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SAVING BEHAVIOUR UNDER IMPERFECT FINANCIAL MARKETS AND THE CURRENT ACCOUNT CONSEQUENCES*

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We seek to establish the general empirical importance of investment-motivated saving. Our hypothesis is that inadequate financial intermediation will induce agents to save more in order to undertake lumpy physical investment in the future. The result is a positive relationship between the degree of capital market imperfection and the size of the private saving rate. A simulation exercise calibrated on Taiwan found a close match between the simulated and actual data. Regression analysis established that the private saving rate was negatively related to the level of financial market sophistication.

We limit discussion to the small-country case, and define a capital market as perfect when a small-country resident can lend or borrow at the foreign interest rate provided that her actions fall within her *intertemporal* budget constraint. We have highlighted the intertemporal budget constraint rather than the existence of complete contingency markets in our definition of 'perfect' because our focus is on how saving is affected by inadequate financial intermediation rather than how it is affected by inadequate insurance markets.

The central role of financial intermediation is to borrow short and lend long, and in order to do that, financial institutions have to be able to assess the riskiness of future earning streams competently and develop appropriate financial instruments in response. We equate the degree of financial market sophistication with the ability to perform both of these functions. So the wider and deeper the market for long-term financial instruments (e.g. corporate bonds, mortgage bonds, consumer loans) the more sophisticated is the financial system. A primitive financial system is one where there is only short-term credit because of the inability of the financial institutions to perform risk assessments.

The current account balance (CA) is simply the difference between national saving and domestic investment. It equals the sum of the government budget surplus (T–G) and the excess of private saving (S_p) over private domestic investment (I_p). An interesting result from the perfect capital market setting is that investment behaviour is independent of saving behaviour. Investment is undertaken to maximise the value of wealth, and saving (consumption) is chosen to maximise utility subject to the (investment-maximised) wealth constraint. This means that investment shifts do not require corresponding

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saving shifts because the current account will act as the buffer.[1] The current account balance, in short, is the outcome of intertemporal optimisation.[2]

This paper evolved from our attempt to understand why Taiwan's current account surplus has tended to increase over time since 1970, a trend that has been masked by the two OPEC shocks (Woo, 1988). As Taiwan is still far from being a capital-rich country like Japan and Germany,[3] the issue is how this capital export could represent optimal behaviour when 'such surpluses would divert resources from high-yielding domestic investments, which sustained past growth, into the accumulation of low-yielding foreign assets' (Balassa and Williamson, 1987). Our hunch was that because of the extreme imperfections in the Taiwanese financial system, the current account developments reflected increases in saving motivated by the desire to invest.

The purpose of our paper is to show the general empirical importance of investment-motivated saving.[4] Our hypothesis is that there is a positive causal relationship going from the degree of capital market imperfection to the private saving rate directly, and to the $(S_p - I_p)$ component of the current account balance indirectly.

Our brief is organised as follows. Section I examines the *CA* surpluses of Germany, Japan and Taiwan. Section II models the saving behaviour of a representative agent who has to resort to self-financing of lumpy investment because she faces an imperfect capital market. Section III simulates the model calibrated on Taiwan's characteristics, Section IV tests it, and Section V concludes the paper.

This paper adds to three areas in the economics literature. First, it adds to the saving literature by showing that the investment motive has been empirically as important as the retirement motive and the precautionary motive, the two traditional reasons for saving. Secondly, it adds to the capital–mobility literature by demonstrating the widespread existence of liquidity constraints. Thirdly, the paper adds to the financial repression literature by showing that imperfect capital markets can cause a country to run current account surpluses when the efficient response to its high rates of return on domestic investments is to run a current account deficit (i.e. receive capital inflow).

I. DATA OVERVIEW OF SAVING-INVESTMENT BEHAVIOUR AND FINANCIAL SYSTEM

Table 1 shows that the $(S_p - I_p)$ component is the main reason for the persistent current account surpluses of Taiwan, Japan and Germany. We note that both

[1] This is the basis for the Feldstein and Horioka (1980) and Sachs (1981) test of the degree of capital mobility.

[2] See Sheffrin and Woo (1990*a*, *b*) for empirical support.

[3] Taiwan's *per capita* income was US$7,500 in 1989 compared to US$8,700 for Irish Republic, US$9,300 for Spain and US$15,000 for Italy – all of which normally run *CA* deficits (excluding official transfer) – US$20,000 for Germany and US$24,000 for Japan.

[4] The empirical importance of investment-motivated saving is supported by history (Williamson, 1988) and by post-war Japanese experience (Balassa and Noland, 1988; and Horioka, 1985).

