CONSUMPTION AND LIQUIDITY CONSTRAINTS IN AUSTRALIA AND EAST ASIA: DOES FINANCIAL INTEGRATION MATTER?

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Abstract

One of the recurring themes in the literature on financial systems is whether financial integration – that is, openness in the domestic and international financial system – has real, structural economic effects. This paper examines the effect of financial openness on the consumption of non-durables in Australia and selected East Asian economies. A range of variables, some of which explicitly represent financial regulation, are used to proxy the shadow price of the liquidity constraint. Non-durable consumption in Hong Kong, Japan, Korea, Singapore, Taiwan and Thailand can be modelled as the outcome of constrained optimisation, in some cases with time-varying real interest rates and demographic change, while that in Australia is liquidity unconstrained, at least from the 1980s. The constraint appears constant but very weak in Hong Kong and declining in Singapore, consistent with the extent and timing of domestic and international financial reforms in these economies. It appears unchanged for Japan and Korea. For Taiwan and Thailand, there is strong evidence that domestic financial regulation and control have constrained the intertemporal optimisation of consumption, although the constraint may be expected to unwind with recent liberalisation. The experience of Australia and the selected East Asian economies suggests that the liberalisation of the capital account, combined with deregulation and expansion of the domestic financial sector, eases the constraints on consumption smoothing. Financial integration *does* matter. The experience of these countries also indicates that there is no simple connection between the openess of a country's financial system and its saving and investment performance.

JEL Classification Numbers D91, E21, O11, O53, O56.

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CONSUMPTION AND LIQUIDITY CONSTRAINTS IN AUSTRALIA AND EAST ASIA: DOES FINANCIAL INTEGRATION MATTER?

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1. Introduction

This paper assesses the effect of domestic and international financial integration on consumption in Australia and selected East Asian economies – Hong Kong, Japan, Korea, Singapore, Taiwan and Thailand. The basic intuition is that when people are forward looking, they try to reduce the variability of consumption over their lifetime, and so expanding the means by which they can smooth consumption over time should reduce the dependency of their consumption on current income. A simple model of consumer choice is outlined which allows for liquidity constraints and changing real interest rates and demographics. This motivates tests for a statistically significant effect on consumption of a range of variables which proxy financial and non-financial liquidity constraints. Consumption is defined as expenditure on non-durables.

In Section 2, a model of the consumption of households is constructed based on intertemporal optimisation with demographic change and subject to liquidity constraints. Motivated by this model, an estimating equation which considers aggregation over time, aggregation over heterogeneous households, proxies for the liquidity constraint and definitions of consumption and income, is then outlined. In Section 3, this equation is estimated and the results discussed. Non-durable consumption is shown to be tied to income in all countries examined except Australia, where the innovation in non-durable consumption is unforecastable. Non-durable consumption is liquidity constrained in East Asian countries but the degree of the constraint and its source vary considerably between countries. The constraint is constant but relatively weak in Hong Kong and appears to be declining in Singapore, consistent with the extent and timing of domestic financial and capital account reform in these countries. It does not appear to have eased over time in Japan. Consumption in Korea, Taiwan and Thailand is also dependent on income, and in the latter two countries there is strong evidence that this is due to an undeveloped and controlled financial system. Section 4 discusses whether it is

possible to separately identify domestic and international financial effects. Section 5 looks at two implications for welfare and policy. The conclusion summarises the results. The key findings of the paper are that financial integration affects the real economy and that the liberalisation of *both* the domestic financial system and the capital account appear to be necessary for households to be able to smooth consumption over the life-cycle.

2. The Euler Equation with Liquidity Constraints

This section provides a simple motivation for the equation used to examine the behaviour of consumption. The literature on consumption smoothing is extensive and well summarised by Hall (1989), Deaton (1992), Muellbauer (1994) and Muellbauer and Lattimore (1994). The model used here is based on Hall (1978) but includes demographic change, which is a major structural feature of East Asian economies World Bank (1993, pp. 38-40), and, following Muellbauer (1983) and Zeldes (1989), a liquidity constraint, which is the factor commonly cited for the failure of the basic Hall model.

The representative household is assumed to maximise a concave expected utility function:

$$E_0\left[\sum_{t=0}^{T}\left(1+q+\imath_t\right)^{-t}u\left(c_t\right)\right] \tag{1}$$

where E_0 is the subjective expectation at time *0* based on all available information, c_t is consumption, θ is the pure time discount, and $\imath_t$ is the time discount varying in the demographic change particular to the country, assumed to be increasing in expected mortality and the birth of new cohorts (Masson 1992 and Schmidt-Hebbel, Webb and Corsetti 1992). The household faces three constraints, the first being that its assets accumulate according to the rule:

$$A_{t+1}=\left(1+r_t\right)\left(A_t+y_t-c_t\right) \tag{2}$$

where A_{t+1} is end-period t net wealth, including financial wealth and real wealth such as housing and durables, y_t is labour income, r_t is the real interest rate and c_t is

consumption. Secondly, given no bequest motive, the no-Ponzi game outcome requires that net assets are zero at the terminal date, *T*:

$$A_T = 0. \tag{3}$$

This means that the present value of lifetime expected consumption is tied to the present value of lifetime expected income – consumption is always 'constrained' in the sense that income is limited and the bliss-point for consumption never reached. This is not, however, the meaning of 'liquidity constrained'. A liquidity constraint may exist for a number of reasons and hence may take on a number of forms. One form, outlined by Muellbauer (1983) and Zeldes (1989), is that household net assets plus saving be non-negative each period:

$$\left(A_t + y_t - c_t\right) \geq 0. \tag{4}$$

Assuming that utility is isoelastic, in the form $u_t = \frac{1}{1-a} c_t^{1-a}$, constrained optimisation yields the familiar first-order condition:

$$\hat{c}_t = b_0 + b_1 r_{t-1} - b_2 \gamma_{t-1} + \bar{l}_{t-1} + \bar{e}_t \tag{5}$$

where $\hat{c}_t = \Delta \ln c_t$ (consumption growth rate) and $\bar{l}$ is a variant of l. As summarised by Hall (1989), when the constraint of non-negative net worth is binding, the household is denied access to its stream of future income. It is forced to reduce current consumption in favour of future consumption to equate marginal utilities over time, much as it would if it faced a higher interest rate. The constraint does not mean that the household consumes all its current income. Rather, the liquidity constrained household smooths consumption but, given a concave utility function, the more binding the constraint, the lower is current consumption, and the higher is future consumption. Hall's (1978) famous prediction that consumption follows a random walk does not follow in the presence of liquidity constraints.

