation (Kimball and Shumway 2006; Van Rooij et al. 2011a) and a greater propensity to invest in lower cost mutual funds (Hastings and Tejeda-Ashton 2008; Hastings et al. 2010; Hastings and Mitchell 2011).

Of greater concern for policy makers are the macroeconomic consequences of poor financial literacy. It has been shown that low levels of financial literacy within a country affect the overall economy, where lower savings result in less capital available for expansion, greater inequality in wealth distribution, exacerbated business cycles and reduced workplace productivity (OECD 2005 among others; Mandell and Klein 2009). The US Federal Reserve has also highlighted the importance of financial understanding for the efficient functioning of the capital markets (Greenspan 2003, 2005).

Governments and policy makers have spent considerable time and effort to address the persistent and pervasive poor levels of financial literacy. The predominant method used to overcome this weakness has been through financial education.[1] Financial education programmes have been provided in many settings, such as inclusion in high school curricula (Bernheim et al. 2001; Sherraden et al. 2007; Mandell 2008), workplace education programmes (Bernheim and Garrett 2003), education efforts by banks (Braunstein and Welch 2002) and advertisements

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[1] Evidence of this can be seen in calls for the inclusion of compulsory financial literacy education into schools in the US (National Association of State Boards of Education 2006; National Council on Economic Education 2008).

and web-based solutions. To date, however, evaluations of these programmes have generally shown little success in improving financial literacy and changing financial behaviour (Braunstein and Welch 2002; Lyons et al. 2006; Mandell 2008).

Bernheim et al. (2001) examine the relationship between financial education and an individual's savings rate. They survey individuals who graduated from high school in the US between 1964 and 1983 and split individuals based on whether the state in which they attended high school required a financial education programme or not. While the study shows that those who had undertaken a financial education programme at high school had a higher savings rate, many respondents could not recall whether they had attended a programme or not.

A survey of the literature by Braunstein and Welch (2002) concludes that programmes that take a specific goal-orientated approach to financial education, such as those aimed towards improving home ownership (Hirad and Zorn 2001), improving workplace retirement scheme participation (Bayer et al. 1996; Lusardi and Mitchell 2009) or offering credit counselling (Elliehausen et al. 2003) have a positive effect on financial behaviour. However, other studies find that similar goal-orientated programmes like retirement seminars are ineffective in changing financial behaviour (Madrian and Shea 2001; Duflo and Saez 2003; Choi et al. 2006). Braunstein and Welch (2002) also conclude that more general programmes aimed at improving overall financial knowledge, as opposed to providing just goal-orientated information, have limited success. For example, Mandell (2008) examines the financial literacy of high school seniors via a national survey conducted periodically by the Jump$tart coalition.[2] He finds no improvement in the knowledge of participants who have undertaken a full-semester money management or personal finance course. Mandell and Klein (2009) conclude that students who have undertaken a financial management course between one and four years earlier were no more literate, nor did they demonstrate better financial behaviour than those who had not undertaken the course. In contrast, Mandell (2009) finds that a one-semester course on financial management at high school alters financial behaviour by improving behaviour around credit cards, reducing cheque bouncing and increasing savings adequacy in college students.

While the efficacy of financial education programmes in improving financial literacy is limited, several studies find that financial experience can make people more receptive to financial education. Bradley et al. (2001) find

[2] For more information on the Jump$tart coalition and the surveys conducted see www.jumpstart.org

that the major source of learning of their participants was a difficult financial experience. Weiner et al. (2005) find marked improvements in financial behaviour as a result of a financial education programme aimed at those in bankruptcy. Mandell (2008) finds that participation in a stock market game results in a 6–8 per cent improvement in financial literacy among respondents. These studies suggest that financial experiences make people more receptive to financial education programmes, and improve financial literacy and financial behaviour.

The above-mentioned literature suggests that experience plays an important role in a person's motivation to become financially literate. To date, many education programmes have been relying on the assumption that, if people undertake financial education, they will increase their financial literacy and improve their financial behaviour. However, the relationships between financial education, literacy and behaviour may be more complex than this. If experience with financial products or with specific financial situations drives a person's motivation to acquire financial literacy (either by increasing a person's internal motivation to acquire financial literacy or by making a person more receptive to financial education programmes), then many of the education programmes to date may not have been very effective, especially those targeted at a general audience. Given that experience may be crucial in motivating a person to become more financially literate, we examine the causal effect of financial experience on financial literacy.

The causality between financial literacy and financial experience

The endogeneity problem

The existing literature has established a positive correlation between financial literacy and experience (e.g. see Hilgert et al. 2003). This correlation may, either implicitly or explicitly, have been assumed to indicate a causal relationship, i.e. that literacy affects experience. This could explain the belief that financial education programmes can improve financial behaviour (National Association of State Boards of Education 2006; National Council on Economic Education 2008). However, arguments can be made for causality running in both directions, where either more financially literate people engage in more financial activity and therefore become more experienced, or where people may learn from their financial experiences and therefore become more literate. A simple correlation between the two variables (or a cross-sectional regression of one on the other) cannot identify the causal relationship between them if both financial experience and financial literacy affect each other. If both

affect each other, an OLS regression of one on the other leads to a simultaneity bias.

To illustrate this simultaneity issue in the context of financial literacy and financial experience, consider the following two models

$$\text{FinLit}_i = \alpha_1 + \beta_1 \text{FinExp}_i + \gamma_1 \text{Controls} + \varepsilon_i \qquad (1)$$

and

$$\text{FinExp}_i = \alpha_2 + \beta_2 \text{FinLit}_i + \gamma_2 \text{Controls} + \eta_i \qquad (2)$$

The first equation aims to explain financial literacy (FinLit) with financial experience (FinExp) and the second equation aims to explain financial experience with financial literacy. Using OLS, we cannot distinguish between Equations (1) and (2) as they are essentially identical. This illustrates the simultaneity/endogeneity issue as both financial literacy and financial experience are determined simultaneously. However, we can determine the causal effect of one on the other [i.e. we can estimate either Equation (1) or (2)] if we find proper instrumental variables.

