Reassessing the 'Threat' of E-Money: New Evidence from the Euro Area

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Outline of the Presentation

i. What is 'E-Money'?
ii. The 'Threat' Posed by E-Money
iii. Wider Issues Related to E-Money
iv. Historical Performance of E-Money Systems
v. Forecasting E-Money Adoption
vi. Longer-Term Prospects
vii. Concluding Remarks

What is 'E-Money'

'Electronic money' shall mean monetary value as represented by a claim on the issuer which is:

i. stored on an electronic device;

ii. issued on receipt of funds of an amount not less in value than the monetary value issued;

iii. accepted as means of payment by undertakings other than the issuer.

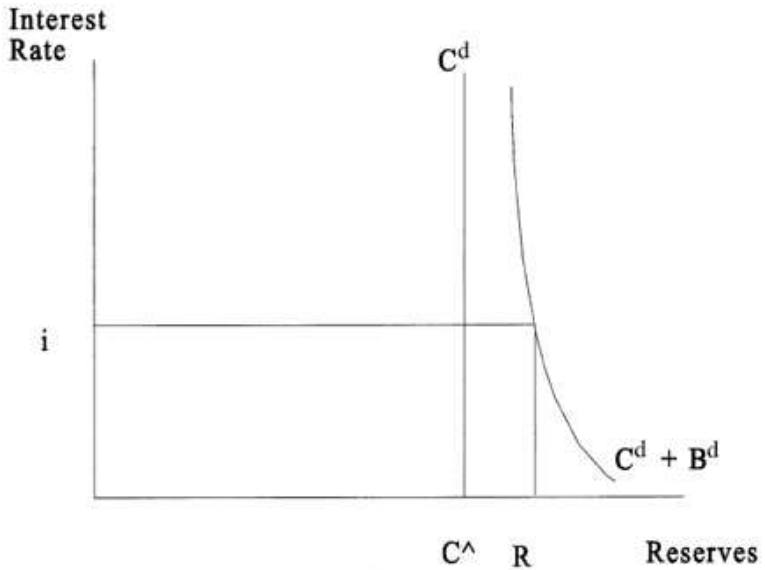
– Article 1(3)(b) of Directive 2000/46/EC

What is 'E-Money' (cont'd)

- Freedman (2000) developed a three-way typology:
  i. Access devices: provide access to traditional banking services;
  ii. Hardware e-money: prepaid value stored on an electronic device; and
  iii. Software e-money: prepaid value stored on a computer network.
- Allen (2003) discusses a fourth category:
  iv. Mobile payments: payments made using a mobile phone.
- In general m-payments are special cases of (i.) to (iii.).
- The exception would be where contract phones provide SVC functionality **chargeable to the contract** as this would amount to the provision of credit (NTT DoCoMo in Japan?).

The 'Threat' Posed by E-Money

- Friedman (1999; 2000) and King (1999) advance two scenarios in which e-money may threaten monetary policy:
  i. E-money wholly displaces currency.
  ii. E-money displaces the settlement facilities of the central bank.
- Palley (2001) discusses these as follows:



Scenario 1: SVCs wholly displace currency

- If SVCs displace currency then $\widehat{C} = 0$.
- However, the interest inelastic demand for settlement balances arising from commercial banks remains.
- Therefore monetary policy remains effective but the CB balance sheet shrinks.
- The CB may need to find alternative means of funding its activities.
- This **could** affect its independence but it is **not** a fundamental obstacle to monetary policy.
- Hence the substitution of e-money for currency among the non-bank public poses no threat to monetary policy.

Scenario 2: E-money offers final settlement

- If hardware e-money systems were to displace the settlement facilities of the central bank then $\widehat{C}$ remains unchanged but B^d would disappear.
- The balance sheet of the CB would not shrink substantially but the remaining demand for CB liabilities would be perfectly interest inelastic (by assumption).
- In this model, the linkage between the quantity of reserves and the interest rate is removed.
- The CB has three options:
  i. Expand its operations until they are substantial relative to the market.
  ii. Extend reserve requirements to e-money issuers.
  iii. Pay interest on reserves.

Scenario 2: E-money offers final settlement (cont'd)

- By paying interest on deposits, the CB can pursue its policy goals using the deposit rate rather than the spread as its policy instrument.
- Where the CB pays interest on deposits it sets a reference rate for all other settlement facilities.
- Any facility paying a lower rate would not be used.
- The payment of a higher risk-adjusted rate of return on deposits obviously has an associated cost.
- The provision of settlement facilities is not inherently profitable so it is unclear how a private settlement facility would derive its income.

A Rebuttal of the Extreme Position

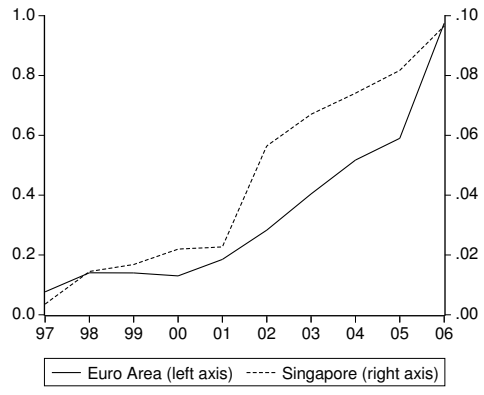
- E-money would have to possess the following attributes to eliminate reserve holding at the central bank:
  i. Non-redeemability for CB money;
  ii. Universal acceptance and complete interoperability;
  iii. Full transferability (i.e. it is not extinguished when spent);
  iv. Payment of wages in e–money so that the value chain can exist independently of CB money;
  v. Payment of interest on deposits;
  vi. Extension of credit;
  vii. Provision of settlement systems offering all the benefits of settlement at the central bank; and
  viii. Acceptance in the payment of tax debts.
- Such developments are at best a distant prospect!