Table 1

A Decomposition of Current Account Balance in Taiwan, Japan, and Germany

(% of GNP)

	Taiwan				Japan				Germany		
(1) Year	(2) Current account	(3) Private sector excess savings	(4) Public enterprises excess savings	(5) Government balance	(6) Current account	(7) Private sector excess savings	(8) Public enterprises excess savings	(9) Government balance	(10) Current account	(11) Private & public corporations excess savings	(12) Government balance
1965	−2·02	−1·52	−1·28	0·79	1·01	2·31	−3·73	2·43	−1·42	−2·25	0·83
1966	0·96	2·26	−1·96	0·66	1·18	3·25	−3·84	1·78	0·08	−0·93	1·02
1967	−1·61	0·87	−3·16	0·67	−0·15	0·94	−3·16	2·07	2·03	2·15	−0·12
1968	−2·76	−2·05	−2·27	1·56	0·70	1·05	−3·51	3·16	2·23	1·75	0·48
1969	−0·70	−0·47	−2·36	2·13	1·23	−0·36	−2·32	3·91	1·25	−1·33	2·59
1970	0·01	1·94	−2·73	0·80	0·98	0·86	−2·36	2·48	0·46	−1·16	1·62
1971	2·61	4·82	−3·64	1·43	2·52	2·54	−2·52	2·50	0·44	−1·21	1·65
1972	6·54	6·02	−3·47	3·99	2·19	4·61	−2·86	0·44	0·45	−0·72	1·16
1973	5·29	6·30	−4·80	3·79	−0·03	2·25	−2·64	0·36	1·48	−1·47	2·94
1974	−7·77	−4·64	−8·21	5·07	−1·03	0·81	−3·29	1·45	2·78	2·29	0·49
1975	−3·86	2·71	−9·30	2·73	−0·14	5·10	−3·93	−1·31	1·05	4·97	−3·91
1976	1·60	5·18	−7·26	3·68	0·67	6·82	−3·38	−2·77	0·83	2·45	−1·62
1977	4·25	6·67	−4·72	2·30	1·58	7·13	−3·19	−2·36	0·77	1·19	−0·43
1978	6·04	6·09	−4·25	4·20	1·70	8·73	−3·16	−3·86	1·42	2·11	−0·69
1979	0·55	0·58	−4·80	4·78	−0·86	5·27	−2·83	−3·30	−0·74	−0·01	−0·73
1980	−2·24	2·36	−7·12	2·52	−1·02	4·13	−2·30	−2·84	−1·71	−0·71	−1·00
1981	1·13	4·53	−5·35	1·94	0·41	4·77	−2·47	−1·89	−0·50	1·28	−1·78
1982	4·83	8·18	−3·50	0·15	0·63	4·97	−2·27	−2·07	0·75	2·25	−1·49
1983	8·70	9·64	−2·23	1·30	1·76	6·23	−2·29	−2·18	0·82	1·71	−0·89
1984	12·10	9·68	0·65	1·78	2·79	5·87	−2·30	−0·78	1·55	1·57	−0·01
1985	15·30	12·67	1·35	1·27	3·70	5·16	−2·13	0·67	2·72	2·03	0·69
1986	20·80	20·16	1·53	−0·90	4·37	6·15	−2·08	0·30	4·43	3·97	0·45
1987	16·59	19·24	−0·61	−2·04	3·65	N.A.	N.A.	N.A.	4·02	N.A.	N.A.

Sources:

Taiwan: *Taiwan Statistical Data Book*, Council for Economic Planning and Development, Republic of China, 1989; *Financial Statistics*, Taiwan District, Republic of China, May 1989.

Japan: *International Financial Statistics*, IMF, 1989; OECD *National Accounts*, vol. II, 1983–88; *Japan Statistical Yearbook*, the Bank of Japan, 1972–75.

Germany: *International Financial Statistics*, IMF, 1989; OECD *National Accounts*, vol. II, 1983, 1984, and 1988.

the public and private sector contributed to the unprecedented levels of *CA* surpluses in the 1980s.

The private sector contribution could be attributed to one common international factor – private saving rates rose because agents realised that the export-driven income growth (caused by the Reagan fiscal shocks) was temporary – and to country-specific factors. For Taiwan, we can attribute part of the large jump in the private saving rate from 20% in 1981 to 22% in 1984 and then to 30% in 1987 to Fry's (1988*b*) finding that the private after-tax rate of return on private capital also rose dramatically in this period, 10% in 1981, 11% in 1984 and 19% in 1987.

Since Taiwan and Japan have the largest *CA/GNP* ratios, we will briefly describe their financial systems.[5]

Taiwan's financial system up to 1987 was characterised by interest rate controls, credit rationing, government-imposed conservative lending criteria, high legal barriers to entry and tight foreign exchange controls. The long-term loan market was underdeveloped largely because almost all the domestic banks were owned and controlled by the government and loan officers were personally responsible for bad loans.[6]

The Japanese financial system appears to have met the capital needs of the corporate sector quite satisfactorily. The 'failing' appears to be in the scarcity of mortgages and other consumer credit. In 1986, personal consumer credit and housing mortgage credit in Japan were 1% and 33% of consumption expenditure respectively, compared with 22% and 62% respectively in the United States. Only 46% of the Japanese in the 30–39 age bracket were home-owners compared with 74% of Americans in that age bracket.[7]

II. SAVING-INVESTMENT BEHAVIOUR IN A MODIFIED LIFE-CYCLE MODEL

We amend the standard life-cycle model (Modigliani and Brumberg, 1954) in four ways. The first amendment is that investments are lumpy, K_0 is the size for a firm. The second amendment is to assume that banks are the only financial institutions and, being conservative, they lend only working capital to

[5] In Liu and Woo (1992), the (Equity/M1), (Equity/M2) and ((Equity-M1)/GDP) ratios, which were taken as indicators of financial market sophistication, for Taiwan and Japan were lower than those for the United States.