Identification strategy: instrumental variable analysis

In this paper, we aim to provide new evidence for the impact of financial experience on financial literacy [Equation (1)]. Estimating the causal effect of financial experience on financial literacy cannot be achieved through an OLS regression due to the simultaneity problem (i.e. there are potential causal effects running in both directions, where more financial experience may lead to better financial literacy and vice versa). However, the simultaneity bias introduced can be solved by instrumental variable analysis.[3]

The key to instrumental variable analysis is finding a strong and valid instrument. A strong and valid instrument has two key features. First, an instrument should correlate strongly with the variable of interest (in our case, we need a variable that strongly correlates with financial experience). Second, a valid instrument is one that is uncorrelated with the residual in Equation (1). In other words, the instrument should not affect financial literacy, except through its relationship with financial experience and after controlling for other factors that may explain financial literacy. Although the first condition can be tested (by means of correlation, regression analysis, etc.), the second condition cannot be tested in the case of a single instrument. A common issue with

[3] See also Wooldridge (2010).

instrumental variables is the difficulty of identifying a valid (one that meets the second condition) instrument.

The instrumental variable is essentially used to construct a proxy for financial experience, which has the property of being uncorrelated with the residuals in Equation (1). This proxy can be constructed by running a regression of financial experience on the instrumental variable and various other controls. This regression is also known as the first-stage regression, i.e.

$$\text{FinExp}_i = \alpha_1 + \beta \text{IV}_i + \gamma_{ik}\text{Control}_{ik} + v_i \qquad (3)$$

where FinExp_i is the observed measure of financial experience of individual i, IV_i is the instrumental variable and Control_{ik} are a set of k control variables that are also included in the second-stage regression. From this first-stage regression, we obtain a proxy for financial experience, i.e.

$$\hat{\text{FinExp}_i} = \hat{\alpha} + \hat{\beta}\text{IV}_i + \hat{\gamma}_{ik}\text{Control}_{ik} \qquad (4)$$

where $\hat{\alpha}, \hat{\beta}$ and $\hat{\gamma}$ are the estimated coefficients of the first-stage regression and $\hat{\text{FinExp}_i}$ is the estimated value of FinExp_i. Note that, by definition, FinExp_i and $\hat{\text{FinExp}_i}$ have a one-to-one relationship (a regression of FinExp_i on $\hat{\text{FinExp}_i}$ produces an intercept of zero and a slope coefficient of one). Furthermore, if the instrumental variable is uncorrelated with the residuals in Equation (1), then, by definition, $\hat{\text{FinExp}_i}$ will also be uncorrelated with these residuals. Hence, we can estimate the second-stage regression as

$$\text{FinLit}_i = \alpha + \beta_{\text{IV}}\hat{\text{FinExp}_i} + \delta_k\text{Control}_{ik} + \varepsilon_i \qquad (5)$$

where we substitute our uncorrelated estimates of $\hat{\text{FinExp}_i}$ for FinExp_i into the section-stage regression. We can now interpret the coefficient β_{IV} as measuring the causal effect of financial experience on financial literacy.

The difficulty, as discussed above, is in identifying a valid instrument, specifically, one that meets the two conditions. Although the first condition can be tested (in the first stage regression), the second condition cannot be tested, and one must assume the second condition to be valid. The use of instrumental variables can be questioned on whether the instrument meets the second condition. Where an instrument meets both conditions, i.e. a strong and valid instrument is found, then the instrumental variables approach offers an econometrically robust method for solving the simultaneity problem.

Several recent studies have used instrumental variables to examine the effect of financial experience on financial literacy or vice versa. The causal effect of financial literacy on financial experience has been examined by Van Rooij et al. (2011a, 2011b). Van Rooij et al. (2011a) examine the

relationship between financial literacy and stock market participation and find a causal and positive effect of financial literacy on stock market participation. They employ the financial situation of the oldest sibling as an instrument for financial literacy, assuming that financial literacy may be higher when people can learn from those around them, but that the financial situation of others has no marginal effect on an individual's stock market participation. In assessing the role of financial literacy in retirement planning, Van Rooij et al. (2011b) use economic knowledge acquired in high school as an instrument for financial literacy, assuming that people who acquired more economic knowledge in high school are financially more literate, but that this acquired knowledge does not affect retirement planning (apart from its effect through financial literacy).

The causal effect of financial experience on financial literacy has been examined by Dvorak and Hanley (2010). They use the participant's age as an instrument for contributions to retirement funds, assuming that age affects retirement contributions but has no marginal impact on financial literacy. They contend that "while some general skills are simply acquired with age, financial literacy requires a set of analytical and mathematical skills that do not increase with age" (Dvorak and Hanley 2010, 650), and conclude that there is a positive causal effect of retirement contributions on financial literacy. However, retirement contributions represent only one way of gaining financial experience. In our study, we consider financial experience in a broader sense and examine its impact on literacy.

We assess the causal effect of financial experience on financial literacy using an instrument based on whether a respondent is a permanent resident or citizen of New Zealand. Based on a financial experience index that exploits features specific to New Zealand, we argue that the international status of respondents is a strong, valid instrument. Specifically, New Zealand offers several financial products that are restricted to New Zealand citizens and permanent residents. In particular, local residents are able to gain access to interest-free student loans for higher education[4] and the recently created New Zealand retirement scheme, KiwiSaver.[5] Given that these products are only available to citizens and permanent residents, financial experience (an index we construct based on experience with or

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[4] For this reason, we conduct our analysis on a sample of university students.
[5] Note that many domestic students participate in the KiwiSaver scheme, as information on enrolment into the scheme is provided to anyone starting any form of employment in New Zealand. Furthermore, the scheme provides considerable monetary incentives for enrolment into the scheme including a $1,000 kick-start from the government, compulsory employer contributions for participants and tax credits. As a result of the generous financial incentives, we observe that 52 per cent of our respondents are currently members of KiwiSaver.

exposure to financial products including student loans and KiwiSaver – see the section 'Financial experience index') is higher, on average, for domestic students than for international students. Consequently, we expect that a dummy variable for whether a student is international or not correlates highly with the financial experience index that we construct. We can test the strength of this relationship in the first-stage regression.

Moreover, we do not expect a relationship between whether a student is international or not and the residuals in Equation (1). Stated differently, we do not expect an innate difference in financial literacy between domestic and international students beyond the differences in financial literacy caused by the differences in financial experience and differences in other factors that we control for (such as ethnic/cultural background, age and gender). This second condition is an identifying assumption that we have to make and is something that cannot be tested. We therefore suggest that a dummy variable for whether a student is international or not is a strong and valid instrument for financial experience, and allows us to assess the causal effect of financial experience on financial literacy.

