

# E-Banking and Consumer Debt

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**Abstract:** Canadian consumers have a debt problem, and averaged a nationwide debt-to-income ratio of 1.654 in 2016. Based on current research, it is unclear whether e-banking has a positive or negative impact on this ratio. This paper hypothesises that e-banking increases consumer access to capital, and – using Canadian nationwide survey data – discovers that e-banking enhances the consumer’s ability to access debt, thus leading to an increase of the debt-to-income ratio by two dollars more for every dollar earned. We suspect that the higher willingness to pay, along with preferring to be rejected for a loan via a web portal, leads to customers using e-banking to request loans via an e-banking portal as opposed to going to the bank. Concluding, this paper recommends an increase in government monitoring of the relationship between e-banking and personal debt.

**Keywords:** consumer debt; electronic banking; debt-to-income ratio; Canadian Financial Capability Survey

## 1 Introduction

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More than two thirds of Canadians bank online according to Wood (2016). This is good news for banking institutions, as Xue, Hitt and Chen (2011) noticed a lower transaction cost of \$0.01 per transaction via online banking (i.e., e-banking), in comparison to ATMs and bank branches at \$0.27 and \$1.07, respectively. Hitt and Frei (2002) stated that these cost savings translate to a higher profitability for e-banking customers versus traditional customers. However, Martins, Oliveira and Popovič (2014) show that e-banking is also good news for customers, as they can avoid a trip to the branch or to an ATM, thereby saving time and transportation costs.

Multiple authors in the current literature consider a bank's perspective to address which factors (customer-based or product-based) lead to e-banking adoption (Gerrard and Barton Cunningham, 2003; Kolodinsky, Hogarth and Hilgert, 2004; Pikkarainen *et al.*, 2004; Martins, Oliveira and Popovič, 2014; Safeena, Kammani and Date, 2014; Singh and Malhotra, 2015; Yaseen and El Qirem, 2018; Anouze and Alamro, 2019; Chikondi Daka and Phiri, 2019; Gayan Nayanajith, Weerasiri and Damunupola, 2019). Therefore, current literature only examines how banks benefit from e-banking (Hitt and Frei, 2002; Xue, Hitt and Chen, 2011; Yang *et al.*, 2018). While there is some research that examines personal factors which lead to personal debt as well as debt delinquency (Lea, Webley and Levine, 1993; Lea, Webley and Walker, 1995; Li *et al.*, 2020), there is no literature available that investigates whether e-banking has an adverse financial effect on consumers.

Canadian consumers have a debt problem, as the nationwide debt-to-income ratio is 1.654 (Canadian-Press, 2016). Based on current literature, it is unclear whether e-banking has a positive or negative impact on this ratio. While e-banking allows consumers to monitor their debt situation and thereby reducing their debt-to-income ratio, e-banking can also entice consumers to use more banking and debt services, resulting in a higher debt-to-income ratio. Using an instrumental

variable approach, this paper shows that e-banking has a causal effect on consumers' debt-to-income ratio, as e-banking households carry a debt-to-income ratio 1.42 times greater on average than traditional customers. Raddon-Financial-Group found in a study (Raddon-Financial-Group, 2014) that, while e-banking is growing in popularity it should be used carefully by consumers, as it may lead to increased consumer debt. Garber et al. (2019) suggested that increased household debt in Canada may be a precursor to a national recession, suggesting government may want to help control household debt.

## **2 Related work and hypothesis**

Consumer debt is a relevant topic in academic, governance, and business domains. Most research uses either proprietary data from one financial institution's database (Hitt and Frei, 2002; Xue, Hitt and Chen, 2011; Yang *et al.*, 2018), or surveys administered via national institutions or by researchers themselves (Chien and Devaney, 2001; Loke, Yen and Tan, 2013; Basnet and Donou-Adonsou, 2016). Each of these approaches provides different perspectives on the issue. For example, Hitt and colleagues (Hitt and Frei, 2002; Xue, Hitt and Chen, 2011) show that e-banking is more profitable than traditional banking from a financial institution perspective.