[6] Shea and Yang (1989) found that (1) public enterprises were granted more loans by financial institutions for per unit of production than private enterprises; (2) 'the larger the firm, the easier to get financing from the money and bond markets'; (3) 'collateral was emphasized instead of profitability'; and (4) 'financial institutions have not allocated the loans according to the growth potential of industries.'

[7] Data are from Jappelli and Pagano (1989). They reported that the down-payment required for mortgage loans was 40% of the house value in Japan versus 10 to 25% in the United States. We thank Ken Hirayama and the anonymous referee for informing us that the figure for Japan should be 20%. The latter pointed out that the big national difference lies not in the size of down-payment vis-à-vis house value but in the size of down-payment vis-à-vis family income. The (house value/income) ratio is much higher in Japan. The ratio of land value plus net value of residential buildings to GNP, in 1984, was 370% for Japan and 169% for United States; and in 1988, was 552% and 163% respectively.

established firms for amounts up to the value of the firms' capital stock (i.e. short-term loans that are completely collateralised). By limiting bank loans to working capital, we disallow an existing firm from doubling its size; and by including firm-owner's consumption in working capital, we allow a firm-owner to smooth her consumption by borrowing on the basis of the firm's capital.[8] The third amendment is to assume a semi-open economy setting, there are binding quantitative restrictions on private capital flows but not on private merchandise trade. The fourth amendment is that the rate of return on investment is greater than both the regulated domestic bank deposit rate and the foreign interest rate.

We assume that people live for D periods, have additive separable utility functions, and do not have bequest motives. We also assume that the proper management of *one* firm requires the full-time attention of the capitalist, this ensures that the amount of the target saving is K_0 and not a multiple of it. Agents face the decision of whether to invest at some future date or not. They calculate the respective utility for the two options, and choose the higher utility option.

Option 1: Save for Retirement and for Investment

The individual's choice problem at the beginning of her career is given by: Maximise

$$\sum_{t=0}^{D} (1+\delta)^{-t}\left(\frac{1}{1-\gamma} C_t^{1-\gamma}\right),$$

Subject to:

$$\sum_{t=0}^{D} C_t(1+r)^{-t} = \sum_{t=0}^{T_1} y_t(1+r)^{-t} - \sum_{t=0}^{T_1} S_t(1+r)^{-t} + iK_0 \sum_{t=T_1+1}^{D} (1+r)^{-t} + K_0(1+r)^{-D}, \tag{1}$$

$$\sum_{j=0}^{t} (c_j - y_j)(1+r)^{t-j} \leqslant 0, \quad t = 0, \ldots, T_1, \tag{2}$$

$$c_t \geqslant 0, \quad t = 0, \ldots, D, \tag{3}$$

where

δ = time preference rate,
γ = degree of constant relative risk aversion,
r = real deposit interest rate,
y_t = labour income at time t,
s_t = saving from non-bank interest income at time t,
c_t = consumption at time t,
i = rate of return on investment,
T_1 = period when investment is undertaken,
K_0 = required amount of investment needed to start enterprise.

[8] The qualitative aspects of the analysis is unchanged when we relaxed the second amendment to allow an entrepreneur 'wannabe' to borrow a proportion, ρ, of K_0 without collateral provided that she has already saved $(1-\rho)K_0$.

Equation (1) is the lifetime budget constraint, the last term on the right-hand side is due to the assumption of no inheritance. Equation (2) requires that the individual has a non-negative net holding of liquid assets in each period before the investment time. The optimal saving paths for the investor are:

$$s_t = y_t - \lambda^{-1/\gamma} R^{-1/\gamma} \left(\frac{1+r}{1+\delta}\right)^{t/\gamma}, \quad t = 0, \ldots, T_1, \tag{4}$$

$$s_t = iK_0 - \lambda^{-1/\gamma} \left(\frac{1+r}{1+\delta}\right)^{t/\gamma}, \quad t = T_1+1, \ldots, D, \tag{5}$$

where

$$R = \frac{i(1+r)^D - i(1+r)^{T_1} + r(1+r)^{T_1}}{r(1+r)^D},$$

$$\lambda = \left(\frac{\beta_1}{\beta_2+\beta_3}\right)^{-\gamma},$$

$$\beta_1 = R \sum_{t=0}^{T_1} y_t (1+r)^{-t},$$

$$\beta_2 = R^{1-1/\gamma} \sum_{t=0}^{T_1} \left(\frac{1+r}{1+\delta}\right)^{t/\gamma} (1+r)^{-t},$$

$$\beta_3 = \sum_{t=T_1+1}^{D} \left(\frac{1+r}{1+\delta}\right)^{t/\gamma} (1+r)^{-t}.$$