Survey and sample

We assess the relationship between financial experience and literacy by conducting a survey on 338 first-year business students.[6] New Zealand universities have a large number of students with interest-free student loans and a relatively high proportion of international students who are ineligible for either KiwiSaver or student loans.[7]

In Appendix 1, we present the survey questions. The survey contains 19 questions covering three areas: understanding of financial concepts, financial activity and experience, and demographics. Understanding of financial concepts is tested in eight questions covering time value of money, compounding interest, diversification, real versus nominal interest rates, risk, market effects of interest rate changes, how loans function and financial planning. These topics have been included in other surveys testing financial literacy, including the Financial Knowledge Survey (Colmar Brunton 2009) conducted in New Zealand on behalf of the Retirement Commission, the Financial Literacy of Young American Adults (Mandell 2008) and the Financial Capability around the World

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[6] This survey was conducted at the Faculty of Business and Law, Auckland University of Technology in 2011.

[7] A substantial proportion of the student population in New Zealand universities is international, having various ethnic and cultural backgrounds. In addition, the population in Auckland, where about a third of total population of New Zealand lives, has a diverse ethnic and cultural background.

Surveys (Lusardi and Mitchell 2011) conducted by the Financial Literacy Center at Dartmouth University. These questions therefore represent pre-tested and validated questions. We construct an overall financial literacy score by summing the number of correct responses to the eight financial literacy questions. Respondents are further asked about their experience with various financial instruments that are common in New Zealand. These include savings, credit cards, and various types of debt and financial assets. The final set of questions is related to the demographics of respondents. Prior financial literacy surveys have established that various demographic features are indicative of those with better financial literacy including age, gender, ethnicity and wealth. We employ parental education as a proxy for the effects of wealth. Finally, we consider the educational background of respondents in high school, as certain subjects are likely to indicate either an interest in or specific education on financial topics (see also Van Rooij et al. 2011b).

Results

Sample composition

Panel A of Table 1 presents the demographic composition of the sample. We expect our sample to be composed of relatively young people as we examine university students, and therefore split the sample into an 18–24 category and a 25+ category. We observe that 85 per cent of the sample falls into the young adult category while the remaining 15 per cent are 25 or older. The sample is relatively even in terms of gender with 50.7 per cent of the sample being male. Slightly more than a quarter of our respondents are classified as international students, meaning they are not citizens or permanent residents of New Zealand. We note that the sample is dominated by respondents who identify themselves as Asian (41 per cent) followed by European (29 per cent),[8] Maori and Pacific Islander (14.5 per cent), Indian and Middle Eastern (12.4 per cent) and other (7.4 per cent). Most of the respondents indicate that the highest level of education of their parents is high school (39.3 per cent), followed by a bachelor's degree (27.5 per cent), trade certificates (17.8 per cent) and postgraduate degrees (13.9 per cent). Finally, we examine whether respondents studied particular subjects in high school that may impart financial literacy, such as business subjects or mathematics. We observe that accounting (31 per cent) and business studies (27 per cent) occur at

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[8] Note that many New Zealanders of the British ancestry classify themselves as European or New Zealand European. Maori people are the indigenous people of New Zealand.

Table 1. Summary statistics

	Number	Percentage
Panel A: Demographic information		
Age		
18–24	288	85.2
24+	50	14.8
Gender		
Male	171	50.7
Female	166	49.3
Residence status		
International	96	28.6
Domestic	240	71.4
Ethnicity		
European	98	29.0
Maori and Pacific Islanders	49	14.5
Asian	139	41.1
Indian and Middle Eastern	42	12.4
Other	25	7.4
Parents' education		
No high school	14	4.1
High school	133	39.3
Trade certificate/diploma	60	17.8
Bachelors	93	27.5
Post graduate	47	13.9
Previous education		
Accounting	105	31.1
Business studies	91	26.9
Economics	135	39.9
Mathematics	227	67.2
Panel B: Financial experience		
Assets		
Savings	223	66.2
Term deposit	71	21.0
Stocks	23	6.8
Bonds	18	5.3
Mutual funds	14	4.1
KiwiSaver	130	38.5
Liabilities		
Credit card	143	42.3
Repay monthly	89	61.8
Hire purchase	52	15.4
Personal loan	61	18.0
Student loan	215	63.6
Panel C: Financial knowledge		
Q1 – Time value of money	153	46.1
Q2 – Compounding interest	252	75.0
Q3 – Diversification	103	30.8

Table 1   *(Continued)*

Q4 – Inflation	223	66.8
Q5 – Risk	219	65.0
Q6 – Interest and exchange rates	140	42.7
Q7 – Loan security	95	28.4
Q8 – Life insurance	157	48.2

Notes: Summary statistics on the information collected in the surveys are shown. In total 338 responses to the survey were received. Panel A reports demographics information collected: age, gender, ethnicity, parents' education and previous studies taken in high school. Panel B reports summary statistics on financial experience arranged by experience with assets and liabilities. Panel C reports summary statistics on the financial knowledge questions.

similar rates while economics (40 per cent) is more prevalent among the respondents. Mathematics occurred at a higher rate than business-orientated subjects (67 per cent).

Panel B of Table 1 presents summary statistics on the financial experience of the respondents. We split experience into assets and liabilities as they represent different experiences. Liabilities, in particular, are likely to represent situations where people might have made poor financial decisions and therefore do not represent good experiences (except for interest-free student loans). We observe that two-thirds of the respondents save on a regular basis. More than 50 per cent of the domestic respondents participate in the retirement saving scheme, KiwiSaver. Term deposits are the next most common (21 per cent), but experiences with more advanced instruments like stocks, bonds and mutual funds are low, between 4 and 7 per cent.[9] With respect to liabilities, 85 per cent of the domestic respondents have experience with student loans, but other experiences with financial instruments are more limited. For example, 40 per cent of the sample has a credit card, and less than 20 per cent of the sample has experience with personal loans and hire purchases.