There are four issues to deal with before equation (5) can be used as an estimating equation. The first is aggregation over time. Annual data are used in the estimation because the demographic data and, for most countries, the expenditure and income data are only available on an annual basis. Moreover, expenditure data, particularly on a quarterly basis, are constructed using extrapolated data based on periodic and

occasional surveys, and this introduces a degree of smoothing and measurement error in the series which can be minimised by using annual data. However, this renders equation (5) unsuitable as the basis for an estimating equation. When the consumption decision is made continuously or within a short period, such as a week, fortnight or month, then variables which are lagged once in equation (5) are approximately current-dated on an annual basis. For example, if the household's non-durables expenditure plan is tied to the profile of its income payments, which is, say, monthly, then the consumption decision is monthly and the real interest rate, demographic change and liquidity constraint in the previous month are relevant to the consumption decision in the current month. But on annual data, the interest rate etc in the previous month are contemporaneous in eleven cases out of twelve and well approximated by the current-dated variable. Equation (5) then reduces to a regression on current-dated variables.[1]

The second issue is aggregation across households. There has been considerable demographic change in East Asian economies over the past few decades, as strong population growth has eased and longevity and the share of the aged in the population has increased. Change also varies considerably between countries. Lahiri (1989), Takahashi and Kitamura (1993), Shintani (1994) and Lattimore (1994), to name a few, have shown the empirical importance of this for saving or consumption decisions in various economies in the region. Three differenced variables, defined in Table 1 and plotted in levels in Appendix A, are included in the estimating equation in the form of a time-varying discount factor in the utility function in equation (1). First differences are used to capture change.

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[1] An alternative derivation is the approach initially presented by Hall (1978) and developed by Campbell and Mankiw (1987, 1989, 1991), by which the population is bifurcated into a group which maximises consumption intertemporally and a group which are liquidity constrained. This is a special case of the model outlined in this paper when the shadow price on the liquidity constraint is proxied by current income growth.

Table 1: Demographic Change Variables

Variable	Definition
d0-19	first difference of ratio of population aged 0-19 years to total
d65	first difference of ratio of population aged >64 years to total
ddepend	first difference of ratio of population aged 0-19 and >64 years to total

The third issue is how to model the shadow price of the constraint. Since it is not observable, various proxies, termed *z*, are used. Liquidity constraints (and hence a positive shadow price) may exist for a number of reasons. Firstly, domestic financial markets may be repressed or insufficiently developed, or capital controls which impede access to international financial markets may exist. Secondly, when information about the borrower's credit risk is incomplete or asymmetric, the possibilities of moral hazard and adverse selection indicate that would-be borrowers may be denied access to capital markets (Stiglitz and Weiss 1981), at least until they have proven their reliability which may be related to age and experience (Scheinkman and Weiss 1986). Thirdly, lenders may prefer to extend credit secured by financial or real assets rather than on the basis of expected future labour income since lenders cannot indenture labour but can seize assets (Faruqee, Laxton and Symansky 1995). Would-be borrowers without capital may find it more difficult to obtain funds than would-be borrowers with capital (Cox and Jappelli (1993) provide evidence for the US). If wealth is acquired over time or is increasing in human capital, then younger or unskilled people are more constrained than older or skilled people.

These reasons suggest a range of variables which may be used as a proxy for the shadow price. If financial repression is the source of the constraint, for example, financial variables, such as real credit growth, the spread between money market and deposit rates or between loan and deposit rates and financial depth may be correlated with the liquidity constraint. Consider these in turn. Real credit growth is a constraint when there are controls on bank lending through window guidance. It is expected to be positively correlated with consumption since an expansion of credit reduces the constraint. Interest rate spreads are a function of, among other things, interest rate regulation and the depth and development of the banking sector (de Brouwer 1995), and are expected to be negatively correlated with consumption. Financial depth, commonly proxied by the ratio of money to GDP, is expected to be positively correlated with consumption since it implies greater access to financial

markets. Given that loan approval tends to depend on the ability of the prospective borrower to pay loan principal and interest out of *current* income, access to funds tends to be decreasing in the level of nominal interest rates, and nominal interest rates are expected to be negatively correlated with consumption (Wilcox 1989).[2] If establishing credibility or sufficiency of collateral are the issue, then the proportion of young people in the work-force (such as the proportion of the work-force aged between 20 and 29) may also proxy the shadow price and be negatively correlated with consumption.

If either financial repression or insufficiency of collateral is the source of the constraint, real asset prices (such as real residential property prices and share prices) and real income growth should be correlated with the liquidity constraint: an increase in real asset prices or real income eases the bind of the constraint, allows consumption to be brought forward, and current consumption rises. To the extent that constraints are binding and consumption cannot be brought forward, a rise in real income must increase current consumption, and so the excess sensitivity of consumption to income will occur generally when there is a constraint. The proxy variables outlined above and the expected effect of an increase in them on consumption growth are summarised in Table 2.

Table 2: Proxies for the Liquidity Constraint

Liquidity constraint	Expected effect on consumption
1. Real consumer credit growth	positive
2. Money market-deposit spread	negative
3. Loan-deposit spread	negative
4. Financial depth (M/GDP)	positive
5. Nominal interest rate	negative
6. Pop'n 20-29/pop'n 20-64	negative
7. Real asset prices	positive
8. Real per capita income growth	positive

[2] The nominal, rather than the real, interest rate is the proxy for the shadow price of borrowing. In the early literature on the real effects of financial reform, the real interest rate was often used as a proxy for repression (with a low rate indicating repression) (Fry 1995, p. 45). In this model, the real interest rate enters the equation as the opportunity cost of consumption.

The downside in this testing procedure is that since the proxies are not derived from first principles, their selection is relatively *ad hoc*. But the key test of validity in this case is that they be signed as expected if statistically significant. On the upside, the testing procedure has some strong advantages. It is broader than the simple excess-sensitivity test (in which consumption growth is just regressed on income growth) and provides a way to explicitly discriminate, albeit crudely, between financial market repression and other causes of liquidity constraints. The significance of real credit growth, interest rate spreads or financial depth, for example, implies that official controls or inadequate financial development generate the constraint, which can be remedied by liberalisation or implementing policies to develop financial markets. The significance of the nominal interest rate or share of young workers, on the other hand, points not to official controls or the under-development of financial markets, but to a constraint which arises out of the operation of capital and labour markets in general (although it is less clear what sort of policy should follow when this is the case).

