

TOPIX MODEL

Objective

The objective of the model is to estimate the expected Topix by using only the fundamental economic variables.

Overview of the model

This model consists of two stages. The first stage calculates the expected free cash flow (FCF) of Japanese corporations. The second stage is to estimate Topix by using the expected FCF calculated in the first stage. The following section explains each stage.

The first stage: FCF calculation

The first stage is to calculate the expected FCF. Firstly we define the FCF as follows

$$FCF_t = (\text{Current profit}_t + \text{Interest payment}_t) * (1 - \text{effective tax rate}) + \text{Depreciation}_t$$

Current profit estimation

The first component to model is the current profit. The current profit is explained by Japanese GDP, US GDP and Yen-Dollar rate. It also includes Lehman and Yamaichi dummies to take account of the Lehman (2008-2009) and Yamaichi shock (1997-98) in the sample period.

Model specification is defined as follows:

$$Y = D4LSA \text{ profit};$$

$$Z = \text{Constant, } D4L\text{ngdp}_{jp}, D4L\text{ngdp}_{us}, \text{Lehman, Yamaichi, } D4Lfx;$$

Where D4 means 4-lag difference and Ln means logarithm of the original number.

(Hence, D4Ln means annual growth rate of variables)

(SA referees to seasonally adjusted variables)

Current profit model result

Initially lagged explanatory variables (t_1, t_2, t_3, t_4) to be included to capture possible lagged relationship between macroeconomic variables and current profit. However, none of these were statistically significant in the model. As a result, only contemporaneous variable have remained. As can be seen from the result below, the effect of US nominal GDP is four-times larger than that of Japanese. Note that the effect of FX change is relatively small.

Modelling Current Profit by Ordinary Least Square (OLS)

The estimation sample is: 1981 – 2013

	Coefficient	Std.Error	t-value	t-prob	Part.R ²
Constant	-0.0947578	0.02830	-3.35	0.0011	0.0835
D4Lngdp_{jp}	1.02787	0.5180	1.98	0.0494	0.0310
D4Lngdp_{us}	4.41148	0.8704	5.07	0.0000	0.1727
Lehman	1.32423	0.09815	13.5	0.0000	0.5967
Yamaichi	0.301407	0.06983	4.32	0.0000	0.1316
D4Lfx	0.329486	0.1516	2.17	0.0317	0.0370

Standard Deviation:	0.191685
RSS:	4.51940541
R²:	0.703711
F_(5,123)	58.43 [0.000] **
Log-likelihood:	33.1243
Durbin-Watson Statistic:	0.53
No. of observations:	129
No. of parameters:	6
Mean_(Y):	0.0364999
Variance_(Y):	0.118243

Interest payment estimation:

The second component to estimate is the interest payment by Japanese corporations taking into consideration the long-term interest rate. Due to the strong correlation between the long-term interest rate and interest rate payments from 2005, the sample period from 2005 is been taken and a simple regression been performed on the given period below. The result is shown in the following table.

(The unit of the interest rate payment is set at trillion JPY in order to match with the unit for the interest rate)

Modelling Interest payment by Ordinary Least Square (OLS)**The estimation sample is: 2005 - 2013**

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	0.600430	0.03484	17.2	0.0000	0.9027
Interest	14.8030	2.575	5.75	0.0000	0.5081

Standard Deviation:	0.0466747
RSS:	0.0697127407
R²:	0.508123
F_(1,32)	33.06 [0.000] **
Log-likelihood:	56.9815
Durbin-Watson Statistic:	0.465
No. of observations	34
No. of parameters	2
Mean (Y)	0.795397
Variance (Y)	0.00416847

Topix estimation

The second stage is to estimate the expected Topix. It is estimated by using the FCF with the post bubble trend and bubble dummy in order to capture the downward trend in the post-bubble period and the spike due to the bubble economy at the end of 1980's. FCF, the explanatory variable, is been calculated by the actual figures from the statistics data as follows.

$$FCF_t = (\text{Current profit}_t + \text{Interest payment}_t) * (1 - \text{effective tax rate}) + \text{Depreciation}_t$$

The estimation result is shown as follows.

Modelling Ltopix by Ordinary Least Square (OLS)**The estimation sample is: 1981 - 2013**

	Coefficient	Std.Error	t-value	t-prob	Part.R²
Constant	-15.6783	0.8130	-19.3	0.0000	0.7484
FCF	1.45660	0.05210	28.0	0.0000	0.8621
Postbubbletrend	-0.0117322	0.0005641	-20.8	0.0000	0.7758
Bubble	0.516662	0.03547	14.6	0.0000	0.6293

Standard Deviation:	0.123328
RSS:	1.90122192
R²:	0.898362
F_(3,125):	368.3 [0.000] **
Log-likelihood:	88.9738
Durbin-Watson:	0.522
No. of observations:	129
No. of parameters:	4
Mean (Ltopix):	7.10987
Variance (Ltopix)	0.145006

The lagged explanatory variables is been calculated to capture the forward-looking attributes of the variables associated with Topix. However, none of these were statistically significant in the model. As a result, only contemporaneous variable have remained. Similarly, we included Yen-Dollar exchange rate but did not improve the model and the parameters were not statistically significant.

Topix computation:

The first step to compute the expected Topix is to calculate the expected FCF. The expected FCF is been calculated by using the estimated current profit and estimated interest payment by using the parameters estimated in the first stage with the expected JP and US nominal GDP growth rate and USD/JPY.

Once the expected FCF is been calculated, it is been substituted in the Topix estimation model by using the parameters estimated in the second stage. The logarithm of the expected Topix is derived and therefore, anti-log of the number is calculated, resulting the level of the expected Topix.