In Panel C of Table 1, we report the number and percentage of correct answers per financial knowledge question. Although the majority of the respondents correctly answer questions with regards to compounding, inflation and risk, many struggle with the concepts of diversification and loan security. Given the relatively basic nature of these questions, these statistics represent a relatively low level of financial knowledge. To put the results in context, Lusardi and Mitchell (2011) notes that

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[9] The lack of investment experience in this area may be due to the youth of the sample and the lack of disposable income.
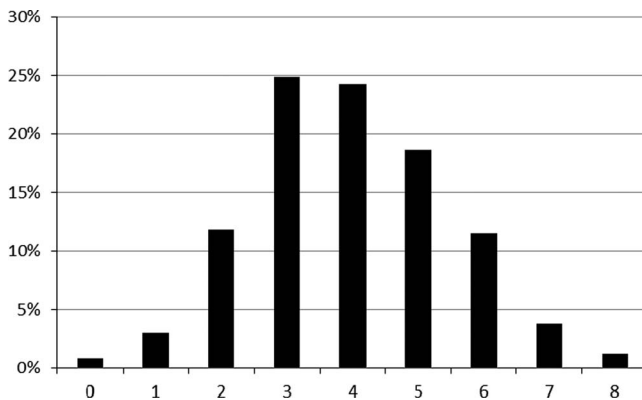
Figure 1 Respondents by financial literacy score.

New Zealanders in general correctly answer questions on compounding, real interest rates and diversification, 86, 81 and 27 per cent of the time, respectively. In our sample, respondents got equivalent questions correct 70, 65 and 30 per cent of the time, a notably worse performance on compounding and real interest rates. This is likely a result of the relatively lower financial knowledge of the first-year university cohort.

Financial literacy scores

To examine the financial literacy of our respondents, we create a financial literacy score based on the number of correct responses to the eight financial questions. Figure 1 provides a distribution plot of the financial literacy score. The plot reveals that the financial literacy score has a symmetric distribution, with the majority of respondents scoring either a 3 or 4 (the respondents had an average financial literacy score of 3.97).

Panel A of Table 2 splits the sample based on demographic factors. We observe significant differences in financial literacy based on personal characteristics. On average, older students, who may be expected to have greater financial literacy as a result of greater exposure to financial matters, score slightly higher although not significantly so. We observe that male respondents have a significantly higher financial literacy score (0.45 points higher) than female respondents, a finding that is corroborated by Dvorak and Hanley (2010) and Van Rooij et al. (2011a), among others. Domestic students score nearly 0.40 higher, on average, than their international peers. There are also significant differences between the scores of different ethnicities. Specifically, respondents identifying

Table 2. Summary statistics on financial literacy scores

	Average	Difference
Panel A: Financial literacy by demographics		
Age		
18–24	3.93	
24+	4.22	−0.29
Gender		
Male	4.18	
Female	3.73	0.45***
Residence status		
International	3.69	
Domestic	4.08	−0.39**
Ethnicity		
European	4.37	0.56***
Maori and Pacific Islanders	3.71	−0.30
Asian	3.97	0.00
Indian and Middle Eastern	3.36	−0.70**
Other	3.64	−0.36
Parents		
No high school	4.14	0.18
High school	3.91	−0.10
Trade certificate/diploma	4.10	0.16
Bachelors	4.01	0.06
Post graduate	3.94	−0.04
High school studies		
Accounting	3.91	−0.08
Business studies	4.00	0.04
Economics	4.09	0.20
Mathematics	4.00	0.09

	Yes	No	Difference
Panel B: Financial literacy by financial experience			
Assets			
Savings	3.98	3.97	0.01
Term deposit	4.14	3.93	0.22
Stocks	4.61	3.92	0.68*
Bonds	4.00	3.97	0.03
Mutual funds	4.50	3.95	0.55
KiwiSaver	4.12	3.88	0.25*
Liabilities			
Credit card	3.84	4.07	−0.23*
Repay monthly	3.88	4.00	−0.13
Hire purchase	3.87	3.99	−0.12
Personal loan	4.28	3.90	0.38*
Student loan	4.04	3.85	0.20

Notes: Summary statistics on the financial literacy score are reported. Financial literacy is calculated as the sum of the correct responses to the eight financial understanding questions. Panel A reports the financial literacy scores by demographics, while Panel B reports the financial literacy scores by financial experience. Difference is calculated as the difference in mean of those in a category against all other respondents. Significance is assessed using a *t*-test. ***, **, * for significance at the 1, 5, 10% levels, respectively.

themselves as European score half a point more than non-Europeans, while respondents identifying themselves as Indian score 0.70 less, on average. Neither the education of parents, nor the subjects that respondents themselves studied at high school, have a significant impact on the level of financial literacy. The latter is supportive of Mandell's (2008) findings, which show that high school programmes teaching financial education in the US are largely ineffective in improving literacy. Given the emphasis on financial education as a solution to poor financial literacy, the lack of significant difference in financial knowledge as a result of taking subjects closely related to basic financial concepts raises questions about the efficacy of education programmes.

Panel B of Table 2 presents evidence on the relationship between financial experience and literacy. We observe that there are significant differences in respondents' literacy based on their experience with four particular financial products, specifically, stocks and KiwiSaver on the asset side and credit cards and personal loans on the liabilities side. Interestingly, credit cards are actually associated with a significant decline in financial literacy, implying that those without credit cards are more financially knowledgeable. Those with experience of personal loans appear to be more financially literate.

Financial experience index

To examine the relationship between financial experience and financial literacy, we create four indices based on respondents' experience with financial instruments. The first index is the sum of the financial assets that the respondent has experienced plus student loans and subtracts experience of other liabilities. We give credit cards, personal loans and hire purchases negative weights as they represent (mostly) poor financial decisions. For instance, hire purchases typically represent expensive borrowing for depreciating assets. By contrast, we give student loans a positive weight, as they are interest-free and have voluntary repayment bonuses for early repayments, making them potentially very profitable "liabilities". Our second version of the index is calculated by first grouping the financial instruments into five categories: savings, investments, debt, KiwiSaver and student loans. Savings is defined as 1 if the respondent had either regular savings or experience with term deposits and 0 otherwise; investments is defined as 1 if respondents had experience with either stocks, bonds or mutual funds (and 0 otherwise); debt is defined as 1 if a respondent had experience of credit cards, hire purchase or personal loans (and 0 otherwise). The second financial experience index is then calculated as the sum of savings, investments, KiwiSaver and

student loans less debt. Our two financial experience indices have a correlation of 0.85.[10]

The first two indices are based on the view that experiences with so-called "dumb debt" instruments would indicate financial inexperience. These instruments represent expensive debt. As a result, the financial literacy literature has treated exposure to these instruments as symptomatic of making poor financial decisions (Hilgert et al. 2003). However, it may be that, while these instruments indicate financial inexperience, experiences with these products may result in learning moments and so may improve financial literacy. For instance, Weiner et al. (2005) find that financial education aimed at those in financial distress, often a result of misuse of debt, results in marked changes in financial behaviour. Given that the literature provides no clear guidance on the treatment of experiences with debt instruments, we construct alternative financial experience indices that give experience with debt instruments a positive weight as opposed to a negative weight.[11] As such, the third index is constructed as the sum of all financial instruments a respondent has had. The fourth financial experience index again classifies instruments into one of five classes: savings (saving or term deposit), investments (stocks, bonds and mutual funds), debt (personal loans, hire purchases and credit cards), KiwiSaver and student loans. Experience in a class results in that class being assigned a 1, or a 0 otherwise. We then sum the five classes.