This paper takes a consumer perspective, and uses similar surveys administered by national institutions in prior research. Such surveys address the following issues: the role of internet access regarding credit card debt in the US (Basnet and Donou-Adonsou, 2016), the role of attitude towards credit regarding credit card balances (Chien and Devaney, 2001), and how families save (Fisher and Montalto, 2011). In addition, multiple studies investigate e-banking diffusion (Gerrard and Barton Cunningham, 2003; Pikkarainen *et al.*, 2004; Laforet and Li, 2005). The common

thread amongst all these studies is the perceived risk of e-banking as the main differentiating factor by country. Other common findings for diffusion were ease and convenience of use of e-banking.

Already, multiple studies exist that consider psychological and socioeconomic factors that lead to increased personal debt (Lea, Webley and Levine, 1993; Lea, Webley and Walker, 1995; Norvilitis *et al.*, 2006). These studies find that personal income, consumer perception of debt, and how money is spent are all factors that lead to an increase in personal debt. In this study, no data is used for the psychological factors of respondents, but socioeconomic and various demographic factors that lead to increased debt are controlled for, as identified in other literature. In this study's dataset, differential household debt is observed as shown in figure 1.

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[insert Figure 1 about here]  
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The dots shown in figure 1 are not data points per se, but instead are centroids of at least 15 household observations, as is required by Statistics Canada's privacy restrictions. The left panel (fig. 1) suggests that for households that bank online, the debt-to-income ratio is constant, i.e., as household income increases, household debt increases. The right panel suggests that for households that do not bank online, the relationship is much weaker, if non-existent. While this does not allow for a definition of causality, it does define an age and family profile of those who use e-banking. In the 1960's, Modigliani and Ando (1963) defined an economic theory that households use debt to keep consumption roughly equal throughout the lifecycle. This theory has not withstood the test of time as e-banking was introduced, as data shows that households do not "smooth out" their incomes over time. Instead, the profile is that of a concave function (i.e., an

inverted checkmark) wherein early household debt is low, climaxes during childbearing years, and declines thereafter (Laibson and Harris, 2001; Laibson, 2002).

E-banking allows consumers to apply online for a new home equity line of credit, a new credit card, or a new consumer loan. Consumers can also request increases on these debt instruments using e-banking. On the surface, this seems to be a rather benign innovation. But Hurst (2011) shows that debt-to-income ratios rose 55% from 1990 to 2009, and that young families with children (170% debt-to-income ratio) and sole parent families with children (227% debt-to-income ratio) have much higher ratios than average households (148%).

Moreover, Xue et al. (2011) use transactional customer data from a US bank regarding the adoption of e-banking, and find that within three months of adoption customers open 0.254 more deposit accounts, obtain 0.105 more loans, and use 0.039 more investment accounts on average. Additionally, two studies investigate internet use and credit card debt: Basnet and Donou-Adonsou (2016) use a survey to show that internet access leads to higher credit card debt by about 4% to 5% for younger customers; and Chien and Devaney (2001) show that debt is related to various factors such as marital and professional status, specific credit attitudes, and education. Therefore, it is hypothesised that e-banking enhances credit accumulation, thereby increasing a household's debt-to-income ratio:

**H<sub>1</sub>:** E-banking has a positive causal relationship with household debt-to-income ratio.

### **3 Data**

This paper uses the Canadian Financial Capability Survey (CFCS) administered approximately every three years by Statistics Canada, with 2014 being the latest survey data available (Canada,

2014). The voluntary survey uses a complex design along with random stratified sampling across Canada. There are three survey questions that are of crucial importance to this study: total household income, total debt and liabilities, and how respondents typically check balances of their accounts. This paper uses the “check balances online” question (y/n) as a proxy for potential credit applications, since CFCS does not include a question about online loans. It also uses the standard demographic questions as controls, as suggested by Chien and Devaney (Chien and Devaney, 2001). The summary statistics of variables utilized are presented in table 1.

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[insert Table 1 about here]  
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#### **4 Methodology**

This paper analyses the relationship between e-banking and consumer debt; and to mitigate the effect of income relative to debt (i.e., higher income households typically have higher debt) the debt-to-income ratio for each household is used instead of absolute debt. We also considered using the ratio of debt to assets, however, we examined the debt-asset variable and found many outliers. We chose not to use debt-asset ratio in this analysis since income and debt are readily known to respondents—from their pay stub and from their bank account. However, assets are far more subjective and difficult to assess since the respondent must provide an answer ‘on the spot’ as to the value of their capital goods, such as cars, financial instruments, jewelry and their home.

