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Advertising as a Predictor of Investment

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Abstract

This paper uses a measure of the volume of advertising to predict the volume of investment before, during and after the collapse of Iceland's financial sector in October 2008. We find that advertising is a good leading indicator for investment.

Keywords: Advertising, investment.
JEL Classification: E22, E32

1. Introduction

Advertising is an attempt to capture market share. It follows that advertising has an investment dimension. In this paper we test whether the volume of advertising could serve as a leading indicator for gross capital formation. We use data from the idyllic sparsely-populated Iceland that became a symbol of the current global financial crisis when its banking system collapsed in October 2008, only a couple of weeks after the failure of Lehman Brothers. We use data on the volume of advertising to test whether firms reduced the volume of advertising in the preceding months in expectation of the collapse. Moreover, by looking at data over a longer period from the first month of 2001 until October 2010 we can map the cyclical behaviour of advertisement expenditures and relate them to the cyclical behaviour of investment.

Our idea to use the volume of advertising to predict the volume of investment is rooted in the customer market model of Phelps and Winter (1970) and Okun (1981). In this model firms and their customers form long-run relationships when customers become attached to a particular firm because of imperfect information about prices elsewhere or habit formation. In this setting a firm's market share becomes an asset and advertising constitutes investment in market share. Our setup can be justified by the results of a recent survey of managers of Icelandic firms (Choudhary, Karlsson and Zoega, 2009). The results show that managers agree that customers are valuable to firms and they use advertising to augment their customer base. These results are consistent with Lye and Sibly (1994) who found rigid prices in customer markets using Australian data.[1]

Below we first model advertising as investment in market share and then use data from Iceland in the subsequent section to test whether the volume of advertising prior to the collapse of the country's financial system reveals expectations about the impending shock.

2. A model of advertising expenditures

Following Stigler and Becker (1977) and Kotowitz and Mathewson (1979)[2] we assume that utility depends on two-dimensional quality where advertising affects one of the dimensions –

[1] This provides direct support for Okun (1981) and also for Akerlof (2007), who argued that prices seem to be especially sticky in customer markets due to price norms; Nakamura and Steinsson (2005) who argue that firms keep prices unchanged as a part of an implicit contract with habit-forming customers; and Sibly (2007) who shows how the introduction of imperfect customer information reduces variability in retail prices when customers engage in repeat purchases.

[2] See Butters (1977), Grossman and Shapiro (1984) and Stegeman (1991) for the alternative setup where advertising is purely informative.

such as the associated social status – while the other dimension can be effortlessly observed.[3] We assume that the dimension affected by advertising affects consumers' choice of a product but not the volume bought by each customer. It follows that advertising is a way of attracting new customers while existing customers may be tempted to leave because of the advertising by rival firms. The flow of customers N to the representative firm is then described by the following equation

$$\dot{N} = g(a)(\overline{N} - N) - Lg(a^*)N \tag{1}$$

where $\overline{N}$ denotes the total number of consumers – or potential customers – in a market, N is the number of customers of the representative firm, a is the volume of advertising by the representative firm, a^* is the volume of advertising by rival firms and L is the number of rival firms. We assume that there are positive but diminishing returns to advertising so that $g'(a)>0$ and $g''(a) < 0$. The equation implies that the inflow of customers is a positive function of the volume of own advertising, a negative function of the volume of advertising by others and a negative function of own market share $N/\overline{N}$.[4] In steady state we find that the size of own market share relative to that of others is

$$\frac{N}{\overline{N}-N} = \frac{g(a)}{Lg(a^*)}\,. \tag{2}$$

Thus the share of the representative firm is rising in its own advertising relative to that of rival firms and decreasing in the number of rival firms.

The representative firm maximises the present discounted value of profits, where current profits are defined as

$$\pi = Nd(p)(p - c) - p_a a \tag{3}$$

and p is the price of unit of output, $d(p)$ is a downward sloping demand curve; $d'(p)<0$, c is the constant cost of production per unit produced and p_a is the price of advertising. Defining the shadow price of a customer by q we derive the Pontryagin conditions. The first condition sets the marginal benefit of advertising equal to the marginal cost;

$$qg'(a)(\overline{N} - N) = p_a\,. \tag{4}$$

[3] See Bagwell (2001) for a survey on the economics of advertising.
[4] In a slightly different setup, Sibly (1995) models advertising as affecting the rate of flow of customers responding to price differences between firms.