Table 3 presents our financial experience indices split on demographic factors. Given that indices 1 and 2, and indices 3 and 4 are constructed in similar ways, we observe high degrees of overlap between the indices 1 and 2, and indices 3 and 4. For indices 1 and 2, we find that older respondents have significantly lower financial experience scores. For indices 3 and 4, we find that this relationship reverses. Given that the only difference between indices 1 and 2 and 3 and 4 is in the way we treat debt (which in indices 1 and 2 is assigned a negative weight, whereas in indices 3 and 4 it is assigned a positive weight), this suggests that older respondents have greater experience with debt. We find only weak evidence of significant differences in financial experience between men and women, with men having slightly more experience with financial products than women in all of the four indices. When we look at the relationship

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[10] Note the construction of a financial experience index will always have some degree of subjectivity. When an index is not constructed correctly, this introduces an errors-in-variables bias, which typically biases estimated coefficients towards 0. However, the use of instrumental variables corrects for this bias and makes our results based on TSLS less prone to errors introduced in the construction of the index.

[11] We thank an anonymous referee for this suggestion.

Table 3. Financial experience and demographics

	Financial experience 1	Difference	Financial experience 2	Difference	Financial experience 3	Difference	Financial experience 4	Difference
Age								
18–24	1.41		1.39		2.70		2.41	
24+	0.70	−0.71***	1.04	−0.35**	3.42	0.72***	2.68	0.27*
Gender								
Male	1.40		1.43		2.93		2.57	
Female	1.21	−0.19	1.24	−0.20*	2.70	−0.23	2.33	−0.25**
Residence status								
Domestic	1.60		1.72		2.98		2.67	
International	0.56	−1.04***	0.41	−1.31***	2.38	−0.60***	1.88	−0.79***
Ethnicity								
European	1.78	0.67***	1.85	0.71***	2.98	0.24	2.72	0.39***
Maori and Pacific Islanders	1.37	0.08	1.65	0.36**	3.16	0.41**	2.80	0.41**
Asian	0.92	−0.65***	0.84	−0.83***	2.65	−0.28*	2.17	−0.47***
Indian and Middle Eastern	1.38	0.09	1.5	0.18	2.81	0.00	2.55	0.12
Other	1.36	0.06	1.56	0.24	2.80	0.02	2.44	−0.01
Parents' education								
No high school	1.64	0.36	1.64	0.32*	2.50	−0.32	2.36	−0.09
High school	1.40	0.17	1.44	0.17	2.86	0.09	2.51	0.11
Trade certificate/diploma	1.23	−0.08	1.45	0.13	3.23	0.51***	2.78	0.41***
Bachelors	1.30	0.07	1.22	−0.16	2.67	−0.20	2.30	−0.20
Post graduate	1.30	−0.01	1.36	0.02	2.83	0.02	2.47	0.03

Table 3   *(Continued)*

Previous education								
Accounting	1.30	0	1.36	0.03	2.91	0.14	2.49	0.06
Business studies	1.54	0.32***	1.57	0.32**	2.97	0.21	2.65	0.28
Economics	1.36	0.10	1.39	0.07	2.77	−0.07	2.42	−0.04
Mathematics	1.36	0.18	1.40	0.18	2.75	−0.17	2.44	−0.02

Notes: Financial experience scores by demographics are reported. Difference is calculated as the difference in mean of those in a category against all other respondents. Financial experience 1 is calculated as the sum of the financial assets respondents had experience with plus student loans, minus financial liabilities. Financial experience 2 is calculated as the sum of savings plus investments plus KiwiSaver and student loans minus debt. Savings was defined as 1 if the respondent either saved regularly or had experience of term deposits. Investments equalled 1 if the respondent had experience of stocks, bonds or mutual funds. Debt equalled 1 if the respondent had experience of personal loans, credit cards or hire purchases. Significance was calculated using a *t*-test.
***, **, * for significance at the 1, 5, 10% levels, respectively.

between residency status and financial experience, we find large and highly significant differences, where domestic students score significantly higher on the experience index than international students. This provides strong initial evidence that our instrument, the international student dummy, meets the first condition of an instrument, namely a strong relationship with the variable of interest, financial experience. Respondents of European ethnicity have significantly higher financial experience scores (except for index 3), while Asian respondents have significantly lower financial experience scores. We find some role for parents' education in financial experience and a positive significant relationship between respondents who studied business studies in high school and financial experience for indices 1 and 2.

Regression analysis of the relationship between financial experience and financial literacy

We next investigate the relationship between financial experience and financial literacy in a regression framework. As we mentioned in the section 'The causality between financial literacy and financial experience', the presence of a simultaneity issue, where experience could improve literacy or vice versa, may cause the results from OLS regressions to be biased. If there is an endogeneity issue, then we cannot give causal interpretations to the results from an OLS regression.

In this section, we present regression results for the relationship between financial experience and financial literacy. We start by presenting the results for the first-stage regression, where we regress the international dummy on the various financial experience indices. We then present the results for OLS regressions together with the results for the two-stage least squares regressions (TSLS).