Given the preceding discussion, we only use debt-to-income ratio in this study. In order to establish a causal relationship between e-banking and debt, we use instrumental variable regression (Wright, 1928). While controlled experiments are the standard for establishing causality, in typical

regression studies such as this it is only possible to establish correlation between the variables of interest. Instrumental variable regression is a technique used to establish a causal relationship as the instrument is only correlated with the variable of interest and not correlated with the dependent variable. Each potential instrument is checked for its correlation with e-banking. This study also checks when regressing debt-to-income on e-banking and other covariates that the residual from that regression is not correlated with the instrument. If these two preconditions are met, the instrument is further vetted with the following tests at a 0.05 level of significance – under-identification test (i.e., a Kleibergen-Paap rk LM statistic), weak identification test, Hansen J statistic, and a test for endogeneity (i.e., Wu-Hausman F statistic). After these tests, the study retains only the remaining instruments. All regressions are corrected for heteroskedasticity using Huber-White standard errors and are clustered by Canadian province. This study then clusters by province since the error terms are expected to be correlated within a given province but not correlated between provinces. This is assumed because Canadian provinces differ in terms of personal tax rates, and consumer policies. For the continuous dependent variable case (i.e., debt-to-income ratio) standard two-stage least squares is used. For the dichotomous dependent variable case (i.e., e-banking) probit instrumental variable regression is used.

## **5 Results and implications**

Agarwal and Hauswald (2008) point out that banks know the credit risk of every loan applicant, and can easily summarize household and financial characteristics for e-banking loan applicants versus traditional applicants. Traditional applicants have the added advantage of trust relationships with their local branch (Mukherjee and Nath, 2003), while e-banking customers do not: The e-banking application is algorithmic and there is no trust relationship between the online application

and the customer. The online application is designed to price the loan to account for risk (Agarwal and Hauswald, 2008). This means, a higher risk applicant has a higher probability of obtaining credit online, through trying multiple lenders, than in a face-to-face transaction. For the lower-quality customer, the algorithm simply adjusts the annual percentage rate to account for the higher risk (i.e., a risk premium is added to the APR).

This research tested 297 potential instruments from the survey. From the first part of instrument selection, 38 instruments are identified for the debt-asset (OLS) regression along with 59 instruments for the e-banking (probit) regression. For the debt-to-asset regressions, 16 instruments remained after final testing. For the e-banking probit regressions, only 3 instruments remained. Table 2 summarizes the results for the marginal effect of e-banking on the debt-to-income ratio, while table 3 summarizes the results for the average marginal effect of debt-to-income on e-banking. Table 2 shows that if e-banking=1 then the debt-to-income ratio increases on average by 1.42. This is a significantly large change. Table 3 contains the effect of changing the debt-to-income ratio by x% above the mean value (0.626) increases the probability y% that e-banking = 1. Three cases are presented (tbl. 3) where debt-to-income increases by 10%, 50% and 100% respectively: In the first case the probability that e-banking = 1 increases by 1.3%; in the second case the probability that e-banking = 1 increases by 6.4%; and in the third case, when the debt-to-income ratio increases by 100% from 0.626 to 1.252, the probability that e-banking = 1 increases by 12.4%. When the debt-to-income ratio changes by a large amount (100%), it only increases the probability by 12.4%. In contrast, the marginal effect of e-banking on the debt-to-income ratio is large.

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[insert Table 2 about here]



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[insert Table 3 about here]  
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Thus, there may be practical and psychological factors that explain why e-banking leads to an increase in total debt. Canada's Big Five banks (i.e., TD, RBC, BMO, Scotia, CIBC) all provide online banking that allows customers to apply for a loan or home equity line of credit. Additionally, Canada's four online-only banks (i.e., Alterna Bank-alternabank.ca, EQ Bank-eqbank.ca, Simplii Financial-simplii.com, Tangerine Bank-tangerine.ca) are specifically designed for customers to acquire credit easily and quickly. Prelec and Simester (2001) find that with access to credit, as measured by credit-card use, consumers have a higher willingness to pay. In addition, they preferred modes of communication, customers that are unsure or have low confidence, for example on the likelihood of getting a loan, prefer to use e-mail to communicate rather than a face-to-face meeting. Based on this study, it is assumed that the higher willingness to pay, along with preferring to be rejected for a loan via a web portal, leads to customers using e-banking to request loans via an e-banking portal as opposed to going to the bank. This provides practical insights to financial institutions, as they may see more success in offering hassle-free loans to e-banking customers. Meanwhile, consumers may request to have that option removed if they find themselves using online portals for loans option more than preferred.