Wider Issues Related to E-Money

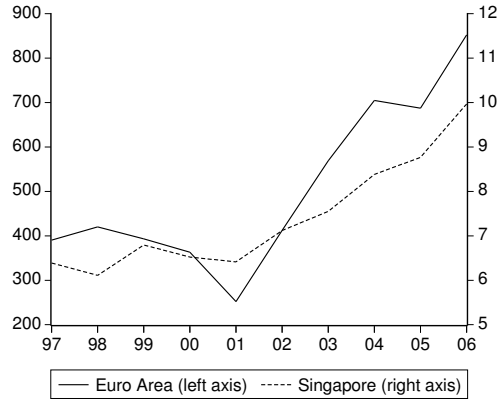
- A number of more mundane issues related to e-money can be identified:
  i. Bank runs;
  ii. Circuventive innovation;
  iii. Inaccuracy of monetary aggregates;
  iv. Systemic risks arising from offshore issuers;
  v. Systemic risks arising from insolvency of issuers;
  vi. Social exclusion; and
  vii. Anonymity and the underground economy.
- These have received little attention because the extreme scenarios have dominated discussion in the field.
- However, these are likely to be the more important issues!

Historical Performance of E-Money Systems

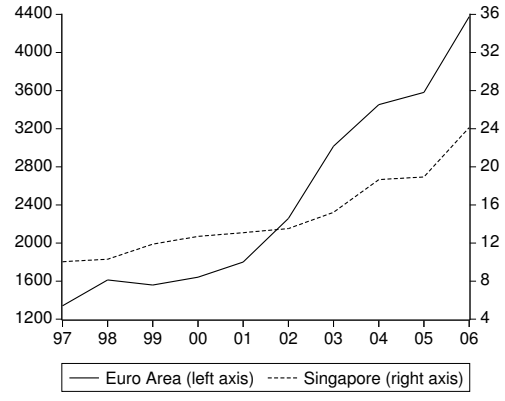
- The Committee on Payment and Settlement Systems at the BIS records e-money data for a number of countries.
- The data is most complete for Singapore and a number of continental European countries.
- Using this data, it is possible to evaluate the historical development of e-money in relation to the following:
  i. Outstanding balances of various payment instruments
  ii. Relative importance of payment instruments by transaction volume
  iii. Number of cards by category
  iv. Number of ATMs and e-money loading terminals
  v. Number of POS and e-money purchase terminals



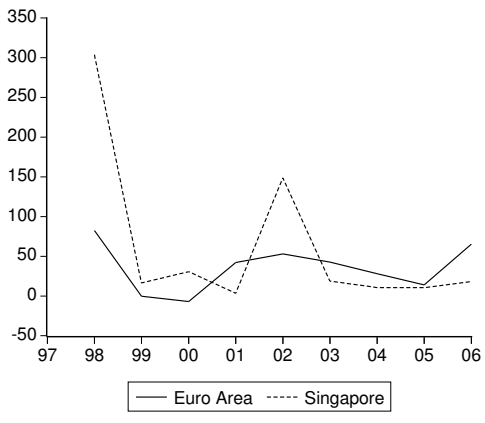
(a) E–Money



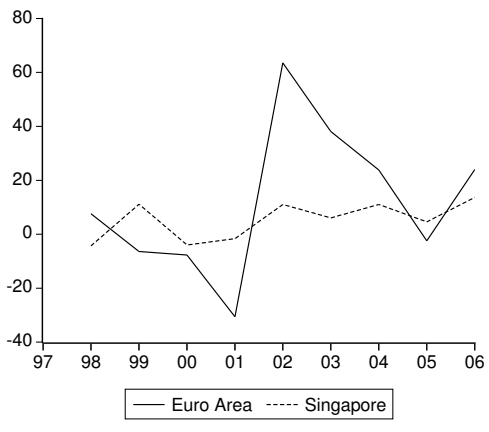
(b) Currency



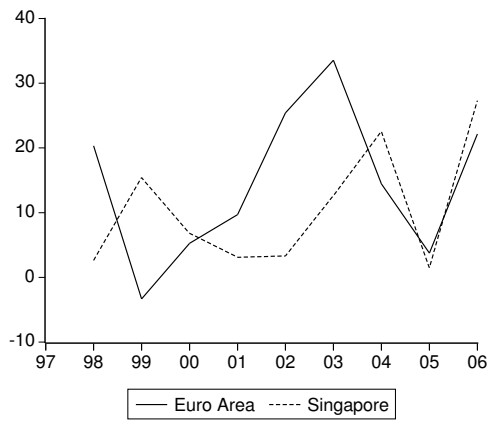
(c) Overnight Dep.



(d) E–Money

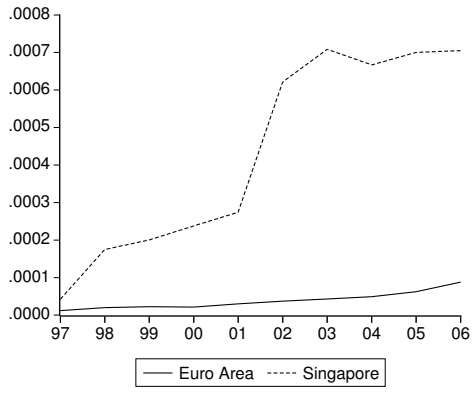


(e) Currency

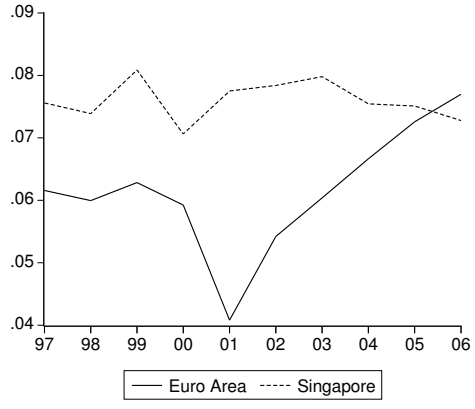


(f) Overnight Dep.