Option 2: Save only for Retirement

In this case, the optimal saving path for the individual is:

$$s_t = y_t - \theta^{-1/\gamma} \left(\frac{1+r}{1+\delta}\right)^{t/\gamma}, \quad t = 0, \ldots, D, \tag{6}$$

where

$$\theta = \left[\frac{\sum_{t=0}^{T} y_t (1+r)^{-t}}{\left(\frac{1-\alpha^{D+1}}{1-\alpha}\right)}\right]^{-\gamma},$$

$$\alpha = (1+\delta)^{-1/\gamma} (1+r)^{1/\gamma - 1}.$$

III. SIMULATION RESULTS

As T_1 is described by a highly non-linear equation, numerical methods were used to solve for it. We calibrated the parameters of the model on Taiwan's values in 1985.[9] We assumed that the representative agent:

[9] The information are from: Report on the *Survey of Personal Income Distribution in Taiwan District*, R.O.C., 1985; *Taiwan Statistics Data Book*, 1989; Fry (1988*b*); *The Report on 1986 Industrial and Commercial Census*, Taiwan-Fukien Area, R.O.C.; *Small and Medium Enterprises Statistics*, 1987; and *Small and Medium Enterprises Overview in Taiwan*, 1986.

(1) starts life and work at age 20 and dies at 75, i.e. $D = 55$;
(2) starts her career at the initial income level, y_0 = US$3,200, that grows 1·2% annually in real terms;
(3) retires at age 65 ($T = 45$) if she decides to stay a worker;
(4) enters into an equal partnership with another agent if she decides to invest (i.e. the total required amount of capital for a small and medium enterprise (SME) is twice K_0.[10]);
(5) faces a real bank deposit rate, $r = 7\%$;
(6) faces a real rate of return to capital, $i = 20\%$;
(7) has a time preference rate, $\delta = 6\%$; and
(8) has a risk aversion coefficient, $\gamma = 1$.

Fig. 1 is the $K_0 = 0$ case; the consumption and income paths when the agent saves only for retirement. Fig. 2 shows the income and consumption paths of the entrepreneur when K_0 = $50,000, with the investment occurring at age 53. The utility level associated with Figs 1 and 2 are 139·47 and 139·60 respectively.

Since the preceding simulations were based on parameter values that approximated Taiwan's and chosen without prior data-mining, we could get a sense of the veracity of our alleged 'financial market-saving' nexus by comparing the simulated data with the actual data. For the investment case, we calculate the simulated aggregate private saving, S^A, for a particular year as:

$$S^A = \sum_{t=0}^{T_1} n_t y_t + \left\{ \sum_{t=0}^{T_1} n_t [(1+r)^{D-t} - 1](y_t - c_t) + \sum_{t=T_1+1}^{D} n_t [(1+r)^{D-t} - 1](iK_0 - c_t) \right\} + \sum_{t=T_1+1}^{D} n_t (iK_0) - \sum_{t=0}^{D} n_t c_t, \quad (7)$$

where n_t is the population number at age $t+20$, and t *is interpreted in the cross-section sense* and not in the time-series sense. The first term on the right-hand side of equation (7) is the aggregate labour income before T_1, the second term covers the *net* aggregate interest income, the third term is the aggregate investment income after T_1, and the fourth term is aggregate consumption expenditure. We calculated the simulated excess private saving (EPS^s) for:

(*a*) the investor works until she dies at the age of 75, EPS_1^s = US$29·8 billion;
(*b*) the investor retires at the age of 70, EPS_2^s = US$23·3 billion;
(*c*) no desire to invest, EPS_3^s = US$5·7 billion.

The logic of the representative agent model would dictate that only one of the three EPS_i^s could be true. But we know that only 16% of the working population are SME-owners. To rationalise this, we note that the utility level

[10] The World Bank's definition of an SME is that it employs less than 100 people. SMEs account for over 98% of Taiwan's enterprises in the 1961–85 period; and, assuming that SMEs employ the *entire* workforce, the average SME has only 11 workers. We interpret the great number of SMEs to be caused by the low amount of fixed capital needed for setting up low-tech industries.

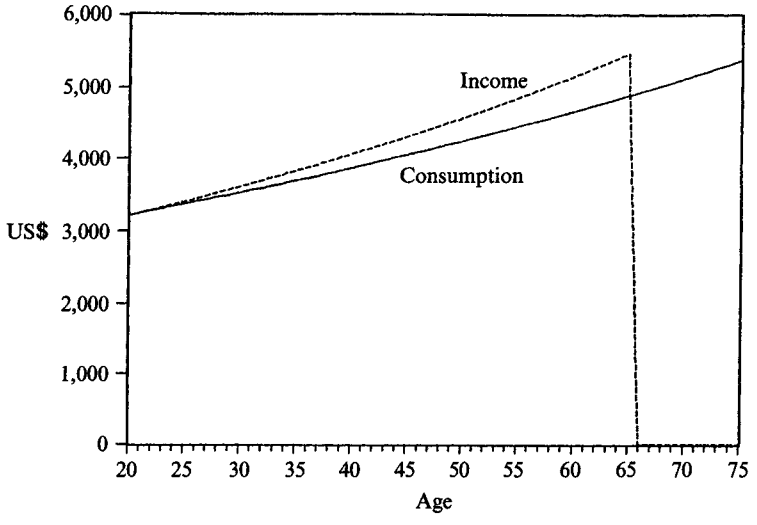

Fig. 1. The consumption pattern of a representative individual who saves only for retirement ($\gamma = 1$, $y_0 = \$3{,}200$, $w = 0{\cdot}012$, $r = 0{\cdot}07$, $\delta = 0{\cdot}06$) in the closed capital market.