In the estimations, this *ad hoc* specification is augmented by an error-correction term[3] which is included for a number of reasons. Firstly, the Euler equation predicts that variables dated *t-1* and earlier do not contain information about current consumption growth and should be statistically insignificant when included in the estimating equation, with the variables included in this case being the first lag of real *per capita* income and consumption. This is not particularly persuasive, however, since aggregation across households has the effect that predictions based on an individual Euler equation do not generally follow through to the aggregate Euler equation when households are not infinitely lived (Gali 1990, 1991; Clarida 1991; Deaton 1992, pp. 37-43, pp. 167-176; and Muellbauer and Lattimore 1994, pp. 272-273). Even though labour income and consumption are not cointegrated at the individual household level, they will be at the *aggregate* level (Deaton 1992, p. 170). Moreover, if households are liquidity constrained, then their consumption is forced to follow the path of their income, so that if income is a non-stationary

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[3] While lags of the first-difference of consumption and income are not included and the general-to-specific modelling strategy is not applied, this is not expected to have an effect on the results. In the first place, consumption and income appear to be random walks and so lagged first-differences are unlikely to have explanatory power. Furthermore, given the likely correlation of the proxy variables with the error term and the need for twice-lagged instruments, as discussed in Section 4, it is unlikely that past differences will enter the equation.

process, consumption will also be non-stationary and cointegrated with income (Blinder and Deaton 1985). Including an unrestricted error-correction term is a further way of testing the existence of liquidity constraints, although given the problem of aggregation, interpretation is not unambiguous.

The final issue concerns data definitions. Based on the theory, income should be defined as disposable labour income, but this definition is not generally available for the countries in this sample. The income variable for each country is defined in Appendix A, and varies from household disposable income (Australia, Japan and Thailand), factor income (Korea and Taiwan) and GDP (Hong Kong and Singapore). It is well understood that consumption, which is the object of intertemporal optimisation, is not necessarily the same as expenditure, which is the subject of statistical collection. Accordingly, time-series studies generally use data on sub-sets of consumption – either expenditure on non-durables or (most commonly) on both non-durables and services – or on the full set of consumption calculated as the sum of expenditure on non-durables and services and the estimated services flow from the stock of durables. Other papers use total private expenditure as a proxy of consumption. In this paper, results are reported for consumption measured as expenditure on non-durables, defined as food, beverages, tobacco and clothing. This measure is coincident with consumption, at least on an annual basis, and so is consistent with the theoretical derivation (assuming that welfare is separable between non-durables, services and the services flow from durables). Using non-durable expenditure ensures, firstly, that consumption is additively separable, and so the marginal rate of substitution between consumption in non-contiguous time periods is irrelevant, and, secondly, that difficulties associated with modelling adjustment costs do not arise (Deaton 1992). Expenditure on non-durables, as opposed to non-durables and services, is used as the base case for testing liquidity constraints since services expenditure may be contaminated by adjustment costs, time-series extrapolation or long-term welfare effects which render it non-additively separable even on an annual basis.

It is appropriate to ask what information non-durables expenditure contains about liquidity constraints. Common sense suggests that households do not generally use domestic and international credit markets to borrow to buy a jar of Vegemite or whatever, but do so to buy a car, household durables or a home, and so a better test of the evolution of liquidity constraints may be whether *durables expenditure* has become less sensitive to income (Takahashi and Kitamura 1993). The

microeconomics of durables *expenditure* is, however, different to that of durables *consumption* and has to be addressed explicitly. Suffice to say that the objection is an exaggeration. If individuals do not face liquidity constraints, then it should be most obvious in the case of annual consumption of non-durable goods since issues of adjustment and time inseparability do not arise. Moreover, while expenditure on one item may be small, the bundle of total expenditure on non-durables is not (from an average 32 per cent in Japan to 58 per cent in Thailand) and credit markets, formal or informal, may facilitate these transactions. And, indeed, the existence of constraints on one class of expenditure, like durables, would be expected to spread to other groups of expenditure since saving to finance the former type of expenditure occurs at the expense of the latter.

3. Estimation And Results

Motivated by the discussion in Section 2, the estimating equation including the proxy for the shadow price on the constraint and the unrestricted error correction is:

$$\hat{c}_t = b_0 + b_1 r_t - b_2 l_t + b_3 z_t + b_4 y_{t-1} - b_5 c_{t-1} + u_t . \qquad (6)$$

The proxy is a current-dated variable, and is likely to be correlated with the consumption innovation, rendering the estimated coefficients biased and inconsistent. This is notably so when current income is used as the proxy since innovations in current income are likely to be correlated with unforecastable innovations in permanent income which, liquidity constraints aside, are related to innovations in consumption in standard models (Muellbauer 1983 and Blanchard and Fischer 1989). Accordingly, an instrumental variables procedure is used for the liquidity constraint proxies and the real interest rate. Lagged consumption and income are not instrumented since they are pre-dated and so orthogonal to the error term.

The instrumental variables are lagged two periods.[4] In the case of income, the use of data for which the reporting interval exceeds the planning interval generates

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[4] The instruments used vary with the country examined but are generally natural logs of per capita real income, per capita real consumption, real exports, real US GDP and the

spurious correlation between the current consumption growth and the first lag of income growth, rendering first lags inadmissible as instruments (Deaton 1992, pp. 96-98). Using the second lag has the additional benefit of excluding possible problems with measurement error or transitory income. Nelson (1987) and Attanasio and Weber (1989) report, however, that the effect of temporal aggregation on the rejection of REPIH is minimal, and its importance can be judged by comparing the results for OLS and IV estimation.

To introduce the material, a basic model, popular in the literature, in which the growth of real *per capita* non-durables consumption is regressed only on a constant and the growth of real *per capita* income, was estimated using instrumental variables. The results are reported in columns (2) and (3) of Table 3, with the coefficient of determination in column (4). To form a view on the constancy of the regression coefficients, the equation was estimated for income growth with a multiplicative decade dummy (excluding Australia and the Philippines because of the short sample), shown in columns (5) to (7). Generally, the diagnostics were sound.[5]

The results indicate a high degree of variation in the income dependence of non-durables consumption across countries and time. In Australia, non-durables expenditure growth has been independent of income growth. This is not a problem of finding appropriate instruments since the coefficient is insignificant even using OLS (and in OLS it is minuscule). Non-durables consumption growth has been tied to income growth in Hong Kong, Japan, Korea, Singapore, Taiwan and Thailand, but has fallen (by more than one standard error) or become insignificant

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unemployment rate, in levels and in first differences. Lagged consumption and income are not instrumented since this does not affect the results.

5 The equations were estimated using the instrumental variables option in Microfit 386, and the standard diagnostics are Sargan's test of misspecification, a Lagrange multiplier test for first-order serial correlation, Ramsey reset functional form test, Bera-Jarque normality test and the Ramsey reset heteroscedasticity test. The error term in the Japan equation was serially correlated and corrected using the Newey-West procedure with a Parzen window of 2 lags.