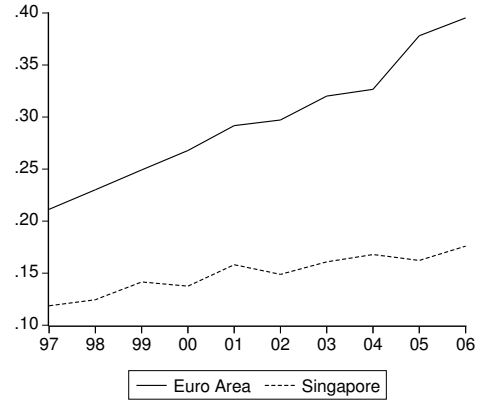
Figure: Outstanding Balances (a-c, $bn) and Growth Rates (d-e, %p.a.)



(a) E–Money



(b) Currency



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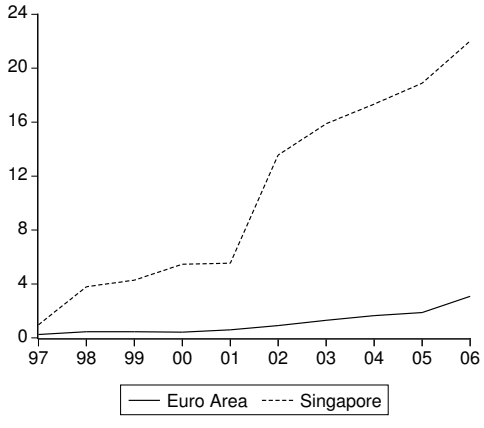
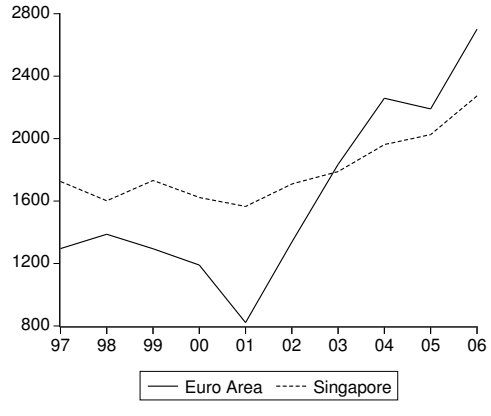
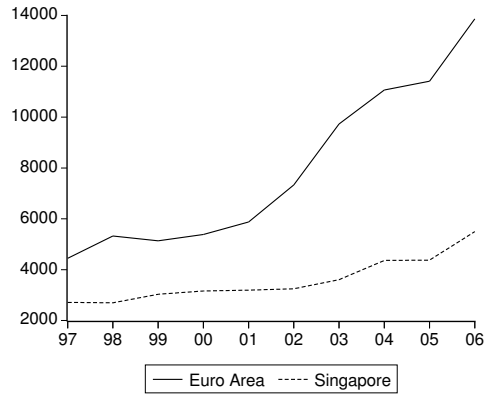


(d) E–Money

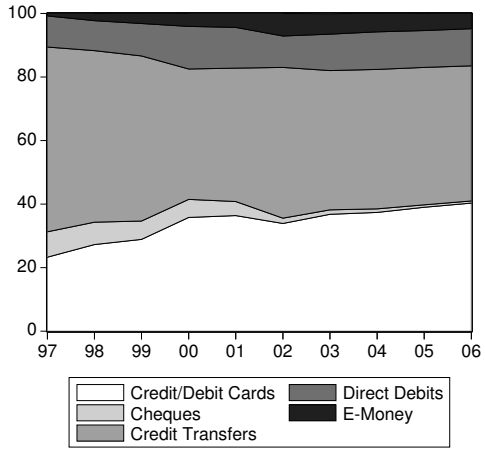


(e) Currency

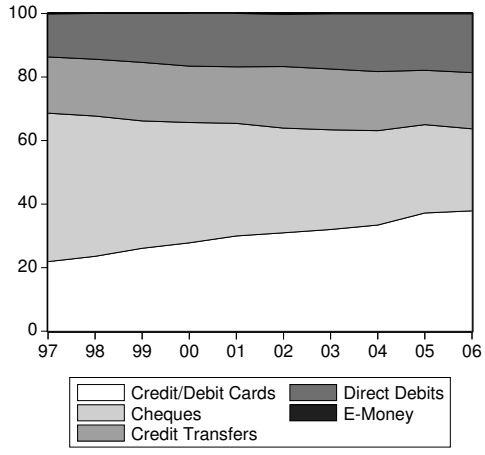


(f) Overnight Dep.

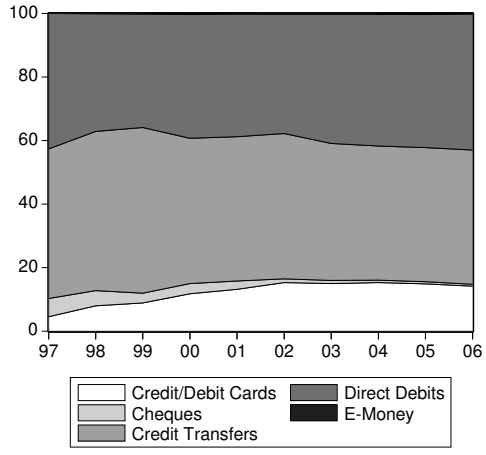
Figure: Outstanding Balances/GDP (a-c) and per Capita (d-e, US$)