## **6 Conclusion**

This research shows that there is a statistically significant causal relationship between e-banking and customers' debt-to-income ratio. Though the causality is bi-directional, the effects are far

greater in terms of e-banking's impact on the debt-to-income ratio. It is unfortunate that no actual transaction-level data is made available by banking institutions. Therefore, the results presented in this study offer only an indirect test of e-banking and the accumulation of debt. Thus, more research with better data is warranted, although this begs the question: Would it be in the bank's interest to release transaction-level data for in-person versus online debt acquisition? Considering the drawbacks of this study, researchers can still advocate for consumers as e-banking is proven to be associated with higher debt-to-income ratios. As it is easier to obtain credit online – even when applicants have lower credit ratings and higher probabilities of default – consumers should be aware of this issue. Based on this research, governments should be encouraged to monitor the situation.

The presented study suggests there may be a link between e-banking and higher personal debt, though the available data is limited to a single year. Individual transaction data would further address any endogeneity issues with current study data. As such, future research could verify this study with individual transaction data. Another avenue of future research could be surveying individuals using e-banking that exhibit higher debt to determine how they use e-banking in their debt accumulation. We currently speculate that easy access to a personal line of credit may result in higher debt, understanding if individuals consciously or unconsciously take on debt will inform future government regulation.

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<b>Table 1: Sample statistics</b>								
Variable	N	5%	25%	50%	Mean	75%	95%	$\sigma^2$
debt	6683	0	0	1000	54690	50000	275000	153323
ebank	6683	0	0	1	0.56	1	1	0.50
income	6683	20000	41000	70000	87810	110000	200000	88217.5
household-size	6683	1	1	2	2.33	3	5	1.29
age	6683	24	39.5	54	53.16	66	81	17.50
sex	6683	1	1	2	1.54	2	2	0.50
marital	6683	1	1	2	2.81	5	6	2.05
school	6683	0	3	5	4.79	6	9	2.60
current-job	6683	0	0	5	7.39	13	23	7.91
spouse-current-job	6683	0	0	0	4.27	6	21	7.07
debt-income	6683	0	0	0.017	0.626	0.658	2.857	1.80
<i>Definitions</i>								
debt	total household debt, in dollars (mortgages, student loans, payday loans, other loans, credit card debt, lines of credit, other debts)							
ebank	binary variable indicating whether the respondent primarily checks account balance(s) online (no=0, yes=1)							
income	total household income, in dollars for the past 12 months							
household-size	number of people in the household							
age	age of the respondent, in years							
sex	sex of the respondent (male=1, female=2)							
marital	marital status of the respondent (married=1, living common-law=2, widowed=3, separated=4, divorced=5, single or never married=6)							
school	highest level of respondent education (high school or less=1, some college or university without degree=2, college or trade or vocational or technical school=3, university undergraduate degree=4, university graduate degree and/or professional degree=5, not stated=9)							
current-job	current employment status of the respondent (employed=1, self-employed=2, not working and looking for work=3, not working and not looking for work=4, retired=5, a student, including work programs=6, doing unpaid household work=7, other – specify=8, do not know=97, refusal=98)							
spouse-current-job	current employment status of the respondent's spouse (employed=1, self-employed=2, not working and looking for work=3, not working and not looking for work=4, retired=5, a student--including work programs=6, doing unpaid household work=7, valid skip=96, do not know=97, refusal=98, not stated=99)							
debt-income	household debt-to-income ratio = debt/income							

<b>Table 2: Instruments for e-banking</b>		
Instrument name	Description	Marginal effect
AD_08	Total value of any of these assets: Cash savings, investments, registered disability savings plan, tax free savings plan, private pensions, other financial assets	1.467
FC_02A	Source of advice – Accountant	0.970
FC_02B	Source of advice – Lawyer, notary	0.958
FC_02G	Source of advice – Insurance company	0.964
FC_02K	Source of advice – Internet	0.955
FC_03	Pay for any advice	0.951
FM_03A	Unexpected \$5,000 expenditure – Use savings	1.210
IN_01D	Income – CPP/QPP, OAS, GIS	2.410
OE_01	Who is responsible for regular bills	2.004
OE_11	Have a household budget	1.360
OE_12	How often stay within budget	1.239
PMKSTAT	Person most knowledgeable – Status	2.452
TENURE	Housing tenure	1.830
PAY_BILL	Who is responsible for paying regular bills	3.115
Mean effect		1.420