Table 3: Growth in Real Per Capita Non-Durable Consumption

	(1) Data length	(2) Full period constant	(3) Full period income	(4) R-bar-sq	(5) 1960s income	(6) 1970s income	(7) 1980/90s income	(8) R-bar-sq
Australia	1975-1994	0.005	-0.24	-0.12	–	–	–	–
		(0.005)	(0.33)					
Hong Kong	1970-1993	-0.007	0.74**	0.274	–	0.61*	0.77*	0.229
		(0.025)	(0.33)			(0.30)	(0.37)	
Indonesia#	1970-1993	0.005	0.88**	0.151	–	0.73**	0.32*	0.203
		(0.020)	(0.42)			(0.34)	(0.45)	
Japan	1970-1993	0.005	0.48**	0.497	–	0.47**	0.31	0.485
		(0.004)	(0.13)			(0.12)	(0.21)	
Korea	1970-1994	0.027**	0.20*	0.482	–	0.22**	0.34**	0.544
		(0.009)	(0.12)			(0.09)	(0.09)	
Malaysia#	1970-1993	0.017	0.47**	0.469	–	0.39**	0.61**	0.802
		(0.015)	(0.25)			(0.08)	(0.08)	
Philippines#	1975-1992	0.013**	0.65**	0.252	–	–	–	–
		(0.003)	(0.11)					
Singapore	1970-1994	-0.015	0.57**	0.288	–	0.51**	0.34*	0.399
		(0.010)	(0.13)			(0.13)	(0.13)	
Taiwan	1960-1993	0.020**	0.30**	0.276	0.15	0.30**	0.35**	0.245
		(0.009)	(0.13)		(0.14)	(0.09)	(0.12)	
Thailand	1970-1992	0.016*	0.37**	0.419	–	0.34**	0.36**	0.389
		(0.008)	(0.15)			(0.16)	(0.12)	

Note: # national accounts measure of total private consumption expenditure; standard error in parenthesis, ** indicates significant at 5%,* indicates significant at 10%.

in the 1980s and 1990s in Japan and Singapore. The dependency of non-durables expenditure on income has remained unchanged (that is, within one standard error) in Hong Kong, Taiwan and Thailand but has increased in Korea. In Indonesia, Malaysia and the Philippines, total consumption expenditure growth depends on income and in the case of Malaysia, this is increasingly so over time.

These results largely accord with priors about the degree of financial repression and capital account openness in these economies, as outlined in de Brouwer (1996a). For most of the period, Australian financial markets have been open and highly developed. Domestic financial repression was lower and access to international capital markets greater in Japan and Singapore in the 1980s than in the previous decade. Financial and exchange reform in Korea, Taiwan and Thailand is only recent. Oddly, the coefficient on income growth in Hong Kong is consistently high.

The results and interpretation above are only tentative since relevant variables, such as the real interest rate and demographic change, and other variables which enable

more specific identification of the form of the constraint have been excluded. Accordingly, a grid search procedure was applied to identify whether the real interest rate, demographic variables and the proxies for liquidity constraints other than current income growth were significant in economies for which non-durables expenditure data are available. The estimation procedure was as follows. An equation including current income growth, the first lags of consumption and income, the real interest rate and one of the three demographic variables was estimated, and insignificant regressors eliminated. This procedure was applied to the three definitions of the three demographic variables. Current income growth was then replaced by the other proxies for liquidity constraints and the procedure re-applied. If these proxies were statistically significant, current income growth was returned to the regression to test their relative explanatory power. Not all proxies were available for all countries and estimation periods vary with data availability. Tables B.1 through to B.7 in Appendix B present the statistically significant results for Australia, Hong Kong, Japan, Korea, Singapore, Taiwan and Thailand.

The results vary substantially between countries. The coefficient on the real interest rate is positive and significant in Japan, Singapore and Thailand, indicating the importance of inter-temporal wealth effects in consumption and suggesting that the basic Keynesian model with consumption solely dependent on income is inadequate. Demographic variables are relevant in Japan, Taiwan and Thailand. In Japan, the change in the dependency ratio is significant and negative. In Thailand, the change in the proportion over 64 years is significant and negative. In Taiwan, however, the dependency ratio is significant and positive. A linear trend was included in these regressions to test whether demographic change is picking up a simple trend in the data, but it was not significant.

The significance or otherwise of the eight proxies for the shadow price listed in Table 2 are summarised in Table 4, with *n* indicating not significant, *y* indicating significant and *n/a* indicating that the series is not available for that country. In all countries, except Australia and Hong Kong, an error-correction between income and consumption was statistically significant. It was argued earlier that an error-correction may be due, among other things, to aggregation over households or to liquidity constraints. But the result that the error-correction is insignificant only for the two countries with among the most open and developed financial markets in the region suggests that the error-correction arises because of liquidity constraints rather than aggregation effects. Consistent with the results for the basic model outlined in

Table 3, current income growth is a significant determinant of consumption growth for all countries (except Australia). In all cases, except real residential property prices in Japan, income growth added the most explanatory power of all the proxies for liquidity constraints, which is not surprising since it is a catch-all variable.

Table 4: Summary of Significance of Liquidity Constraints

Constraint	Australia	Hong Kong	Japan	Korea	Singapore	Taiwan	Thailand
1. Credit growth	n	n	n	n	n	n	n/a
2. Money-dep rates	n	n	n	n/a	n	n/a	n/a
3. Loan-dep rates	n	n	n	n	n	**y**	**y**
4. M/GDP ratio	n	n	**y**	n	**y**	**y**	**y**
5. Nominal rate	n	**y**	n	**y**	**y**	**y**	**y**
6. Young workers	n	n/a	n	n/a	n	n/a	n/a
7. Real asset prices	n	n/a	**y**	n/a	**y**	n/a	n/a
8. Income growth	n	**y**	**y**	**y**	**y**	**y**	**y**
Error-correction	n	n	**y**	**y**	**y**	**y**	**y**

Note: 'n' indicates not significant, 'y' indicates significant at least 10% level, 'n/a' indicates data series not available.

Australia is an outlier in that neither current income growth nor any variable outlined in Tables 1 or 2 could systematically explain the growth in non-durable consumption. This supports the proposition that non-durables consumption in Australia is unconstrained and smoothed. The sample period is relatively short (1975-1994), and when it is extended back to 1970 using the total private expenditure deflator in place of the non-durables deflator, the coefficients and equations are only significant when decade income growth dummies are included. In this case, income growth is significant in the 1970s but not in the 1980/90s (see Table B.5), consistent with the results in Table 3. The irrelevance of current income does not follow for broader definitions of consumption, although the interpretation is muddier when services and durables are included since issues of data smoothing and stock adjustment arise. When consumption is defined as total private consumption expenditure, income growth, the error-correction, the proportion of the young working age population, and inflation are significant explanators. The coefficient on the share of young workers is negative, consistent with the view that the accumulation of reputation and collateral reduce constraints on smoothing. Rising inflation also depresses real consumption, presumably (in an

inter-temporal model) because it increases uncertainty in real income[6] and it suppresses the real interest rate when the nominal interest rate does not adjust instantaneously and completely, thereby generating a negative intertemporal substitution effect. The result that the basic Hall model is rejected for total expenditure is not surprising given the lumpiness of durables expenditure and the expectation that liquidity constraints operate most strongly with this type of expenditure. The insignificance of financial type proxies is consistent with the developed and open financial markets of Australia. Similar to Blundell-Wignall, Browne and Tarditi (1995), but unlike Debelle and Preston (1995) who use a long span of quarterly data, there is no evidence of a secular decline in the liquidity constraint on *total* expenditure.