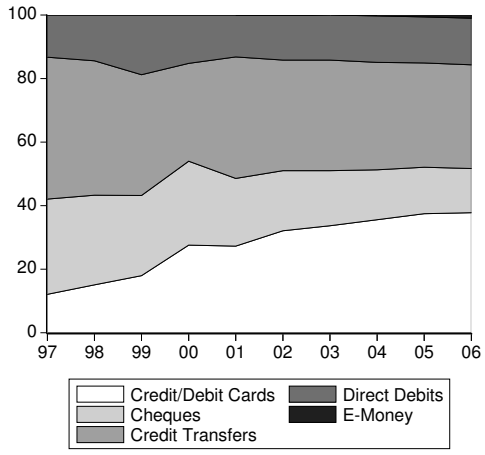
(a) Belgium



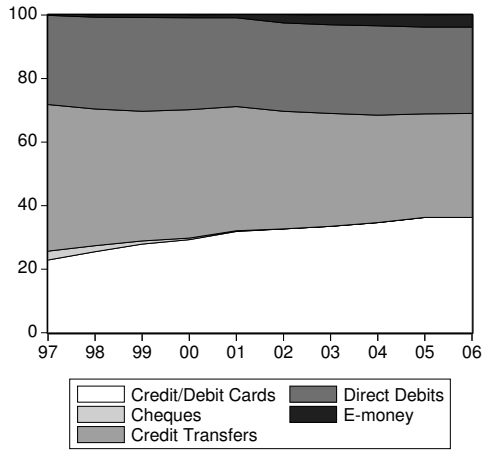
(b) France



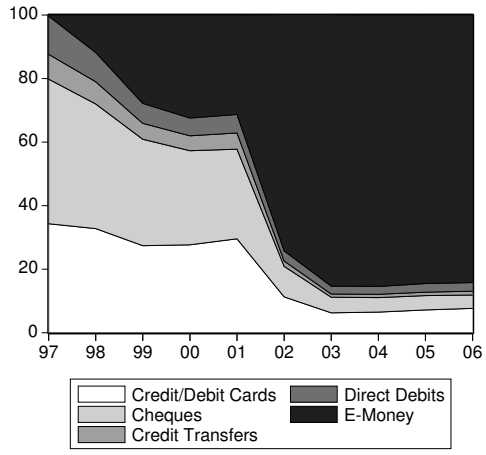
(c) Germany



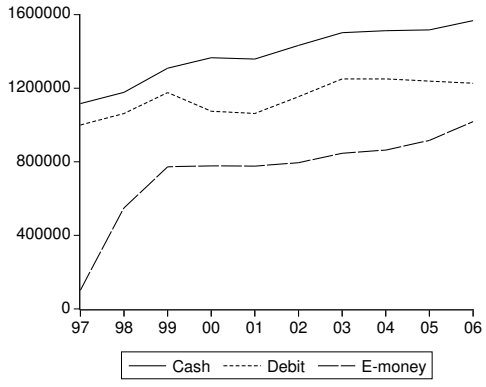
(d) Italy



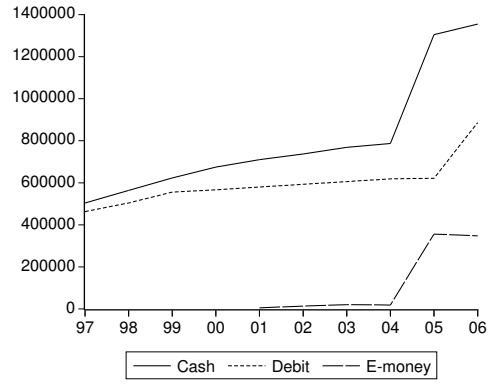
(e) Netherlands



(f) Singapore



(a) Belgium



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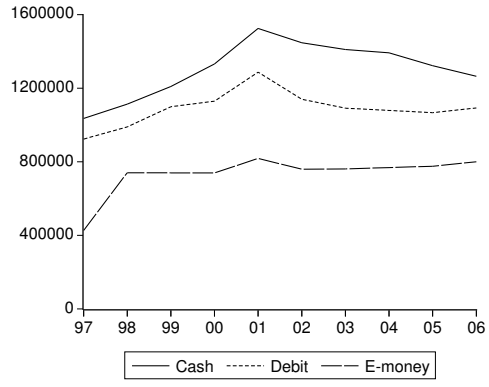

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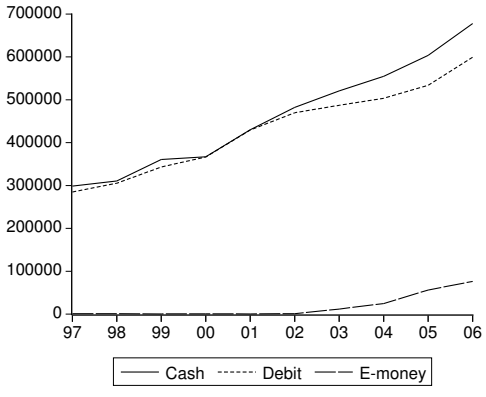

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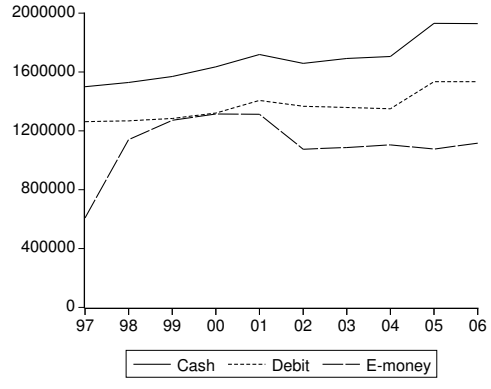