The left-hand side denotes the marginal benefit of advertising and the right-hand side the marginal cost. The marginal benefit is increasing in the shadow price of a customer *q*, the marginal effectiveness of advertising in attracting new customers g'(a) and the number of consumers not yet attached to the representative firm. The marginal cost consists of the price of advertising p_a. The second equation determines the optimal path for the shadow price *q*

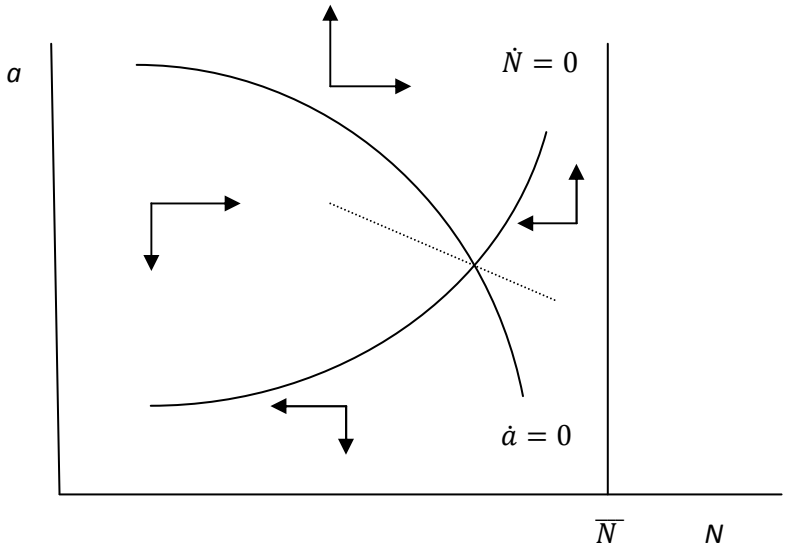
$$r = \frac{\dot{q}}{q} - g(a) - Lg(a^*) + \frac{d(p)(p-c)}{q} \ . \tag{5}$$

Combining equations (4) and (5) gives an Euler equation for the volume of advertising:

$$\dot{a} = -\left(\frac{g\prime(a)}{g\prime\prime(a)}\right)\left[r - \frac{d(p)(p-c)g'(a)(\bar{N}-N)}{p_a} + Lg(a^*)\left(\frac{\bar{N}}{\bar{N}-N}\right)\right] \tag{6}$$

Changes in the volume of advertising *a* over time depend on a comparison of the required rate of return *r* and the rate of return on a customer which is captured by the last two terms in the square bracket. The second term measures the profits from selling to a new customer divided by his marginal price of advertising. There is also a loss from having a customer that is described by the third term. This is the gradual erosion of market share caused by the advertising of other firms. Equation (1) and (6) define a system of two variables that can be solved together.

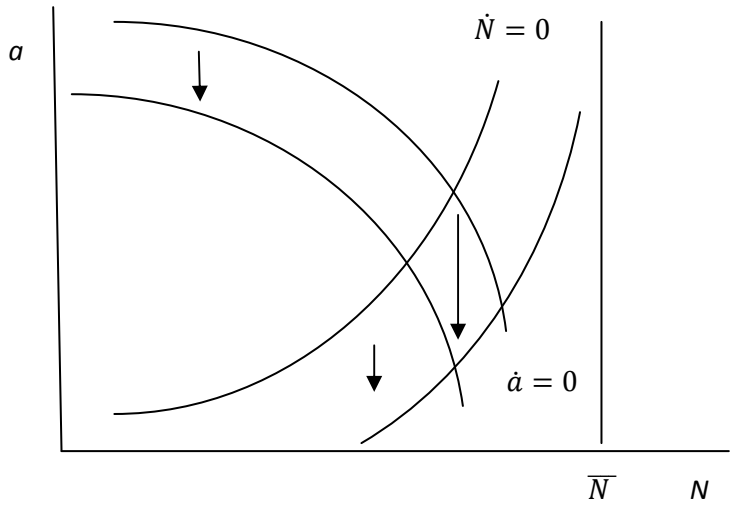
Figure 1. Model dynamics



The expectation of a collapse of a financial system reduces expected demand per customer since customers could be expected to buy less during the crisis. This creates expectations that the $\dot{a} = 0$ schedule shift downwards in the future. In a symmetric equilibrium, the $\dot{N} = 0$ schedule starts to gradually shift downward upon firms forming the expectation of the future

collapse – because of a falling level of a^* – and the volume of advertising a (as well as a^*) gradually falls until the time that customers reduce their demand and the $\dot{a} = 0$ schedule shifts downwards and meets the $\dot{N} = 0$ schedule in a new equilibrium. See Figure 2.

Figure 2. The effect of an imminent crisis



We will now turn to the economic collapse in Iceland in 2008 and describe how the volume of advertising changes during the preceding boom and the economic turbulence that preceded the collapse.