The evidence of liquidity constraints in East Asia is stronger, although the outcome varies substantially by country. Consider Hong Kong and Singapore, two of the most financially developed economies in East Asia. In the case of Hong Kong, current income growth and the nominal loan rate are the only significant proxies, but in both cases the explanatory power is low. Hong Kong's financial markets are in general large and well-developed (although its domestic banking market was cartelised and domestic deposit and loan rates segmented somewhat from the domestic money market during this period (de Brouwer 1995)). There is no secular decline in the dependency on the proxies. In Singapore, the evidence of a liquidity constraint over the whole period is more robust, with the error-correction and current income growth both significant. Substituting for other proxies of liquidity constraints, financial deepening and the nominal interest rate are both significant and signed as expected (the former positive, the latter negative).[7] The significance of financial deepening implies that the constraint is declining over time as the depth of markets expands. Domestic markets were substantially liberalised in 1975 and capital controls removed in 1978, so one would expect a break in the regression between the 1970s and the 1980s/90s. Indeed, the coefficient on both income

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6 The model does not directly address the issue of uncertainty and precautionary saving but Blanchard and Fischer (1989, pp. 288-291) present a model where consumption is decreasing in real income uncertainty.

7 Real residential property prices were not significant but real residential property price inflation entered with a positive and significant coefficient in OLS regressions. A suitable set of instruments could not be found for IV estimation.

growth and financial depth falls over decades. The results suggest that liquidity constraints have eased in Singapore over time, due to financial deregulation.

Japan provides a different perspective on constraints and financial deregulation. Like Singapore, it initiated capital account reform in the middle of the sample period (1980) but it deregulated its bond, money and non-traded financial markets only slowly over the 1980s and 1990s, with the liberalisation of bank deposit rates, for example, extending from 1985 to 1994 (de Brouwer 1995, 1996b) and the Bank of Japan only stopping window guidance in 1991. The real interest rate, the change in the dependency ratio, the error-correction and current income growth are significant – a classic example of constrained intertemporal optimisation with demographic change. When current income growth is excluded, financial depth and real residential land prices are also significant proxies of the liquidity constraint.[8]

At first glance, the significance of financial depth suggests that in Japan, like Singapore, deregulation has enabled households to expand their consumption. There are, however, two pieces of contrary evidence. Firstly, when sub-sample decade dummies are included, the liquidity constraint, measured as income growth or real land prices, is significant in both periods and does not decline in the 1980s/90s relative to the 1970s. Secondly, real residential property prices are strongly significant and explain consumption growth 'better' than the money/GDP ratio, which is consistent with the claim that money in this case only proxies asset prices. As shown in Appendix A, money/GDP and real residential property prices follow the same trend and in the early 1970s and the late 1980s both rose and fell sharply. In the early 1970s, when domestic financial markets were closed, controlled and narrow, the monetary expansion fed directly into asset price inflation. In the second half of the 1980s, when domestic financial markets were being deregulated, expansionary monetary policy also fed directly into asset price inflation. In both episodes, policy was expansionary and asset prices rose, but only in the latter period were markets (being) deregulated, suggesting that deregulation has not *yet* had a separate identifiable effect on non-durable consumption. The tentative evidence in Table 3 of declining constraints looks incorrect: it is too early to identify an effect on consumption. Given that the capital account was liberalised at the start of the 1980s, however, the results are consistent with the interpretation that international

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8 The Nikkei 225 stock price index was also significant but the equation was only marginally significant.

financial openness is not sufficient for consumption smoothing when domestic markets remain undeveloped or controlled.

Korea, Taiwan and Thailand are examples of economies with regulated or repressed domestic and financial systems and controls on the capital account. They are an interesting contrast to Australia, Hong Kong and Singapore. In the case of Korea, the error-correction and current income growth are the only significant explanatory variables.[9] The coefficients are stable over sub-periods, indicating no change in liquidity constraints. While these results are consistent with the casual observation that financial markets in Korea are among the least developed and liberalised in this sample set, Korea is also known as a country which has regularly used controls on non-durable consumption imports (particularly from Japan) to control demand and the current account (Hasan and Rao 1979, p. 271 and Kim 1991, p. 47). The insignificance of financial variables suggests that it may be trade controls which give rise to the constraint.

The results for Taiwan and Thailand, on the other hand, show stronger evidence that financial development affects consumption. For Taiwan, the change in the dependency ratio, the error-correction, current income growth and the margin between loan and deposit rates are jointly significant with the expected signs (except for the change in the dependency ratio). When current income growth is replaced with other proxies for the liquidity constraint, financial depth, the deposit rate and the loan rate enter significantly with the expected sign. For Thailand, aging, real interest rates, the error-correction and current income growth are significant and signed as expected. When current income growth is replaced in the equation for Thailand, financial depth, deposit and loan rates, and the loan-deposit margin are significant with the expected sign. The significance of both the interest rate margin and financial depth point to financial repression or lack of development as causes of the liquidity constraint.[10] There is little evidence of falling liquidity constraints in

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[9] The coefficient on the curb loan rate is significant and negative but only in OLS and not IV estimation. The results across countries are rarely sensitive to the estimation procedure, which suggests that in this case the problem is finding suitable instruments for the curb loan rate.

[10] It was argued above that the money/GDP ratio reflected wealth effects for Japan rather than financial deepening, and so it is necessary to answer the question here of why this may not also be the case for Taiwan and Thailand. Data for residential property prices for Taiwan and Thailand are not available and so the question cannot be answered conclusively but there is

either country: the coefficients on decade dummies for current income growth and other proxies for the constraint are not significantly different over time. This is not surprising since substantive reform in both countries is only relatively recent. While the capital account had been partially liberalised by the late 1980s in Taiwan, systematic controls on inflow still remain (Lee 1990, pp. 160-161), covered interest parity did not hold from 1991 to 1994 (de Brouwer 1996a) and additional foreign exchange controls have been implemented occasionally (for example, mid 1992). Substantive liberalisation of the Thai capital account only took place in May 1990 and April 1991 (de Brouwer 1996a). Moreover, domestic interest rate liberalisation was only implemented in 1989 in Taiwan and in 1992 in Thailand (de Brouwer 1995).

There are two final comments to be made about the modelling procedure and results. Firstly, while the proxies for the shadow price of the liquidity constraint are not derived from first principles, when they are statistically significant they are signed as expected, and this lends support to the model. For example, financial deepening (and real interest rates) are always positively correlated with consumption, and widening interest margins and nominal interest rates are always negatively correlated with consumption.