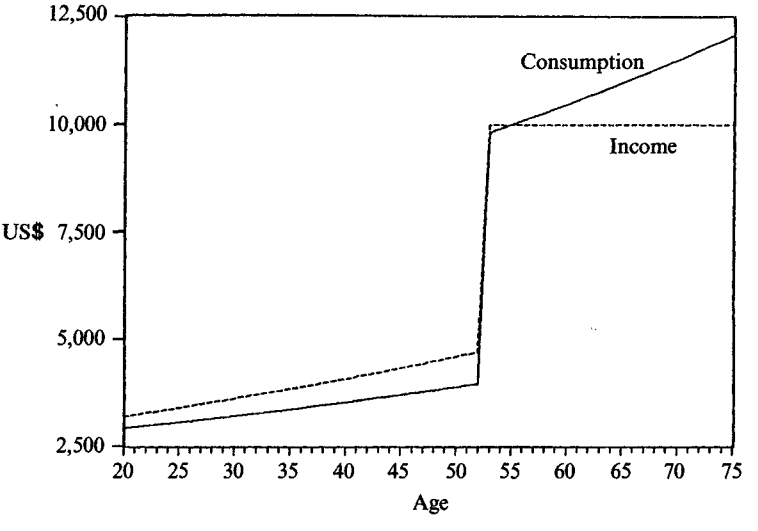

Fig. 2. The consumption pattern of a representative individual who does invest with $K_0 =$ US\$50,000 ($\gamma = 1$, $y_0 = \$3{,}200$, $w = 0{\cdot}012$, $r = 0{\cdot}07$, $\delta = 0{\cdot}06$, $i = 0{\cdot}2$) in the closed capital market.

associated with EPS_1^s is only slightly higher than that of EPS_3^s, 140 and 139 respectively. With people almost indifferent between staying as workers and becoming entrepreneurs, simulated excess saving should be computed as a weighted average of the investment case and the no investment case. The simulated aggregate excess saving for the cases of:

(*a*) the investor who works until she dies at age 75, is $0{\cdot}16\ EPS_1^s + 0{\cdot}84\ EPS_3^s$ = US\$9·7 billion;

(*b*) the investor who retires at age 70, $0{\cdot}16\,EPS_2^s + 0{\cdot}84\,EPS_3^s =$ US$8·6 billion.

The fact that the weighted simulated *EPS* in both cases were higher than the *actual EPS value of US$7·6 billion* establishes two points. The first is that a saving model calibrated on Taiwan's characteristics is capable of generating large amounts of excess private saving. The second finding is that the model generated these large savings without having to assume Ricardian agents, hence justifying our assumption of no bequest motives.[11]

IV. ECONOMETRIC ANALYSIS

The statistical testing follows the 'industry standard' established by Modigliani (1966, 1970). The private saving function estimated takes the form:

$$PSR = f(GPCY, AGER, DEPR, RETSN, R, FS)$$

where

PSR = the private saving rate,
GPCY = productivity growth,
AGER = ratio of the aged population to the working population,
DEPR = ratio of the young population to the working population,
RETSN = length of retirement span,
R = real interest rate,
FS = degree of financial sophistication.

With a positive *GPCY*, a positive amount of household savings will result because the savings of young people will exceed the dissavings of old people. We use the growth rate of real *per capita* private national income as the proxy for productivity growth. *AGER* is the ratio of the population aged 65 and over to the population aged 20–64. *DEPR* is the ratio of the population aged 19 and under to the population aged 20–64. While *AGER* and *DEPR* are expected to affect *PSR* negatively, *RETSN* is expected to affect it positively.

The longer the retirement span, the higher the saving rate during the agent's working years will have to be to ensure that sufficient resources will be available to provide for her retirement.

R is proxied two ways. *RINT* is the nominal interest rate less the actual inflation rate. *RINTE* has the expected inflation rate calculated from a regression of last period's inflation rate and last period's money growth rate. The nominal interest rate is the longterm yield of government bonds (or the closest available alternative). The effect of real interest rates on savings is theoretically ambiguous because an increase in the interest rate creates both a substitution and income effect, and the empirical record is mixed.[12]

FS is proxied in three ways. The first proxy is the ratio of the long-term to

[11] Hayashi *et al.* (1987) found it necessary to assume a bequest motive in order to generate high Japanese savings in their simulation.