In Table 4, we present the results of the first-stage regression of financial experience on the dummy international and various control variables, i.e.

$$\text{FinExp}_i = \alpha + \beta \text{D\_International}_i + \gamma_{ik} \text{Control}_{ik} + v_i \qquad (6)$$

where D_International$_i$ is a dummy variable for whether a student is international or not. The control variables we use include age, gender and ethnicity dummies. We further control for parents' education and previous studies by creating two indices. Specifically, we define parents' education as 0 if they did not complete high school, 1 if they did complete high school, 2 if they have a trade certificate or diploma, 3 if they have a bachelor's degree and 4 if they have a degree higher than a bachelor's degree. We define previous education as the sum of the student's experience with the four high school subjects we examine: accounting, business

Table 4. First-stage regression of financial experience on international dummy

	Financial experience 1	Financial experience 2	Financial experience 3	Financial experience 4
Constant	3.831***	3.123***	1.1042**	2.035***
	(8.30)	(8.71)	(2.09)	(4.86)
International	−0.9610***	−1.182***	−0.5298***	−0.6863***
	(−5.70)	(−9.03)	(−2.75)	(−4.49)
Age	−0.0889***	−0.0548***	0.0602***	0.0194
	(−5.30)	(−4.21)	(3.14)	(1.27)
Gender	0.0748	0.0695	0.2394*	0.2169**
	(0.61)	(0.73)	(1.71)	(1.96)
European	0.0293	0.0703	0.3640	0.2516
	(0.15)	(0.45)	(1.58)	(1.38)
Maori and Pacific Islanders	−0.3225	−0.1161	0.2564	0.2375
	(−1.52)	(−0.71)	(1.06)	(1.24)
Asian	−0.2897	−0.2712	0.2186	0.0940
	(−1.33)	(−1.60)	(0.88)	(0.48)
Indian	−0.1773	−0.0582	0.1585	0.2164
	(−0.71)	(−0.30)	(0.56)	(0.96)
Parents' education	−0.0769	−0.0687*	−0.0120	−0.0369
	(−1.46)	(−1.68)	(−0.20)	(−0.77)
Previous education	−0.0403	−0.0398	0.0325	−0.0171
	(−0.74)	(−0.93)	(0.52)	(−0.34)
Observations	329	330	330	330
Adjusted R^2	0.2208	0.3644	0.0684	0.1208

Notes: OLS and instrumental variable regression results for regressions of financial literacy on financial experience are reported. The instrumental variable employed is a dummy variable of whether a student is international or not. The included ethnicity variables are dummy variables, and the variables for parents' and previous education are included as count variables. We report White's (1980) robust standard errors in parentheses.
OLS = ordinary least-square.
***, **, * for significance at the 1, 5, 10% levels, respectively.

studies, economics and mathematics. In all our regressions, we compute robust standard errors using White's (1980) correction.

For all four financial experience indices, we find that the relationship with the international dummy is highly significant and negative. This suggests that, on average, international students have lower financial experience scores than domestic students. This observation is in line with the findings reported in Table 3. In addition, the relationship is strong as

can be seen from the robust *t*-statistics, which range from -9.03 for the second financial experience index to -2.75 for the third financial experience index. This high significance provides further evidence that the international dummy is a strong instrument for financial experience (a more formal test will be reported in the second-stage regression in Table 5).

For the control variables, we observe that *Age* is negative and highly significant in the regression of indices 1 and 2, and positive and significant in the regression of index 3. Again, this is consistent with what we have observed from Table 3. We also find some significance for *Gender* in the regressions for financial experience indices 3 and 4, which suggests that male respondents have greater financial experience than female respondents. Finally, we find a weak significant and negative relationship between parents' education and the financial experience index 2.

In Table 5, we report the results for regressions that consider the impact of financial experience on financial literacy. Specifically, we report the results for all four financial experience indices for both the OLS regression, i.e.

$$\text{FinLit}_i = \alpha_1 + \beta_{\text{OLS}}\text{FinExp}_i + \gamma_1\text{Controls} + \varepsilon_i \tag{7}$$

and for TSLS analysis as per Equation (4), i.e.

$$\text{FinLit}_i = \alpha_1 + \beta_{\text{IV}}\hat{\text{FinExp}}_i + \delta_k\text{Controls}_{ik} + \varepsilon_i \tag{8}$$

We also report some statistics that indicate the strength of the instrument and the need for the TSLS.

In the first two columns, we report the results for the first financial experience index. For the OLS regression, we find a positive relationship between financial literacy and financial experience, with a coefficient of 0.17 and significance at the 5 per cent level. This confirms the findings of prior literature (e.g. Hilgert et al. 2003) showing that there is a strong correlation between literacy and experience. In line with prior literature (e.g. Van Rooij et al. 2011a, 2011b), we also find a positive and highly significant relationship between *Age* and financial literacy and a positive and significant relationship with *Gender* (indicating that male respondents have significantly higher financial literacy scores than female respondents). Of the ethnic background variables, we find only weak positive significance for respondents from a European background. Furthermore, parents' education and previous high school education of respondents are not significantly related to financial literacy.

We next proceed with the estimation of the second-stage regression for the first financial experience index, which we report in the second column

Table 5. Multivariate analysis of the role of financial experience on financial literacy

	Financial experience 1		Financial experience 2		Financial experience 3		Financial experience 4	
	OLS	TSLS	OLS	TSLS	OLS	TSLS	OLS	TSLS
Constant	1.783***	0.4464	1.772***	1.102	2.271***	1.397	2.170***	0.9309
	(2.70)	(0.40)	(2.70)	(1.34)	(3.63)	(1.45)	(3.36)	(0.98)
Fin_Experience	0.1683**	0.5361**	0.2150**	0.4476**	0.1208**	0.9984*	0.1167	0.7707**
	(2.50)	(2.09)	(2.55)	(2.19)	(1.96)	(1.70)	(1.53)	(1.98)
Age	0.0636***	0.0955***	0.0603***	0.0725**	0.0417*	−0.0122	0.0467**	0.0330
	(2.83)	(2.99)	(2.72)	(3.05)	(1.95)	(−0.26)	(2.16)	(1.42)
Gender	0.3277**	0.2858	0.3314**	0.3034*	0.3255*	0.0955	0.3285**	0.1674
	(1.97)	(1.60)	(1.99)	(1.76)	(1.95)	(0.36)	(1.96)	(0.78)
European	0.5386*	0.4857	0.05187*	0.4695	0.5125*	0.1376	0.5252*	0.3070
	(1.87)	(1.54)	(1.79)	(1.56)	(1.77)	(0.31)	(1.82)	(0.85)
Maori and Pacific Islanders	−0.2424	−0.1665	−0.2824	−0.2887	−0.3153	−0.5967	−0.3140	−0.5237
	(−0.89)	(−0.53)	(−1.04)	(−1.01)	(−1.16)	(−1.48)	(−1.16)	(−1.53)
Asian	0.3617	0.6230*	0.4013	0.5853*	0.2330	0.2457	0.2555	0.3915
	(1.17)	(1.71)	(1.30)	(1.72)	(0.76)	(0.63)	(0.84)	(1.09)
Indian	−0.4693	−0.3964	−0.4824	−0.4630	−0.5181	−0.6473	−0.5238	−0.6559
	(−1.25)	(−1.02)	(−1.29)	(−1.24)	(−1.37)	(−1.37)	(−1.39)	(−1.57)
Parents' education	0.0404	0.0779	0.0408	−0.0641	0.0224	0.0454	0.0257	0.06419
	(0.56)	(0.95)	(0.56)	(0.83)	(0.31)	(0.50)	(0.36)	(0.73)
Previous education	0.1019	0.1081	0.1029	0.1053	0.0951	0.055	0.1006	0.1007
	(1.34)	(1.32)	(1.35)	(1.34)	(1.26)	(0.54)	(1.33)	(1.18)
Observations	329	329	330	330	330	330	330	330
Adjusted R^2	0.0944	0.0202	0.0967	0.0763	0.0890	–	0.0852	–
Weak instruments test		32.48		81.57		7.57		20.19
Test of endogeneity (Durbin-Wu-Hausman test)		2.74*		1.90		4.39**		4.23**