Secondly, the results are probably not the outcome of data mining by which a grid search over a series of proxy variables has been used to select only those relationships which are significant (Lovell 1983). In the first place, all the proxy variables are relevant *a priori* to identifying the impact of the liquidity constraint on consumption, so degrees of freedom have not been 'wasted'. More to the point, statistically significant proxies tend to be bunched together for countries which have less developed, free and open financial markets rather than spread uniformly across all countries as would be the case if the results were purely random over a set of countries. It seems less plausible in this case, therefore, that the Type 1 error of rejecting the null hypothesis that the coefficient is different from zero when it is true

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strong indirect evidence against it. Firstly, the interest margin is also significant for these two countries, which is corroborating evidence of the effect of financial repression. Secondly, significance of the money/GDP ratio does not mean that asset prices are also significant and *vice versa*. In the case of Australia, real residential property prices are barely significant at the 10 per cent level but the money/GDP ratio is not.

is occurring to the detriment of correct inference. Whatever the case, the process is transparent since all the variables tested are cited and the standard error of the significant variables is presented in Appendix B. The marginal significance levels of the proxy variables is usually less than the standard 5 per cent level, often substantially so.

4. Domestic and International Effects

The proxies for liquidity constraints in Table 2 are defined in terms of domestic rather than international financial variables for two reasons. The first is that a sufficient run of relevant time series, such as the covered interest differential, which is a measure of exchange controls, is not available. The second is more fundamental. It is difficult to sharply delineate between domestic and international effects, both in the mechanics and the economic and political dynamics of markets.

Consider some mechanics. A secular expansion in the money/GDP ratio is a proxy for financial development but this can reflect not just domestic but also a range of international influences, such as an expansion of domestic deposits due to the entry of competitive foreign banks, the monetisation of capital inflows under fixed exchange rates, or the balance sheet counterpart of the acquisition of foreign assets by domestic banks under an open capital account regime with floating exchange rates. The money/GDP ratio is a domestic variable and its expansion implies greater financial depth and scope for smoothing income, but the factors cited are international. Similarly, a domestic bank funds an expansion of its loan book by taking deposits or borrowing offshore, among other means, and so an expansion of domestic credit may have an international dimension. Domestic and international factors can both be relevant to the most simple of domestic financial transactions.

But more than mechanics, the economic and political dynamics of domestic and international markets are intertwined, as a few examples show. In Australia, there was a major consolidation and reform of banking services (for example, the introduction of ATMs and changes in hours) by domestic banks in the early 1980s, well ahead of the entry of foreign banks in 1985, but in anticipation of it some time in the future, and similar rationalisation has occurred in East Asian banking sectors. In Indonesia and Malaysia, easy access to offshore, mainly Singaporean, financial markets made control of deposit interest rates less effective and stimulated more

rapid or effective liberalisation of deposit rates. Liberalisation of both domestic and international financial markets in Japan, Korea and Taiwan has been driven by, among other things, US pressure. There is no clear separation of domestic and foreign forces for reform.

The way that the domestic and international dichotomy has been drawn in this paper is to account for changes in the bind of liquidity constraints by the program of liberalisation and deregulation followed. For example, the capital account was liberalised in Singapore in 1978 and in Japan in 1980 and 1984, but their domestic financial systems were liberalised in 1975 and 1985-1994 respectively. The evidence of declining constraints is stronger for Singapore than for Japan, which suggests that it is the confluence of domestic liberalisation and international openness that is important in facilitating households in intertemporal transfers on income. Domestic markets and the capital account were liberalised in Australia in the early 1980s, and liquidity constraints on non-durables expenditure cannot be identified from at least that time.

Bayoumi and McDonald (1994) have presented a model to distinguish domestic from international effects. Their model is based on an earlier insight that the single-country permanent income conditions for smoothing consumption over time can be expressed in terms of insurance in the form of smoothing consumption between countries at a point in time (Cochrane 1991; Obstfeld 1993, 1994; and Canova and Ravn 1994). They define international financial integration as the equalisation of real interest rates and construct a model in which they interpret declining excess sensitivity of domestic consumption on domestic income as evidence of the development of *local* financial markets and a rising correlation with foreign consumption as evidence of the development of *international* financial markets. This model seems flawed on two accounts. Firstly, the derivation relies on real interest parity but this parity condition is stringent (Frankel 1993), such that the real interest differential only equals the expected depreciation of the real exchange rate when there are no barriers to trade in financial assets, financial assets are perfect substitutes, the Fisher effect holds at all points in time and expectations are formed rationally. Even if all these conditions hold, real interest rates are only identical, in general, in the steady state when the real exchange rate is constant. Hence, using real interest parity as the criterion for openness in empirical work is fraught with error. Secondly, consumption becomes less sensitive to domestic income as the set of income-smoothing instruments expands, but this set includes both domestic and

international instruments. It is not necessarily correct to classify falling excess sensitivity of consumption to income as evidence of the development of domestic markets. If the cause is due to *international* factors, then falling excess sensitivity is in fact tantamount to greater consumption insurance.

5. Implications for Welfare and Policy

In terms of the neo-classical model outlined in Section 2, eliminating financial repression whatever the stage of development *must* improve household welfare, and so the policy implication would seem to be straight-forward. Things are probably not that simple since the analysis is partial in that it ignores capital accumulation and growth. In Barro, Mankiw and Sala-i-Martin's (1995) neo-classical model of economic convergence, for example, financial openness is not the decisive factor in growth since the bulk of the capital stock is human capital and only real capital can be financed externally. Ideally, in this framework, a saving-deficit country would borrow on foreign markets to finance investment in real capital and would borrow on local markets to finance investment in human capital. In the earlier stages of development, however, the mobilisation of domestic saving may be necessary to finance real capital accumulation in order to build up the physical capital which secures acceptance of the country by foreign lenders, and so initially limiting access by households to domestic financial markets may be required. But once some productive capital is in place, maintenance of controls on household borrowing is difficult to justify because there *is* a welfare loss in preventing households from smoothing consumption. Moreover, access to consumer credit augments the accumulation of human capital since households have access to funds for better education, better accommodation and higher living standards. The maintenance of controls on household credit in countries like Korea or Taiwan would seem difficult to justify from the welfare perspective.

The results also suggest a loose hierarchy of countries in terms of constraint – very roughly from least to highest, Australia, Hong Kong, Singapore, Japan, Korea, Thailand and Taiwan – and it is interesting to ask how this fits with the structure of their macroeconomies. Table 5 below sets out the profile of saving, investment and current account balance for these countries over the past 15 years. It would seem that there is no correspondence between this hierarchy and current account balance, which is not surprising since the current account balance reflects not just private

consumption decisions but also public consumption and private and public investment. Financial openness has no discernible impact on current account performance. It would also seem that there is no clear correspondence between this hierarchy and saving performance: the constraint is not less binding for countries with higher saving rates. Nor is it *generally* apparent that countries with forced saving occupy a clearly identifiable place in the hierarchy. On the other hand, it may be instructive that for the three most financially open economies in the region, liquidity constraints appear more binding for Singapore, which has a long-established compulsory saving system, than Australia or Hong Kong.