[12] For example, Fry (1988*a*) and Giovannini (1985).

short-term financial assets value (*EQM1R*). Due to the lack of data on the long-term bank loans in most countries, the market capitalisation of exchange-listed equities of domestic companies (*EQUITY*) is chosen as the proxy for the long-term financial assets value and the money supply (*M1*) is used as the short-term financial assets value. The other two proxies are the ratio of *EQUITY* to *GDP* (*EQGDPR*); and the ratio of (*EQUITY* minus *M1*) to *GDP* (*DEQM1R*). We expect negative coefficients for the *FS* proxies.

Since the demographic and financial market variables do not move much from year to year, a time series regression for each country is inappropriate. We estimated the model using cross-section data, averaged over the 1975–85 period.[13] *A priori*, this is the best approach because the averaging eliminates temporary deviations.

The estimations used the WLS (weighted least square) technique. Each observation was weighted by the square root of the product of the country's population and the number of years that the country's data were available. The rationale for weighting the data stems simply from that averages estimated from large samples are more likely to be closer to the true average than averages estimated from small samples. The resulting reduction of the error term by the assigned weight is analogous to the variance of a sample mean being inversely proportional to the sample size.

Table 2 contains the results of the cross-section regressions, with the top half differing from the bottom half by the choice of real interest rate, *RINT* and *RINTE*. The overall fit is good in all six regressions, adjusted $R^2 > 0{\cdot}99$. The coefficients for the three financial market proxies had the expected sign and were statistically significant at the 0·5 % level (using the 1-tail t-test because we had prior about the sign), regardless of the real interest rate chosen.

GPCY, *AGER* and *DEPR* also had the expected sign and statistically significant at the 0·1 % level. The sizes of these coefficients fell within the range of those found by Modigliani (1970), Modigliani and Sterling (1983) and Horioka (1989).

The coefficient for *RETSN* is the only one with an unexpected sign with two of the six cases statistically significant at the 5 % level; but none are statistically significant at the 2·5 % level. When *RETSN* was dropped, the size of the coefficients of the remaining variables remained very much the same, with their t-values increased.

The coefficient of the interest rate variable (which we had no priors about its sign) was always negative and five of the six estimates were significant at the 5 % level (2-retail t-test). The negative interest rate coefficient may be due to more than just the income effect being greater than the substitution effect among households. This is because our private saving rate is an average of corporate saving rate and household saving rate. A corporation's cost is directly related to the size of its debts, and its profits will drop when its short-run price

[13] Sample consists of 1975–85 data from 17 OECD countries, South Korea and Taiwan. The OECD countries are Australia, Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Table 2

Cross-Section Estimates Based on Average Data for the 1975–85 Period

(The dependent variable is *PSR*, private saving rate)

	Constant	*GPCY*	*AGER*	*DEPR*	*RETSN*	*RINT*	*EQM1R*	*EQGDPR*	*DEQM1R*	Adj. R^2	SSE
(1)	0·547	2·001	−0·688	−0·389	−0·003	−0·983	−0·014	—	—	0·996	0·0014
	(17·106)	(5·827)	(−9·552)	(−9·149)	(−1·262)	(−3·913)	(−4·243)				
(2)	0·641	1·990	−0·820	−0·467	−0·004	−1·123	—	−0·101	—	0·996	0·0018
	(13·912)	(5·620)	(−12·72)	(−11·57)	(−1·572)	(−4·460)		(−4·072)			
(3)	0·564	1·814	−0·717	−0·420	−0·004	−0·758	—	—	−0·078	0·994	0·0019
	(13·965)	(3·819)	(−8·684)	(−8·845)	(−1·341)	(−2·450)			(−3·207)		
						RINTE					
(4)	0·571	2·273	−0·643	−0·384	−0·005	−1·186	−0·014	—	—	0·996	0·0015
	(16·653)	(5·994)	(−8·329)	(−8·548)	(−1·920)	(−3·666)	(−4·290)				
(5)	0·669	2·319	−0·777	−0·466	−0·006	−1·335	—	−0·104	—	0·995	0·0020
	(13·192)	(5·827)	(−10·77)	(−10·63)	(−2·076)	(−3·960)		(−3·883)			
(6)	0·582	1·992	−0·686	−0·421	−0·005	−0·854	—	—	−0·080	0·994	0·0021
	(13·722)	(3·667)	(−7·833)	(−8·358)	(−1·685)	(−2·133)			(−3·201)		

Definitions:

PSR is defined as the ratio of net private saving to private national income. Net private saving is the sum of net household saving and corporate saving (or, if available, the total net saving minus the net saving of general government). Private national income is the sum of net private saving and total private consumption expenditures. *RETSN* can be calculated as *LERET*(1-*LFPR*65); where *LERET* is the life expectancy of males at the standard retirement age and *LFPR*65 (the labour force participation rate of males at age 65 and over) is a measure of the proportion of males not retiring. Since some people retire at the standard retirement age and some choose not to retire, the average retirement span, *RETSN*, is a weighted average of *LERET* and 0.

Notes:

The sample size is 19 for equations (2) and (5), and 18 for the others.

The observations are weighted by 'the country's population times the years used to calculate *PSR*'.

The figures in parentheses are t-values.