3. Events

Iceland experienced a credit-driven boom between 2004 and 2007, generated by an inflow of foreign capital. Domestic credit grew annually by 20% or more per year, output growth ranged between 4.6% and 7.7%, fuelled by growing investment and consumption, the real exchange rate rose and the current account deficit ranged between 9.8% and 23.8%.

Table 1. Macroeconomic developments

	03	04	05	06	07	08	09	10
Growth of GDP (%)	2.4	7.7	7.5	4.6	6.0	1.0	-6.8	-3.0
Consumption growth (%)	6.1	7.0	12.7	3.6	5.6	-7.9	-16.0	0.6
Investment growth (%)	11.1	28.1	35.7	22.4	-11.1	-20.9	-50.9	-8.9
Export growth (%)	1.6	8.4	7.5	-4.6	17.7	7.1	6.2	-0.6
Import growth (%)	10.7	14.5	29.3	10.4	-0.7	-18.2	-24.0	1.7
Unemployment rate (%)	3.4	3.1	2.1	1.2	1.0	1.6	8.0	8.6
Real exchange rate	96.0	98.1	111.4	104.2	108.6	85.5	70.0	73.3
Lending growth (%)**	11.4	19.9	31.1	31.0	22.7	--	--	--
Current account (% of GDP)	-4.8	-9.8	-16.1	-23.8	-16.2	-17.5	4.5	2.7

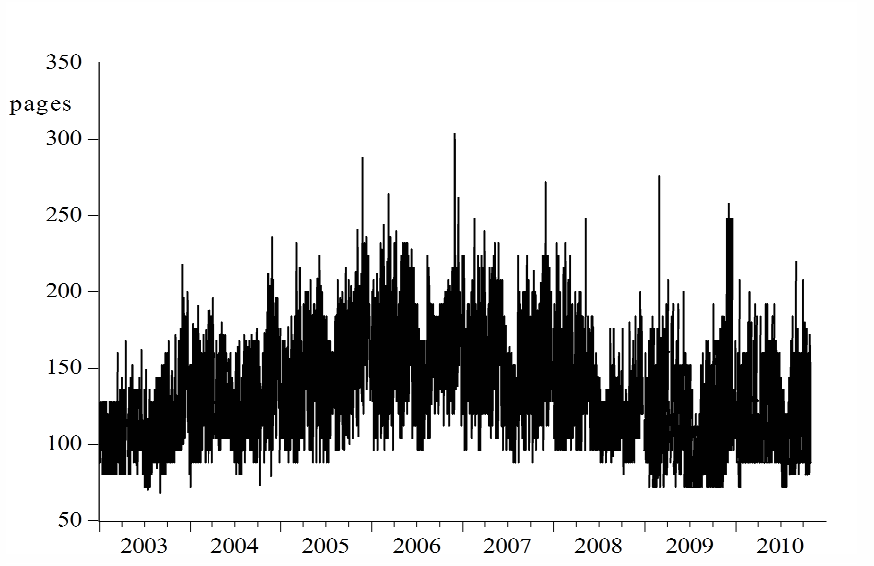
Source: *Monetary Bulletin*, Central Bank of Iceland.

The credit-driven boom came to an abrupt halt in the fall of 2008 when the country's banking system collapsed triggering a perfect storm of a currency crisis, financial crisis, and a contraction of the real economy.

We take advantage of the fact that the population of Iceland is only 300 thousand which limits the number of newspapers and other advertising outlets. We have generated a data base that has the number of pages appearing in each issue of the two main newspapers. Their combined market share was estimated at 95% in 2007 in the market for newspaper advertisements.[5] We measure the volume of advertising by the total number of pages in these two biggest daily newspapers. The papers also include obituaries, op-eds, and domestic and international news items but the numbers of pages used for these items do not vary much over time.[6] The difference between the numbers of pages over time hence reflects differences in the volume of advertising.

During the credit-driven boom advertising also exhibited fluctuations shown in Figure 3 using daily data after correction for differences between weekdays.[7] The average number of pages in the period preceding the boom in 2001-2003 was 112.5; it rose to 160.8 in 2004-2007; was 145.8 in the first half of 2008 and 123.3 in the second half of 2008, 115.5 in 2009 and 117.3 in the first half of 2010.