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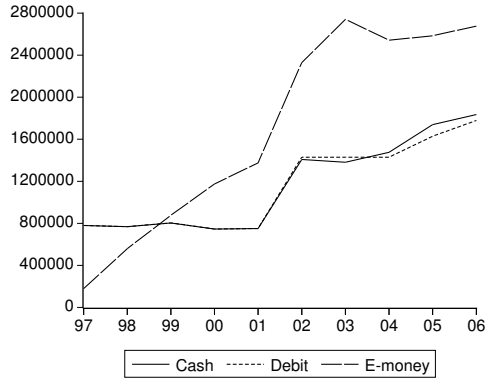
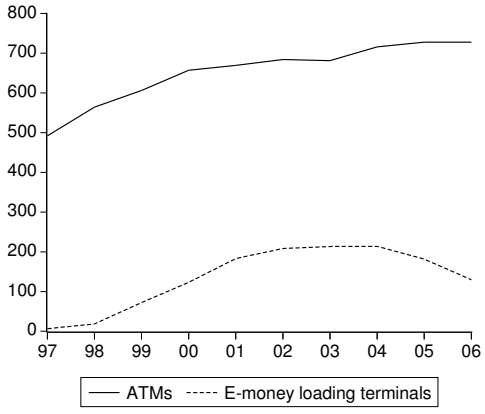
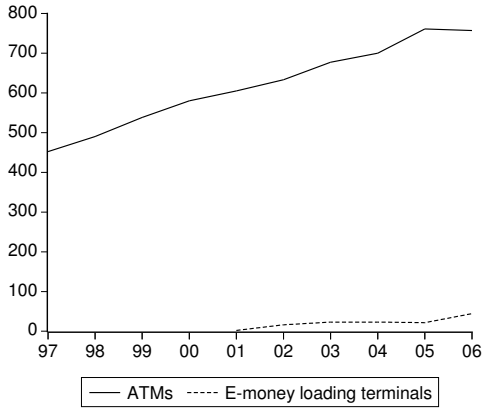


(f) Singapore

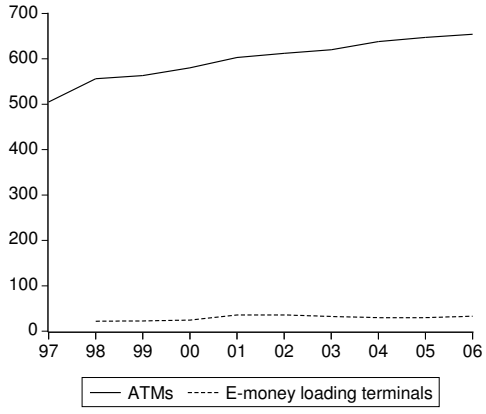
Figure: Number of Cards per Million Inhabitants by Function



(a) Belgium



(b) France



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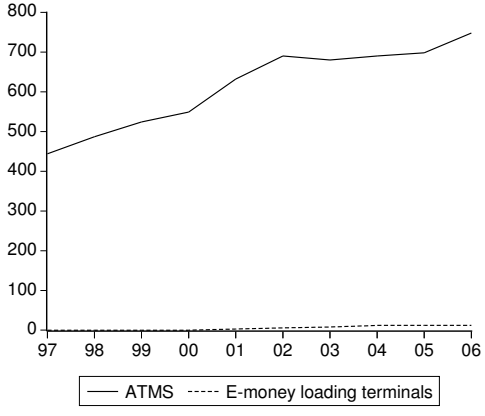

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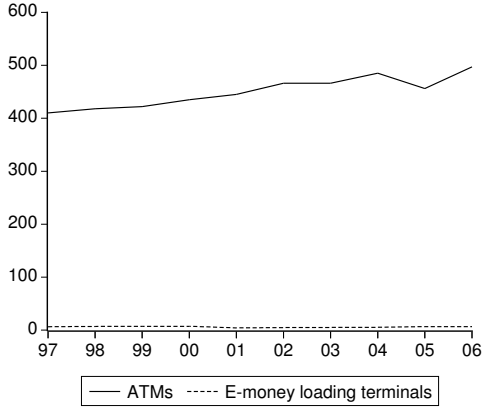
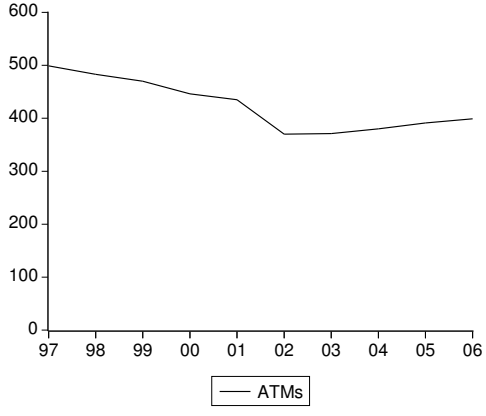
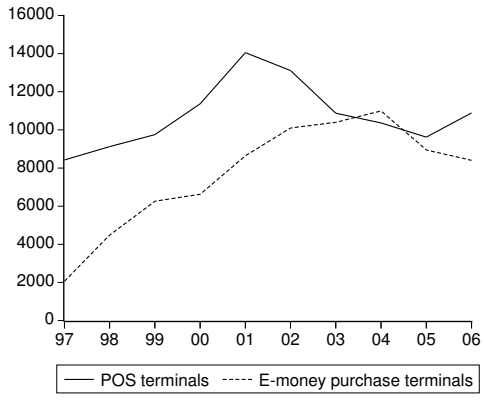


(e) Netherlands

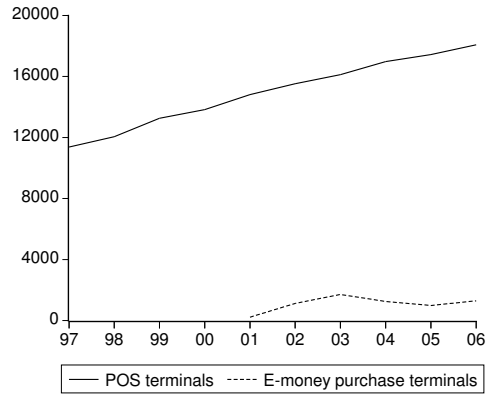


(f) Singapore

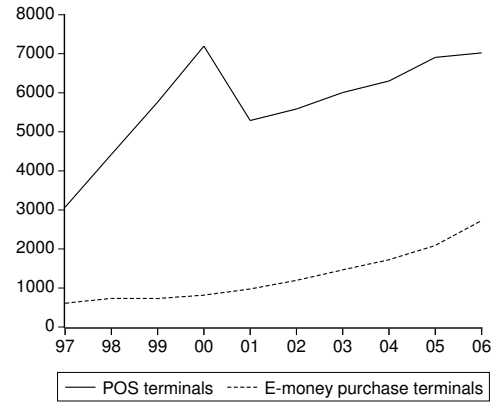
Figure: No. ATMs & E–Money Loading Terminals per Million Ppl.