SSE is the residual sum of squares.

The data period of *PSR* for Denmark is 1975–84; for Luxembourg, it is 1975–82.

The data period of *EQM1R*, *EQGDPR* and *DEQM1R* for South Korea is 1979–85.

adjustment does not cover the increased credit cost. So a higher interest rate will reduce a corporation's saving, and this may more than offset the extra household saving it induced.

In Liu and Woo (1992), we found that the above results (with one exception) were robust to pooled time-series cross-section estimation, and to the country composition of the sample. The exception was that the coefficients of *RINT* and of *RINTE* were positive but statistically insignificant when the largest seven economies (G7) were excluded from the sample.

Given that we did not impose Ricardian Equivalence in our simulations, we tested for its importance by including the government saving rate (*GSR*) in the regressions. Table 3 shows that *GSR* has an insignificant positive coefficient in all regressions, implying that private saving is not affected by government saving. This confirms the negative finding of Ebrill and Evans (1988) on U.S. data.

Table 4 quantifies the contribution of each variable to the difference in private saving rates across countries by using regression (1) in Table 2. We compare the U.S. private saving rate with those of six countries – of which three had persistent current account surpluses (Germany, Japan and Taiwan) and three had high saving rates (Italy, South Korea and Switzerland). Not surprisingly, the single most important factor differed according to the country. *AGER* was most important in Germany and Japan; *DEPR* in Taiwan, South Korea and Switzerland; and *EQM1R* in Italy.

EQM1R contributed substantially to the higher saving rates in these 6 countries, it added at least two percentage points in every case. In the Italian case, *EQM1R* added 3·5 percentage points; and in the German case, it overcame the opposite tendencies generated by the demographic features (*AGER*, *DEPR* and *RETSN*) and created current account surpluses. The fact that the three fastest growing countries (Taiwan, Italy and South Korea) also had the least developed financial markets suggest that undeveloped financial markets do not pose absolute barriers to growth, at least in the early stages of growth.

V. CONCLUSION

We have provided what we deem to be reasonable evidence in support of the hypothesis that inadequate intermediation of imperfect financial markets causes agents to save more in order to undertake lumpy physical investment in the future, with the outcome being a persistent current account surplus. Since the simulation exercises for Taiwan were done without any reiterative searches over parameter values, the close match between the simulated data and the actual data constitutes evidence in favour of the investment-motivated saving hypothesis. The robustness of the statistical significance of the financial sophistication variables to different specifications and sub-samples also constitutes support for our hypothesis.

One interesting policy implication from our analysis is that an important structural impediment to the reduction of Japan's and Taiwan's current

Table 3

Cross-Section Estimates for the 1975–85 Period, Including the Effect of Government Saving

(The dependent variable is *PSR*, private saving rate)

(a) *Sample consists of 16 OECD countries*

	Constant	*GPCY*	*AGER*	*DEPR*	*RETSN*	*RINT*	*EQM1R*	*EQGDPR*	*DEQM1R*	*GSR*	Adj. R	SSE
(1)	0·547	2·242	−0·638	−0·319	−0·006	−0·850	−0·018	—	—	0·119	0·996	0·0009
	(4·872)	(1·648)	(−5·237)	(−1·224)	(−1·197)	(−1·683)	(−2·024)			(0·431)		
(2)	0·730	1·571	−0·812	−0·525	−0·007	−1·201	—	−0·123	—	0·094	0·997	0·0008
	(12·472)	(1·648)	(−9·919)	(−3·818)	(−1·611)	(−3·761)		(−2·653)		(0·410)		
(3)	0·666	1·403	−0·714	−0·472	−0·009	−0·700	—	—	−0·106	0·248	0·997	0·0008
	(9·814)	(1·423)	(−7·619)	(−2·790)	(−1·572)	(−1·398)			(−2·356)	(0·863)		
						RINTE						
(4)	0·569	2·669	−0·627	−0·308	−0·008	−0·996	−0·019	—	—	0·204	0·996	0·001
	(3·835)	(1·968)	(−4·845)	(−1·010)	(−1·543)	(−1·336)	(−1·794)			(0·741)		
(5)	0·771	2·004	−0·802	−0·552	−0·009	−1·499	—	−0·114	—	0·179	0·996	0·001
	(10·502)	(1·954)	(−8·544)	(−3·324)	(−1·735)	(−3·063)		(−2·030)		(0·717)		
(6)	0·679	1·792	−0·706	−0·449	−0·011	−0·735	—	—	−0·113	0·391	0·996	0·0009
	(7·475)	(1·890)	(−7·157)	(−2·229)	(−1·891)	(−0·971)			(−2·120)	(1·171)		