<b>Table 3: Debt-to-income ratio and probability of e-banking</b>				
Instrument for debt-to-income ratio	Description	Increase mean debt-to-income ratio by:		
		10% (debt_inc=0.689)	50% (debt_inc=0.939)	100% (debt_inc=1.252)
		Pr(ebank = 1) increases by:		
EF_02	Have saved to support cost of child's post-secondary education	0.014	.067	0.129
FC_01I	Advice - No, did not use any advice	0.009	.047	0.092
FC_05K	Keep an eye on - None of the above	0.016	.079	0.152
Mean probability		0.013	0.064	0.124



**Appendix A: Instrumental variable regressions for debt-to-income ratio**

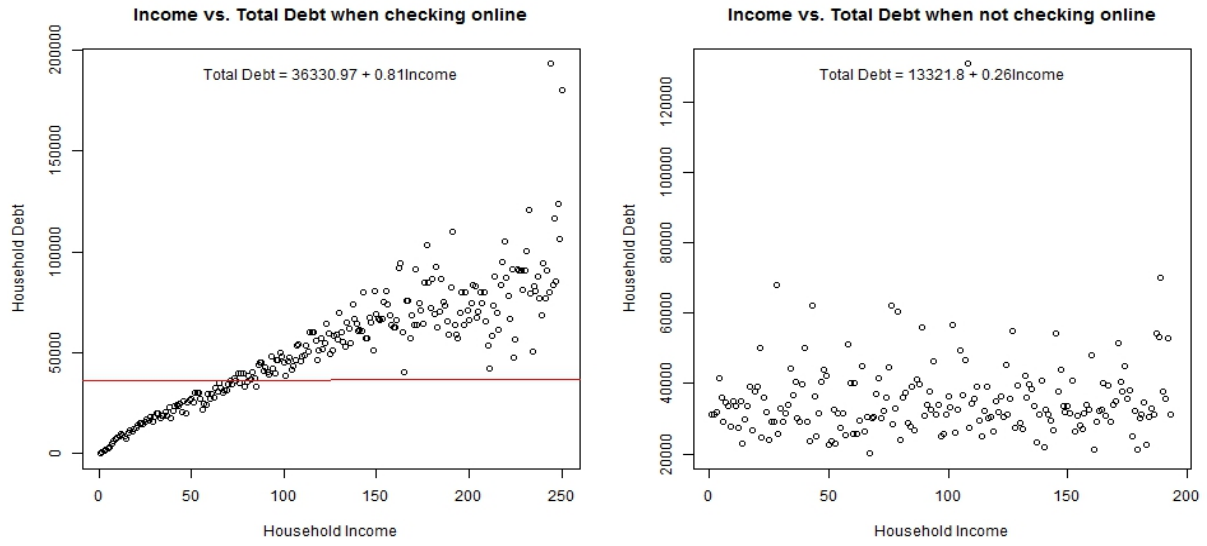
	AD_08	FC_02A	FC_02B	FC_02 G	FC_02 K	FC_03	FM_03 A	IN_01D	OE_01	OE_11	OE_12	pay_bill	pmkstat	tenure
ebank	1.927*** (0.375)	0.797** (0.368)	0.761** (0.366)	0.775** (0.365)	0.755** (0.365)	0.745** (0.376)	1.337*** (0.384)	4.079*** (1.067)	3.156** (0.961)	1.681** (0.650)	1.403* (0.796)	5.698*** (1.556)	4.179*** (1.499)	2.756*** (0.762)
household_size	0.0450* (0.025)	0.0463** (0.023)	0.0464** (0.023)	0.0464* (0.023)	0.0464* (0.023)	0.0464* (0.023)	0.0457* (0.024)	0.0424 (0.031)	0.0435 (0.028)	0.0453 (0.024)	0.0456 (0.023)	0.0405 (0.037)	0.0423 (0.031)	0.0440* (0.027)
age	0.00961* (0.005)	-0.0031 (0.005)	-0.0035 (0.005)	- (0.005)	- (0.005)	- (0.005)	0.00298 (0.005)	0.0338* (0.012)	0.0234 (0.011)	0.0068 (0.007)	0.0037 (0.009)	0.0520* (0.018)	0.0349** (0.017)	0.0189** (0.009)
sex	-0.0978** (0.049)	-0.103** (0.046)	-0.103** (0.046)	-0.103** (0.046)	-0.103** (0.046)	-0.103** (0.046)	-0.100** (0.047)	-0.0884 (0.062)	0.0925 (0.056)	0.0989 (0.050)	0.100** (0.049)	-0.0813 (0.075)	-0.088 (0.063)	-0.0942* (0.053)
marital	-0.0153 (0.019)	- (0.018)	- (0.018)	0.0487* (0.018)	0.0493* (0.018)	0.0496* (0.018)	0.0324* (0.018)	0.047 (0.036)	0.0203 (0.032)	- (0.022)	- (0.025)	0.0940* (0.051)	0.05 (0.047)	0.00872 (0.028)
school	- (0.019)	-0.00977 (0.019)	-0.00799 (0.019)	-0.0087 (0.019)	- (0.019)	- (0.019)	- (0.020)	- (0.055)	- (0.049)	0.128** (0.034)	-0.054 (0.041)	- (0.079)	- (0.076)	- (0.039)
current_job	0.00529 (0.004)	0.00502 (0.004)	0.00501 (0.004)	0.00501 (0.004)	0.00501 (0.004)	0.005 (0.004)	0.00515 (0.004)	0.00582 (0.005)	0.0055 (0.005)	0.0052 (0.004)	0.0051 (0.004)	0.00621 (0.006)	0.00584 (0.005)	0.00549 (0.005)
spouse_current_jo b	0.0114 (0.007)	0.0113 (0.007)	0.0113 (0.007)	0.0113 (0.007)	0.0113 (0.007)	0.0113 (0.007)	0.0113 (0.007)	0.0116 (0.008)	0.0115 (0.007)	0.0114 (0.007)	0.0113 (0.007)	0.0118 (0.008)	0.0116 (0.008)	0.0115 (0.007)
_cons	-0.652 (0.462)	0.489 (0.437)	0.525 (0.438)	0.51 (0.435)	0.531 (0.437)	0.541 (0.446)	-0.0567 (0.457)	-2.824** (1.109)	-1.893* (1.005)	-0.404 (0.676)	-0.123 (0.826)	- (1.618)	-2.925* (1.537)	-1.489* (0.819)
N	6683	6683	6683	6683	6683	6683	6683	6683	6683	6683	6683	6683	6683	6683
Log likelihood	-13753.4	-13314.8	-13308.0	- 13310.7	- 13306.9	- 13305.1	- 13474.2	- 15300.3	- 14576. 7	- 13625. 4	- 13500. 4	- 16591.3	-15381.1	- 14283.6