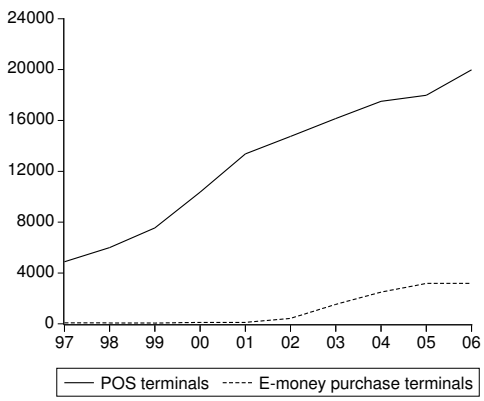
(a) Belgium



(b) France



(c) Germany



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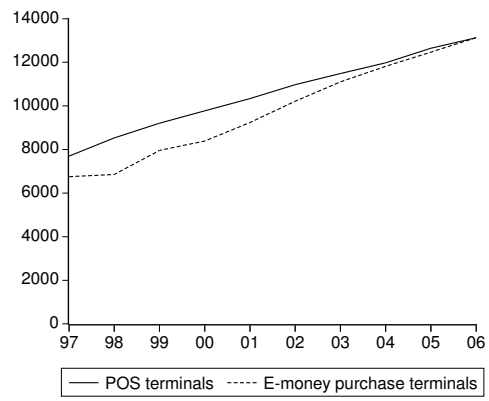

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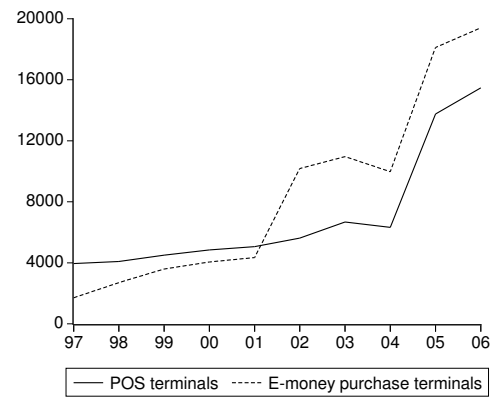


(f) Singapore

Figure: No. POS & E–Money Purchase Terminals per Million Ppl.

Historical Performance of E-Money Systems: A Summary

- E-money is considerably more widely used in Singapore than in the Euro Area and received a major impetus in 2001 with the announcement of SELT.
- The volume of e-money transactions relative to all cashless payments is small in EA countries but very large in Singapore, reaching 85% in 2003.
- E-money cards are relatively widespread in Belgium and the Netherlands but in Singapore every adult holds approximately three e-money cards (evidence of coordination failure?).
- E-money loading terminals are scarce relative to ATMs (Singaporean data unavailable).
- E-money purchase terminals are as common as regular POS in Belgium and Holland and slightly more so in Singapore.

Forecasting E-Money Adoption

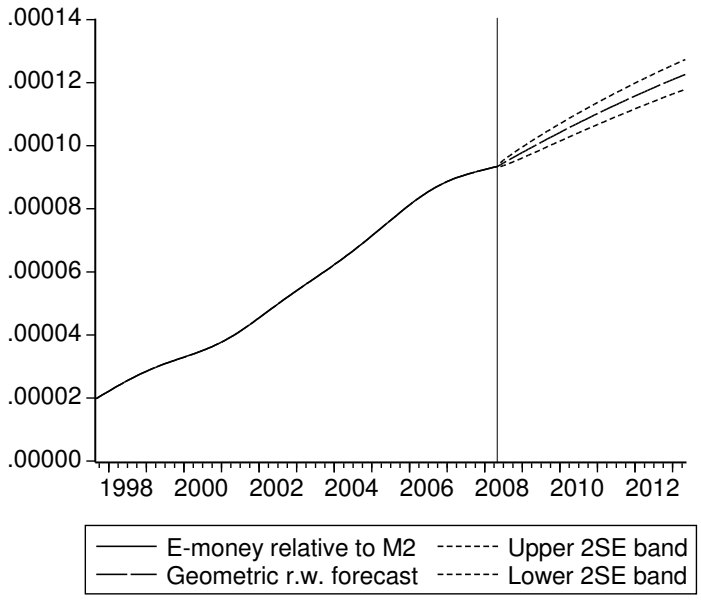
- The ECB dataset covers 10 years at monthly frequency.
- The richness of the data permits sophisticated forecasting of future trends.
- Three forecasts are computed here:
  i. A benchmark geometric random walk;
  ii. A simple average model combining 28 equally weighted candidate models; and
  iii. A nonlinear Gompertz curve.
- Average models are well known for their forecasting prowess.
- The Gompertz curve is a sigmoid function (similar to the logistic function) and allows us to test Roger's (2003) sigmoid adoption hypothesis.