Notes: OLS and TSLS results for regressions of financial literacy on financial experience are reported. The instrumental variable employed is a dummy variable of whether a student is international or not. The included ethnicity variables are dummy variables, and the variables for parents' and previous education are included as count variables. We report White's (1980) robust standard errors in parentheses.

OLS = ordinary least-square; TSLS = two-stage least squares regressions.

***, **, * for significance at the 1, 5, 10% levels, respectively.

of Table 5. The results for this regression are supportive of the hypothesis that financial experience has a significant causal effect on financial literacy. The coefficient on financial experience is significant at the 5 per cent level and more than triples to 0.5381 compared with the OLS result.[12] This result corroborates the findings of Dvorak and Hanley (2010) who document a causal relation between contribution to a retirement scheme and financial literacy.

With regards to the control variables, we observe that *Age* and *Gender* remain significant (as was the case in the OLS regression). We also note that the marginal significance of European ethnicity disappears, whereas the dummy for respondents with Asian ethnicity becomes marginally significant and positive. Further, we find no effect of previous education in business or math-related topics, those subjects most likely to teach basic financial concepts. This supports our earlier finding that there is no significant difference in financial knowledge from having taken finance-related subjects in high school. The finding is also consistent with Mandell (2008) who finds that high school financial literacy programmes are ineffective.

To validate the robustness of the instrumental variable, we first need to assess the strength of the instrumental variable. We have already observed that the first-stage regression produces a relatively high R^2 of 21 per cent, suggesting that there is no issue of our dummy being a weak instrument. A more formal test is the F-test on the instrument, where an F-statistic of less than ten is an indication of the instrument being weak (e.g. see Staigler and Stock 1997). In our case, the test produces a statistic of 32.84, which confirms that there is no issue of the instrument being weak.

A second test, known as the Durbin-Wu-Hausman test, identifies whether there was an endogeneity issue in the first place. This test compares the estimates from the OLS with those from the TSLS and tests whether the difference is statistically significant. If the test rejects the null of no endogeneity, then we cannot give a causal interpretation to OLS, and we need to resort to instrumental variables analysis to find the causal effect of financial experience on financial literacy. If the test does not reject the null of no endogeneity, then OLS is unbiased and these coefficients can be given a causal interpretation. The Durbin-Wu-Hausman test produces a test statistic of 2.74, which is significant at the 10 per cent level, and suggests that there are some endogeneity issues with this specific financial experience measure and that the use of instrumental variable analysis is warranted.

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[12] Note that part of this increase may be due to the errors-in-variables bias in the measurement of financial experience that biases OLS estimates towards 0.

For the second index, we find results that are broadly in line with the results for the first index. OLS shows a positive and significant relationship between financial experience and financial literacy (with a coefficient of 0.21) and *Age*, *Gender* and European ethnicity remain significant.

The instrumental variables regression results for the second financial experience index are also broadly in line with those for the first financial experience index. We see that the coefficient (0.4525) is more than twice the size of the OLS coefficient (0.2090) and is significant at the 5 per cent level, reconfirming the causal effect of financial experience on financial literacy. The significance of the control variables remains as before, with *Age*, *Gender* and Asian ethnicity being significant.

The test on the instrumental variable produces an *F*-statistic of 81.57, which suggests that there is no issue with the instrument being weak. However, the Durbin-Wu-Hausman test for endogeneity does not reject the null hypothesis of no endogeneity, and suggests that the OLS coefficient could have been given a causal interpretation in this instance. Even so, the results still support the finding that financial experience influences financial literacy.

For the third financial experience index, we find that OLS produces results similar to the indices 1 and 2, i.e. there is a positive and significant relationship between financial experience and financial literacy (with a coefficient of 0.1208, which is significant at the 5 per cent level), and the control variables *Age*, *Gender* and European are significant in this regression as well. When we estimate the model using TSLS, we observe that the coefficient on financial experience increases considerably to 0.9984, although the significance of the coefficient weakens. We also note that, in this regression, none of the control variables are significant.

The low level of significance for the financial experience index may be due to the weakness of the instrument in this regression. The test of weak instruments produces a test statistic of 7.57, below the level of ten that is typically used to indicate whether an instrument is weak or not. In addition, the first-stage regression produced a relatively low adjusted R^2 of 0.0684, which affects the standard errors of the estimates in the second-stage regression. The Durbin-Wu-Hausman test for endogeneity, however, suggests that there is an endogeneity problem, and thus the OLS results are biased and cannot be interpreted causally, and therefore an instrument is required.

Finally, we report the results for the fourth financial experience index in the last two columns of Table 5. For OLS, we find that the relationship between financial experience and financial literacy is insignificant. However, the control variables for age, gender and European ethnicity remain significant as before. When we estimate the model using two-stage

least squares, we again note that the coefficient increases considerably in magnitude and becomes significant at the 5 per cent level. However, as for the results for the financial experience index 3, we observe that the remaining control variables all become insignificant.

The test for the strength of instruments produces an *F*-statistic of 20.19, well above the level of ten, suggesting that there are no issues regarding the weakness of the instrument. In addition, the Durbin-Wu-Hausman test for endogeneity produces a test statistic of 4.23, rejecting the null of no endogeneity at the 5 per cent level. This suggests that OLS produces biased coefficients and that we have the resort to TSLS.