Standard errors in parentheses \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

**Appendix B:** Two-step instrumental variable probit regressions for e-banking

	EF_02	FC_01I	FC_05K
debt_income	0.558*** (0.132)	0.388* (0.204)	0.663* (0.387)
household_size	-0.0343** (0.0143)	-0.0285 (0.0176)	-0.0416 (0.0336)
age	-0.0290*** (0.00235)	-0.0312*** (0.00296)	-0.0279*** (0.00564)
sex	0.0399 (0.0411)	0.0212 (0.042)	0.05 (0.0457)
marital	-0.0618*** (0.0185)	-0.0731*** (0.0199)	-0.0537 (0.0387)
school	0.144*** (0.0113)	0.149*** (0.01)	0.140*** (0.016)
current_job	-0.00416* (0.0024)	-0.00328 (0.00242)	-0.00459 (0.00327)
spouse_current_job	-0.00712 (0.00454)	-0.00523 (0.00501)	-0.00828 (0.00585)
_cons	0.954*** (0.208)	1.181*** (0.277)	0.829 (0.542)
<i>N</i>	6683	6683	6683
Wald chi2	2241.87***	2866.73***	1045.00***

Standard errors in parentheses \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01



**Figure 1:** Difference between household debt and income for e-banking and no e-banking groups. Note that each point is the centroid of at least 15 points as per data security requirements.