Geometric Random Walk

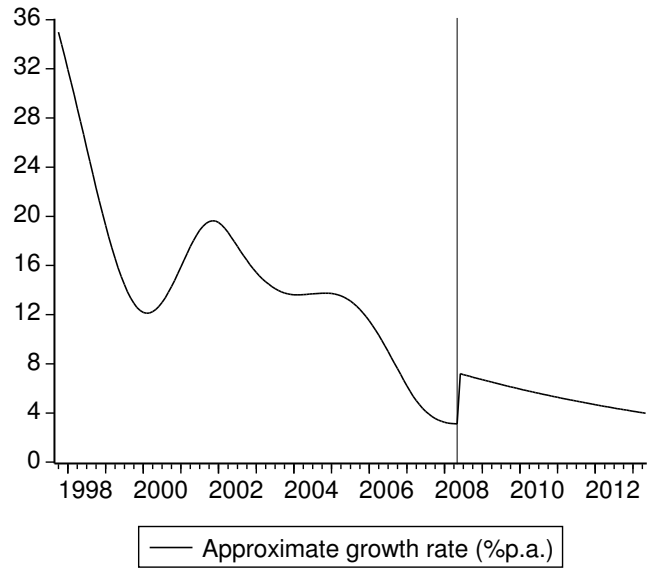
- The geometric random walk is appropriate for modelling series exhibiting exponential growth (e.g. nominal series).
- It is commonly used as a benchmark model.
- It is specified as follows:

$$ln\left(e_t\right) = \alpha_0 + \alpha_1 ln\left(e_{t-1}\right) + \varepsilon_t \tag{1}$$

h-step Ahead Geometric Random Walk Forecast



(a) Level



(b) Growth Rate

Figure: h–step Ahead Geometric Random Walk Forecast

Model Averaging

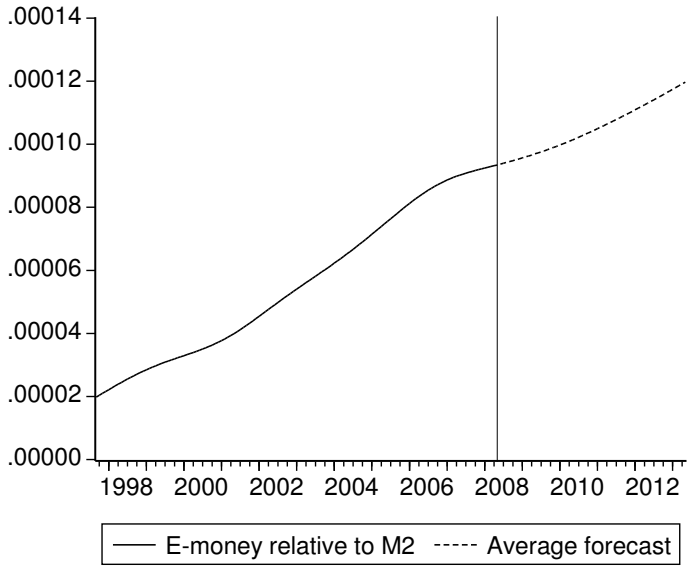
- Model averaging is well known to provide good forecasting performance.
- The candidate models combined in the average model are as follows:
  - AR(p) models including the benchmark geometric random walk model;
  - ARIMA(p,d,q) models;
  - p-th order VAR–in–differences models using a mix of regressors (next slide);
  - p-th order cointegrating VAR models using Johansen's exactly identifying restrictions.
- The 28 candidate models are combined by simple averaging with equal weights.
- Unlike Bayesian averaging, this does not require the 'true' model to be among the canidate set.

Model Averaging (cont'd)

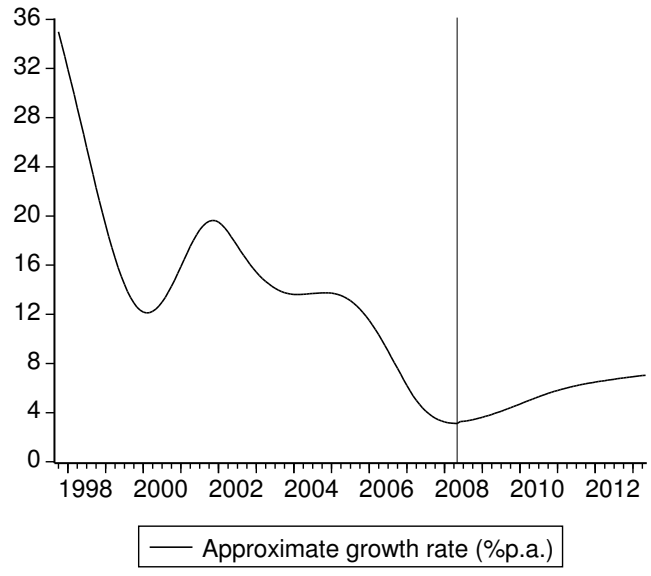
Symbol	Variable definition
m_{hp}	Log of e–money balances outstanding relative to M2
c	Log of currency in circulation relative to M2
d	Log of demand deposits relative to M2
y	Log of real industrial production
r	Log of the 1 month Euribor
z	Log of the technology index
q	Log of the deflated NASDAQ adjusted closing price

Table: Variables Used in the Multivariate (VAR/VEC) Candidate Models

h–step Ahead Average Forecast



(a) Level

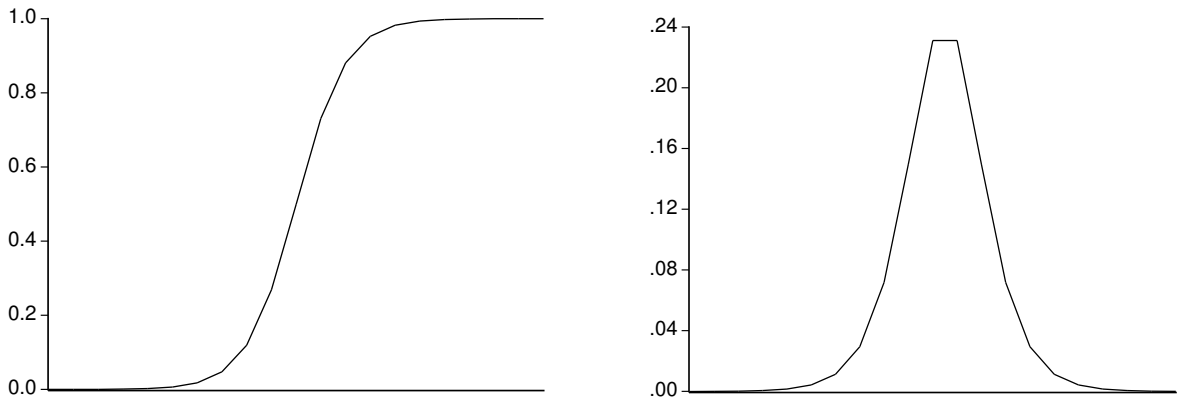


(b) Growth Rate

Figure: h–step Ahead Average Forecast

Nonlinear Gompertz Curve

- Rogers (2003) argues that the uptake of innovative products follows an S-shaped process:



(a) Cumulative Adoption (b) Per–period Adoption

Figure: Sigmoid Adoption of Innovation

- The Gompertz curve provides a simple means of analysing the implications of Rogers' model for the e-money market.