(b) *Sample consists of 16 OECD countries plus Taiwan and South Korea*

	Constant	*GPCY*	*AGER*	*DEPR*	*RETSN*	*RINT*	*EQM1R*	*EQGDPR*	*DEQM1R*	*GSR*	Adj. R	SSE
(1)	0·559	2·054	−0·715	−0·405	−0·003	−1·000	−0·013	—	—	0·060	0·996	0·001
	(11·523)	(5·273)	(−6·712)	(−6·361)	(−1·126)	(−3·753)	(−3·555)			(0·349)		
(2)	0·662	2·089	−0·866	−0·495	−0·004	−1·150	—	−0·094	—	0·130	0·995	0·001
	(11·776)	(5·245)	(−9·525)	(−8·759)	(−1·349)	(−4·255)		(−3·377)		(0·770)		
(3)	0·613	1·946	−0·802	−0·473	−0·004	−0·830	—	—	−0·072	0·225	0·995	0·002
	(11·344)	(4·131)	(−7·763)	(−7·733)	(−1·319)	(−2·724)			(−3·039)	(1·311)		
						RINTE						
(4)	0·602	2·430	−0·702	−0·420	−0·005	−1·272	−0·013	—	—	0·144	0·995	0·001
	(11·458)	(5·621)	(−6·523)	(−6·554)	(−1·828)	(−3·677)	(−3·473)			(0·802)		
(5)	0·709	2·529	−0·851	−0·512	−0·006	−1·452	—	−0·092	—	0·227	0·995	0·002
	(11·736)	(5·794)	(−9·107)	(−8·963)	(−1·985)	(−4·096)		(−3·217)		(1·276)		
(6)	0·649	2·256	−0·791	−0·485	−0·006	−1·059	—	—	−0·072	0·293	0·995	0·002
	(11·418)	(4·251)	(−7·639)	(−7·937)	(−1·850)	(−2·693)			(−3·001)	(1·640)		

Notes: See Table 2. *GSR* is the ratio of government surpluses to national income.

Table 4

The Presentation of Each Variable to the Difference in Saving Rates Between Countries

(In percentage points)

Variable	Sign of the coefficient	Contribution to excess of saving rate over that in United States					
		Germany	Japan	Taiwan	Italy	S. Korea	Switzerland
GPCY	(+)	1·101	1·461	9·019	3·442	9·685	−0·160
AGER	(−)	−5·373	3·337	8·036	−1·534	8·456	−2·635
DEPR	(−)	3·762	2·221	−10·239	1·793	−12·545	3·291
RETSN	(−)	−0·522	0·240	−0·833	−0·916	1·702	−0·194
RINT	(−)	−0·541	0·590	−1·632	2·074	−4·483	2·064
EQM1R	(−)	2·674	1·991	2·992	3·545	2·746	2·065
Subtotal		1·101	9·839	7·343	8·404	5·561	4·430
Unexplained-residual		0·599	0·091	3·787	−0·424	−0·541	2·260
Total difference in *PSR*		1·700	9·930	11·130	7·980	5·020	6·690

Notes:

The calculation is based on the cross-section regression (1) in Table 2.

Independent Variables:

GPCY: growth rate of real per capita private national income.

AGER: aged population to working population ratio.

DEPR: dependent population to working population ratio.

RETSN: average retirement span.

RINT: realised real interest rate.

EQM1R: equality values to money supply ratio.

PSR: private saving rate.

account surplus is the underdevelopment of their mortgage, consumer credit and capital markets. The reduction of their current account surpluses through improved financial intermediation in these two countries will not only soothe US protectionism but will also increase their consumers' welfare.

We end with two caveats. The first is that our investment-saving hypothesis may have to be complemented by a precautionary-saving hypothesis if inadequate financial intermediation is correlated with inadequate insurance markets. Because then, one might also be able to read our econometric findings as evidence of the importance of precautionary saving. Zeldes (1989) pointed out that the fear of hitting a liquidity constraint if an adverse income shock were to occur would cause agents to increase their savings. In a provocative simulation exercise, Caballero (1991) showed that precautionary savings due to uninsurable earnings uncertainty could have been responsible for over 60% of net wealth in the United States. So, if both the relative abundance of long-term financial instruments and the relative abundance of insurance instruments are positively correlated with the degree of financial market development, we could attribute the extreme statistical significance of the financial sophistication variables in our regressions to the additional influence of the precautionary motive.

The correct interpretation of the regressions would then be: the less developed a financial market, the greater would be an individual's savings. Both investment-motivated savings and precautionary savings are the rational responses to the underdeveloped financial markets. The relative importance of these two saving motives will have to be determined in future research.

The second caveat is that the central focus of this paper is investment-motivated saving, with the *CA* position being an interesting and important implication. Our intertemporal model is meant to explain only the broad movements in the *CA* and not the entire *CA* movement from period to period. For example, the temporary low *CA* balance in the 1973–4 and 1979–80 periods for Taiwan, Japan and Germany were more the results of OPEC shocks rather than of unstable private behaviour.

A paper that has *CA* determination as its central focus will need to, one, model how various exogenous shocks shape expectations of future profitability, and, two, model investment behaviour more carefully. Investment in this paper occurred after savings reached K_0, we neglected important considerations like timing (which depends importantly on irreversibility and uncertainty; see Pindyck, 1991) and speed (which depends on installation costs).

Future research efforts should be aimed at removing these two caveats. With an integrated picture of saving-investment behaviour, a more accurate prediction of the *CA* position will be possible.

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