Figure 3. Page numbers as a measure of advertising

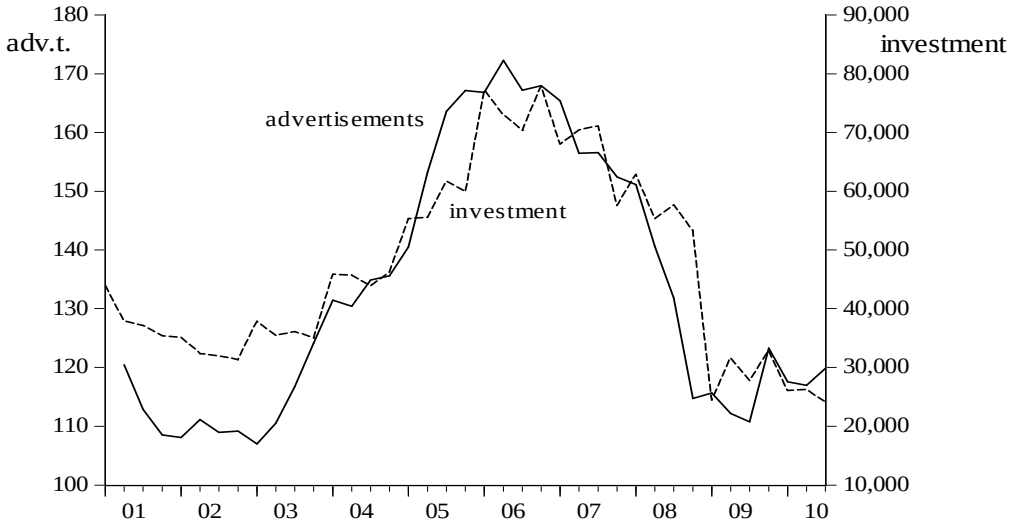


[5] See *Icelandic Competition Authority* (Samkeppniseftirlitið), 2007.
[6] Both newspapers confirmed that the ratio of the number of pages filled with advertisements and the total number of pages in each issue was relatively constant
[7] The daily page numbers were regressed on seven dummy variables, one for each weekday, and the residual plotted in Figure 3 and used in the following analysis.

4. Advertising as a leading indicator

In the light of the model derived in Section 2 above we can use observations on the number of pages as a measure of the volume of advertising to predict gross capital formation. Both advertising as modelled in this paper and gross capital formation are forms of investment and the decision to invest and advertise should be based on the expected present value of future profits in addition to the cost of investing and advertising. Figure 4 shows the two series plotted together at the quarterly frequency.

Figure 4. Advertisements and investment



Advertisements are measured in the average number of pages per day in the two main newspapers while the volume of investment is measured in local currency, prices constant at Q1 2000 level.

In the table below we test for the existence of a unit root in the two series and are unable to reject the hypothesis that each series has a unit root.

Table 2. Unit root tests – augmented Dickey Fuller, 2001-2010

	ADF statistic	Probability
Advertisements	-0.55	0.98
Investment (vol.)	-0.33	0.99
Time period: 2001 Q1 to 2010 Q3		
Observations: 37		

*MacKinnon (1996) one-sided p-values. Critical value at 1% level of significance is -4.23 and -3.54 at 5% level. The equation contains a constant linear trend.

The two series turn out to be co-integrated. A test for cointegration indicates the presence of one cointegrating equation at the 5% level.

Table 3. Unrestricted cointegration rank test

No. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical Value	Prob.*
None	0.56	32.98	25.87	0.006
At most 1	0.08	3.13	12.52	0.861

*MacKinnon-Haug-Michelis (1999) p-values

Granger causality tests reveal that changes in the volume of advertising precede changes in the volume of investment but not the other way around.