In sum, the results for the regressions with the four different financial experience indices suggest that there is a positive and significant relationship between financial experience and financial literacy (seven of the eight regressions produce a positive and significant relationship). In addition, for three out of four models, we find that there is an endogeneity issue with OLS and that we have to resort to instrumental variables analysis to determine causality. In addition, in three out of four cases, we find that the instrument produces *F*-statistics well above the critical threshold used to identify a weak instrument. All in all, our results suggest that there is a strong, positive and causal effect of financial experience on financial literacy.

Conclusions

A fundamental assumption that has permeated the literature on financial literacy is the belief that financial education can improve financial literacy and, by extension, financial behaviour and participation. Several papers have, however, questioned the efficacy of financial education and suggest that other factors, such as experience, play a significant role in improving financial literacy (Mandell 2008; Dvorak and Hanley 2010). As we report, much of the existing literature is unable to determine the causal effect of financial experience on financial literacy or vice versa due to methodological issues. However, many of these studies have been interpreted in a causal way. These inaccurate interpretations mean that we still have no clear understanding of the role of experience on financial literacy.

In this paper, we assess the effect of financial experience on financial literacy using a robust methodology that can determine causal effects. We exploit a unique feature of New Zealand, which only allows those students with citizenship or permanent resident status to obtain interest-free student loans for tertiary study and to participate in the national retirement scheme, KiwiSaver, to develop an instrument that allows for the identification of the causal effect of financial experience on financial literacy. The instrument we

employ is a dummy variable for whether a student is international and therefore not permitted to participate in KiwiSaver and the student loan scheme. This instrument is strongly correlated with the financial experience indices we construct, suggesting that our instrument is strong and that instrumental variable analysis is appropriate for our study. In addition, we find that OLS regressions of experience on literacy often produce biased outcomes that cannot be given causal interpretations. When we use our instrumental variable, we find a positive and significant causal effect of financial experience on financial literacy.

Our results corroborate the findings of Dvorak and Hanley (2010) and have important consequences for the design of policies to improve financial literacy. We further find support for Mandell (2008), who concludes that education programmes in high school have a very limited impact on financial literacy. Previous education, which looks at a respondent's prior studies in either business or math-based subjects and which should give student exposure to basic financial concepts, has no relationship with financial literacy once we control for other effects. While not directly addressing financial education, the lack of any discernible effect on financial literacy from subjects closely linked to financial knowledge is strongly suggestive that attempts to address financial literacy with school-based education programmes will have limited efficacy.

The main implication of our study is that policy makers should consider ways to increase the financial experience of people as a way of improving financial literacy. Education programmes should rely more on experiential learning. Mandell (2008), for instance, concludes that high school financial literacy programmes that incorporate stock market games result in marked improvements in financial literacy scores. These stock market games are a form of experiential learning that give controlled exposure to markets without the risk of real financial losses. Experiences gained in such sheltered environments may be just as effective as those gained in real-world situations, although this is a question requiring further research and testing.

Acknowledgements

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Appendix 1. The survey

Instructions for Completion

By completing this survey you are indicating your consent to participate in this research, and we thank you for your participation. We encourage you to answer all questions, however, you can choose not to answer questions. All efforts will be made to ensure that no participant is identified in the research, therefore, we ask you do not put your name, student id or any other identifying information on the questionnaire.

Survey Questions

1. John inherits $10,000 today and Elizabeth inherits $10,000 6 months from now, whose inheritance is worth more?

☐ They are equally rich   ☐ Elizabeth's
☐ John's   ☐ Do not know

2. Suppose you have $100 in a savings account and the interest rate is 20% per year for the next five years. You never withdraw any money or interest. After 5 years, how much would you have in this account in total?

☐ Exactly $200   ☐ More than $200
☐ Less than $200   ☐ Do not know

3. When a person invests money among different types of financial assets, such as stocks and bonds, the risk of losing money

☐ Increases   ☐ Stays the same
☐ Decreases   ☐ Do not know

4. Imagine that the interest rate on your saving account was 2% per year and inflation was 3% per year. After 1 year, how much would you be able to buy with the money in this account?

☐ More than today ☐ Less than today

☐ The same amount ☐ Do not know

5. In general, which of the following is more risky: Bonds or Stocks?

☐ Stocks ☐ Bonds

☐ They are equally risky ☐ Do not know

6. The Reserve Bank has just announced an unexpected cut in the interest rate of .5%. Which of the following reactions is most likely for the NZ/US exchange rate?

☐ The NZ $ will increase ☐ The NZ $ will decrease

☐ The NZ $ will not changed ☐ Do not know

7. Scott and Eric are young men. Each has a good credit history. They work at the same company and earn the same salary. Scott has borrowed $6,000 to take a vacation overseas. Eric has borrowed $6,000 to buy a car. Who is most likely to pay the lowest interest rate on the loan?

☐ Both pay the same ☐ Eric

☐ Scott ☐ Do not know

8. If each of the following had the same amount of take-home salary, who would need the greatest amount of life insurance?

☐ An elderly retired man with a wife who is also retired

☐ A young married man without children

☐ A young single woman with two children

☐ A young single woman without children

☐ Do not know

9. Do you save money on a regular basis?

☐ Yes ☐ No

10. Do you currently have a credit card?

☐ Yes ☐ No

11. Do you pay off your credit card in full each month? (only answer if you answered yes to Q10.)

☐ Yes ☐ No

12. Have you ever had any of the following? (tick as many boxes as are appropriate)
☐ A hire purchase arrangement
☐ A personal loan from a bank or other lender
☐ A student loan

13. Do you invest in any of the following?
☐ Term Deposit
☐ Stocks
☐ Bonds
☐ Managed investment fund
☐ KiwiSaver

14. Age (in years) ☐

15. Gender ☐ Male ☐ Female

16. Are you an international student? ☐ Yes ☐ No

17. What is the highest level of schooling completed by your parents?

☐ High school ☐ Trade certificate or diploma
☐ Bachelor degree ☐ Masters degree or higher
☐ Did not complete high school

18. What is your ethnicity? (Select as many as are required)
☐ European ☐ Maori ☐ Pacific Islander
☐ Chinese ☐ Indian ☐ Middle Eastern
☐ Other Asian ☐ Other

19. Which of the following subjects did you take at high school? (Only tick those that apply otherwise leave blank)
☐ Accounting ☐ Economics
☐ Business Studies ☐ Mathematics and Statistics