Nonlinear Gompertz Curve (cont'd)

- The Gompertz curve is specified as follows:

$$y_t = \alpha e^{-\beta e^{\gamma t}} \tag{2}$$

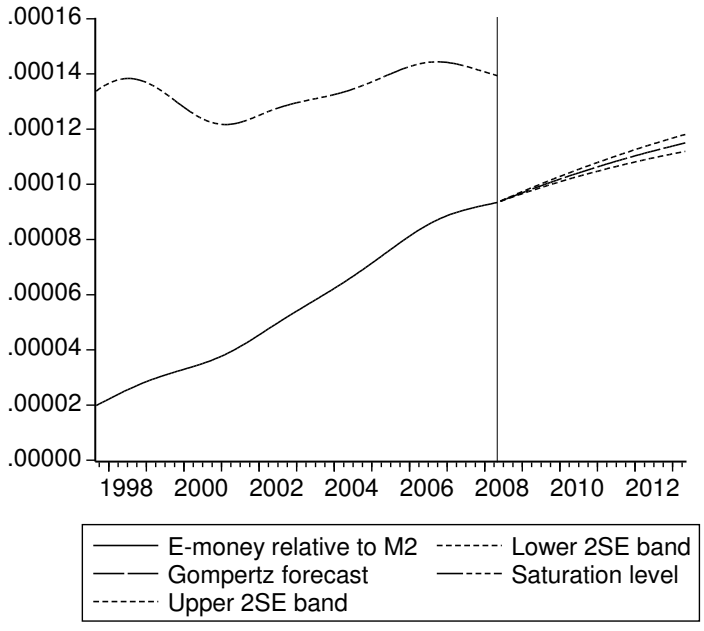
where α denotes the saturation level, γ the rate of growth, β is a positive parameter determining the lateral position of the curve and t is a deterministic trend.

- Franses (1994) rearranges the model to achieve a form that can be estimated simply using nonlinear least squares:

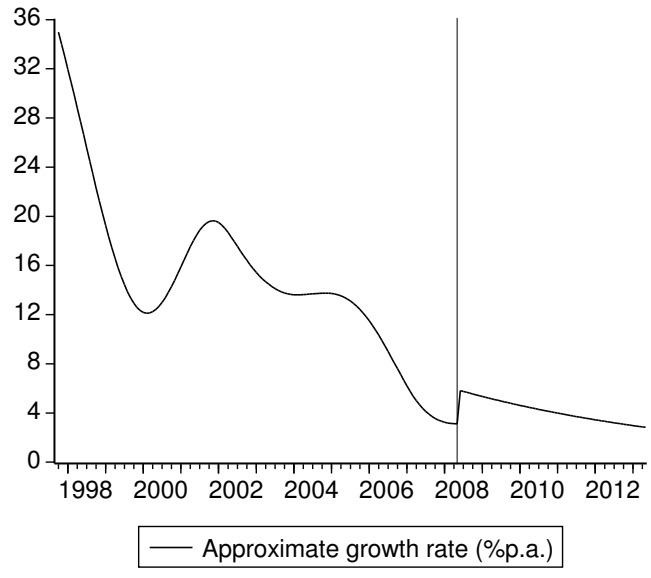
$$ln\left(\Delta ln y_t\right) = -\gamma t + ln\left(\beta e^{\gamma} - \beta\right) + \epsilon_t \tag{3}$$

- The upper asymptote is then computed from the estimates of β and γ.

h–step Ahead Gompertz Forecast



(a) Level



(b) Growth Rate

Figure: h–step Ahead Gompertz Forecast

Summary of the Forecasts

- The random walk and Gompertz forecasts are quite similar and predict modest growth in the medium-term.
- The Gompertz curve suggests that e-money usage is already approaching its upper asymptote.
- The average model is slightly more upbeat but not much.
- The average model performs best in pseudo out-of-sample testing so perhaps it is the most credible.
- Overall, the forecasts agree that the very high growth rates experienced in the past are over, at least if e-money products do not change significantly.
- However, the e-money market is nothing if not evolutionary...

Longer-Term Prospects

- The degree to which e-money succeeds commercially in the longer-term depends on at least three factors:
  i. the incentives for merchants, customers and issuers
  ii. security issues and the potential for identity theft
  iii. developments in the capabilities of e–money systems
- At present, the incentives for merchants in particular are not clear.
- Van Hove (1999) identifies a 'chicken-and-egg' problem.
- There are major perceived security issues (e.g. hacking of the Mifare RFID last year).
- The major opportunities lie in the development of innovative new products and the pursuit of perfect interoperability.
- Singapore highlights the crucial role of regulation.

Concluding Remarks

- The two extreme scenarios pose no threat to monetary policy.
- The related literature has diverted attention from more mundane but more important issues including social exclusion, systemic risk and privacy.
- To date, e-money usage has remained minimal in Europe but has grown rapidly in Singapore.
- A payment system does not have to account for a large value of payments to be important - access to mass transit systems, for example, is socially and economically essential.
- The forecasting exercises show little sign of rapid growth in the medium-term.
- Longer-term prospects depend on incentives, security and the development of innovative new products.
- There is a role for regulation in promoting interoperability (e.g. SELT and CEPAS 2.0).