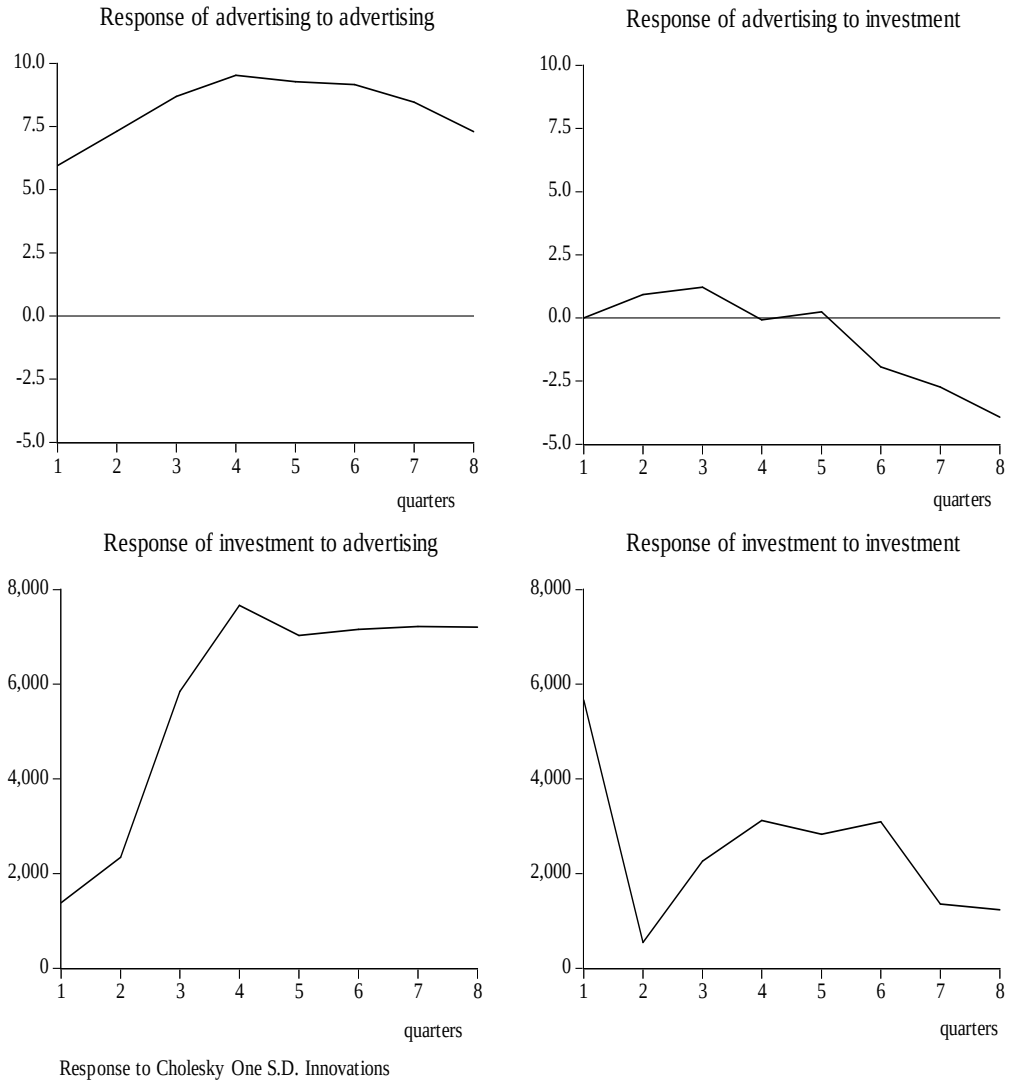
Table 4. Granger causality test

Null hypothesis	F-statistic	Prob.
Investment does not Granger cause advertising	0.48	0.757
Advertising does not Granger cause investment	6.04	0.002

Number of observations: 34

Finally, we can estimate a vector error correction and calculate the impulse response functions of changes in advertisements and the volume of investment. The estimated model is shown in the appendix. Consistent with the results of the Granger causality test in Table 4, we find that lagged advertising is statistically significant in the investment equation while lagged investment does not help explain the current volume of advertising. Using the estimated model we can generate the impulse response functions using quarterly data. These are shown in Figure 5.

Figure 5. Impulse response functions



Note the marked effect of a shock to advertisement on subsequent investment which is not matched by a response of advertisements to an investment shock.

5. Conclusions

We have shown how the volume of advertising in Iceland, measured by the total sum of pages in the two main newspapers, could predict both the high levels of investment during the economic expansion of 2003-2007 as well as the collapse of investment during the financial crisis that started in October 2008. While many other leading indicators of investment, such as stock prices, were manipulated by the banking sector both during their expansion as well as preceding their collapse, we conclude that the volume of advertising contained information

about firm's expectations. Monitoring firm's advertisement expenditures may thus help predict the upcoming recovery.

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Appendix

Vector error correction estimation

Error Correction:	D(advertising)	D(investment)
CointEq1	0.198	-104.87
	(1.75)	(0.98)
D(advertising(-1))	-0.003	475.09*
	(0.01)	(2.01)
D(advertising(-2))	-0.066	887.79*
	(0.25)	(3.47)
D(advertising(-3))	-0.207	826.16*
	(0.77)	(3.16)
D(advertising(-4))	-0.382	260.14
	(1.26)	(0.88)
D(investment(-1))	0.001	-1.13*
	(1.88)	(3.76)
D(investment(-2))	0.001	-0.802*
	(1.83)	(2.58)
D(investment(-3))	0.000	-0.467
	(0.98)	(1.81)
D(investment(-4))	0.000	-0.258
	(1.61)	(1.44)
Constant	0.681	-1476.12
	(0.62)	(1.38)
R-squared	0.39	0.62
Adj. R-squared	0.16	0.47
F-statistic	1.66	4.18

t-statisics in parentheses.

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