Table 5: Saving, Investment and the Current Account

	Saving/GDP			Investment/GDP			Current Account/GDP		
	1980	1990	1994	1980	1990	1994	1980	1990	1994
Australia	24.2	18.2	20.3	25.4	21.3	21.5	-2.6	-5.1	-4.9
Hong Kong	31.7	33.6	33.0	35.9	28.5	29.2	-4.7	8.8	2.3
Singapore	37.5	45.2	48.8	46.3	36.8	43.6	-13.7	6.0	11.5
Japan	31.4	33.5	31.0	32.2	30.9	28.5	-1.0	1.2	2.7
Korea	24.3	36.4	34.5	31.7	37.0	33.8	-8.5	-0.9	-1.4
Thailand	26.4	32.3	34.0	20.1	38.3	39.6	-7.4	-8.3	-6.0
Taiwan	33.1	27.8	25.1	30.2	22.4	22.9	-1.7	6.6	2.4
Malaysia	32.9	32.3	32.4	30.4	36.1	37.0	-1.2	-2.1	-6.5
Philippines	24.2	18.2	18.5	30.6	22.5	25.0	-6.0	-6.1	-5.2
Indonesia	24.7	31.7	32.1	20.9	36.1	33.3	1.7	-5.9	-2.3

Source: Asia-Pacific Economic Group, *Asia Pacific Profiles 1995*.

6. Conclusion

The literature on the effects of financial liberalisation on the macro-economy is mixed (Fry 1995). This paper has presented strong evidence that financial integration affects the ability of households to smooth their consumption over time. Non-durable consumption in Hong Kong, Japan, Korea, Singapore, Taiwan and Thailand can be modelled as the outcome of liquidity-constrained optimisation, while that in Australia is liquidity unconstrained from at least the 1980s. The constraint is very weak in Hong Kong and is declining in Singapore, consistent with

the extent and timing of domestic and international financial reforms in these economies. The constraint appears unchanged in Japan and Korea. For Taiwan and Thailand, there is strong evidence that domestic financial regulation and control have constrained intertemporal optimisation of consumption. There has been major financial reform in these economies, but it is only recent (and piecemeal in the case of Taiwan), and since the tests are conducted on annual data, the effect of unwinding the constraint will take time to appear. The experience of the countries analysed in this paper suggests that liberalisation of the capital account, combined with deregulation and expansion of the domestic financial sector, is necessary for constraints on consumption smoothing to be eased. Financial integration *does* have real effects, in this case on the time profile of consumption. The experience of these countries also indicates that there is no simple connection between the openness of a country's financial system and its saving and investment performance.

Appendix A: Definitions, Sources and Figures of Data

Indonesia

Consumption: total private expenditure 1983 constant prices, ADB *Key Indicators* and United Nations *National Accounts*.

Income: gross domestic product, ADB *Key Indicators* and United Nations *National Accounts*, deflated by the total private expenditure deflator.

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: total population and dependency ratio, World Bank Tables, IEDB Database, ANU; proportion aged 64 and over estimated from Keyfitz and Flieger (1990).

Malaysia

Consumption: total private expenditure 1978 constant prices, ADB *Key Indicators* and United Nations *National Accounts*.

Income: gross domestic product, ADB *Key Indicators* and United Nations *National Accounts*, deflated by the total private expenditure deflator.

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: total population and dependency ratio, World Bank Tables, IEDB Database, ANU; proportion aged 64 and over estimated from Keyfitz and Flieger (1990).

Philippines

Consumption: total private expenditure 1985 constant prices, ADB *Key Indicators* and United Nations *National Accounts*.

Income: gross domestic product, ADB *Key Indicators* and United Nations *National Accounts*, deflated by the total private expenditure deflator.

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: total population and dependency ratio, World Bank Tables, IEDB Database, ANU; proportion aged 64 and over estimated from Keyfitz and Flieger (1990).

Australia

Consumption: non-durables expenditure and total private expenditure 1990 constant prices, Australian Bureau of Statistics (ABS).

Income: household disposable income, ABS, deflated by the total private expenditure deflator.

Deposit rate: 3-month fixed deposit rate at June, 1960-1990, Reserve Bank of Australia (RBA) *Australian Economic Statistics*, and from 1991, RBA *Bulletin*.

Loan rate: maximum overdraft rate at June, 1960-1985, RBA *Australian Economic Statistics*, and from 1991, small and medium sized business rate, RBA *Bulletin*.

Money market rate: 26-week T-note rate at June, 1960-1990, RBA *Australian Economic Statistics*, and from 1991, RBA *Bulletin*.

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: RBA *Australian Economic Statistics*, Table 4.2 and ABS.

Money: currency and deposits with banks (M3), RBA *Bulletin*.

Credit: consumer credit, other personal credit adjusted for breaks, unpublished series, RBA from 1976, before 1976 calendar years are backcast with financial year growth in housing credit, RBA *Australian Economic Statistics*.

Residential property prices: established house prices in Australian capital cities, index 1989/90 = 100, RBA unofficial series comprising Treasury unpublished series from 1960 to June 1978, REIA series from September 1978 to June 1986 and ABS official series from September 1986 onwards.

Figure 1: Non-Durable and Total Consumption and Income in Australia

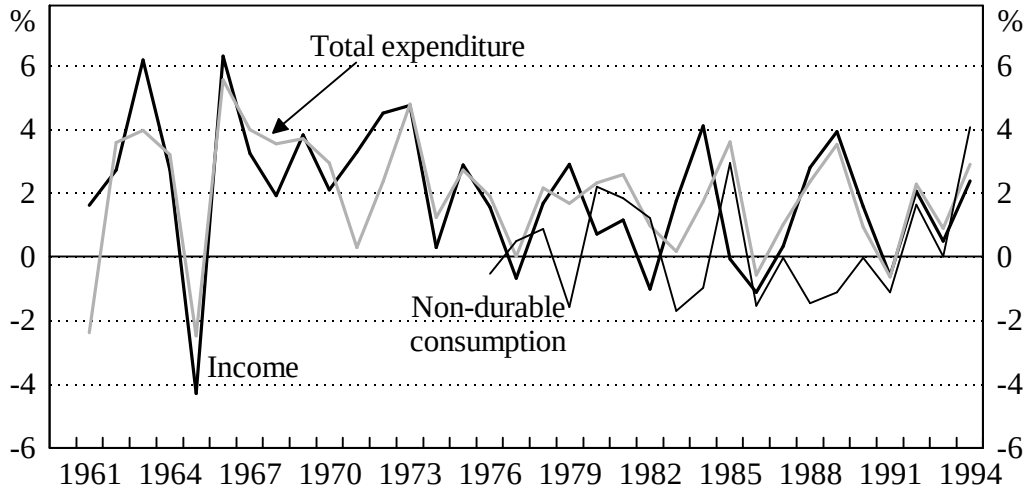


Figure 2: Demographic Change in Australia

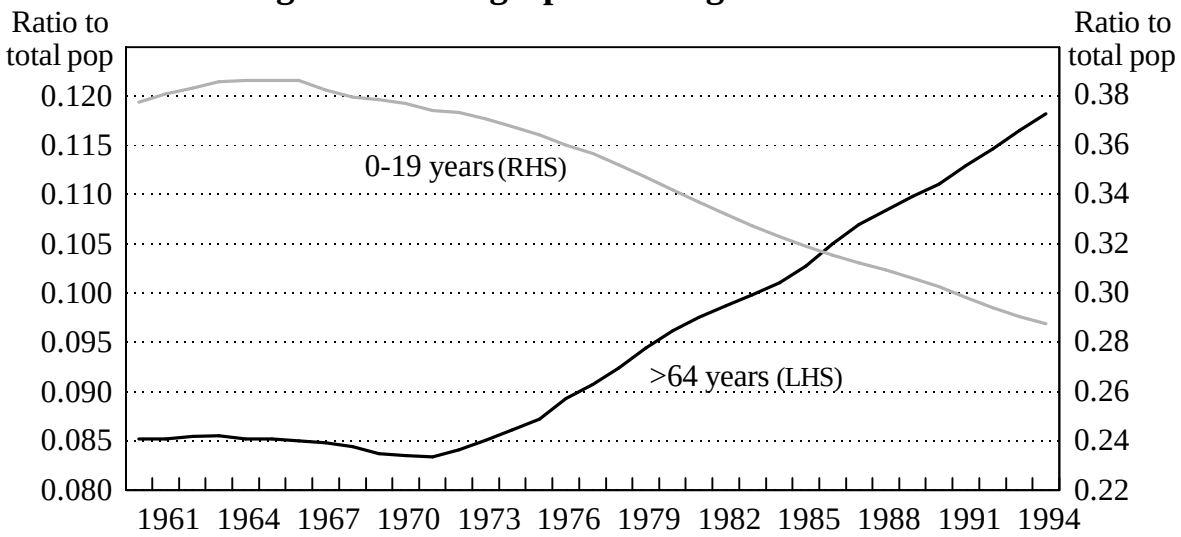
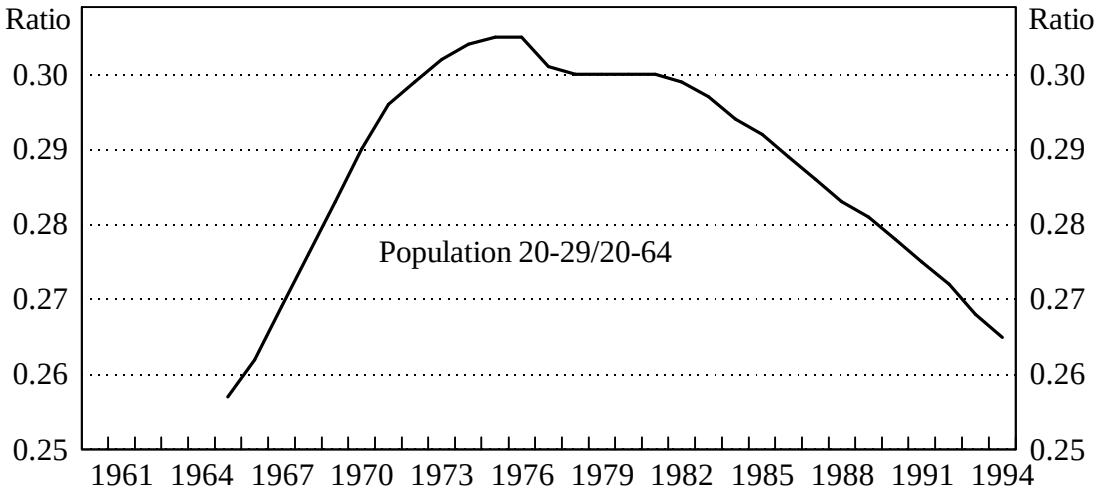


Figure 3: Liquidity Constraints in Australia



Hong Kong

Consumption: non-durables expenditure and total private consumption expenditure 1990 constant prices, provided courtesy of the Hong Kong Monetary Authority.

Income: gross domestic product, World Bank Tables, IEDB Database, ANU.

Deposit rate: annual average 6-month deposit rate 1970-1993, Asian Development Bank (ADB) *Key Indicators*.

Loan rate: commercial bill rate 1970-1993, ADB *Key Indicators*.

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: total population and dependency ratio, World Bank Tables, IEDB Database, ANU; proportion aged 64 and over estimated from Keyfitz and Flieger (1990).

Money: currency and deposits with banks (M2+NCDs), ADB *Key Indicators*.

Figure 4: Non-Durable and Total Consumption and Income in Hong Kong

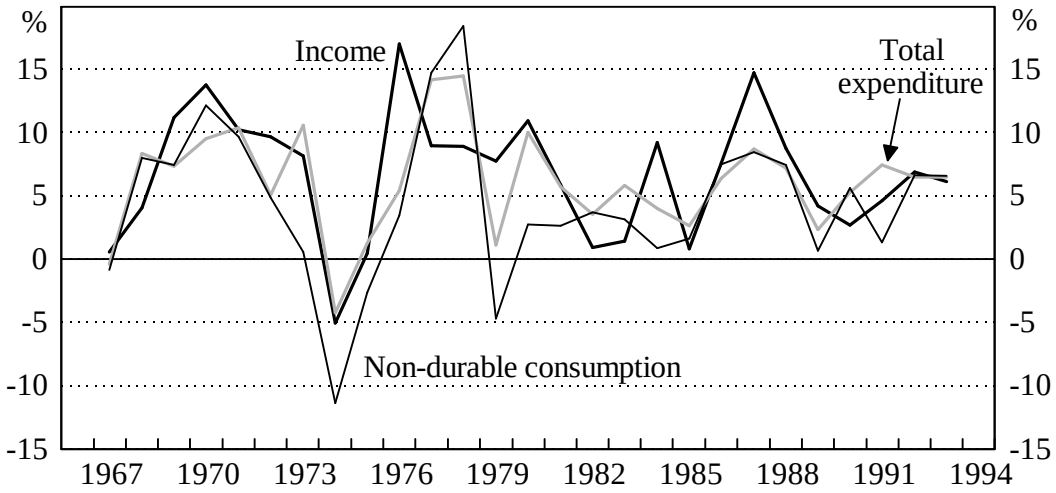
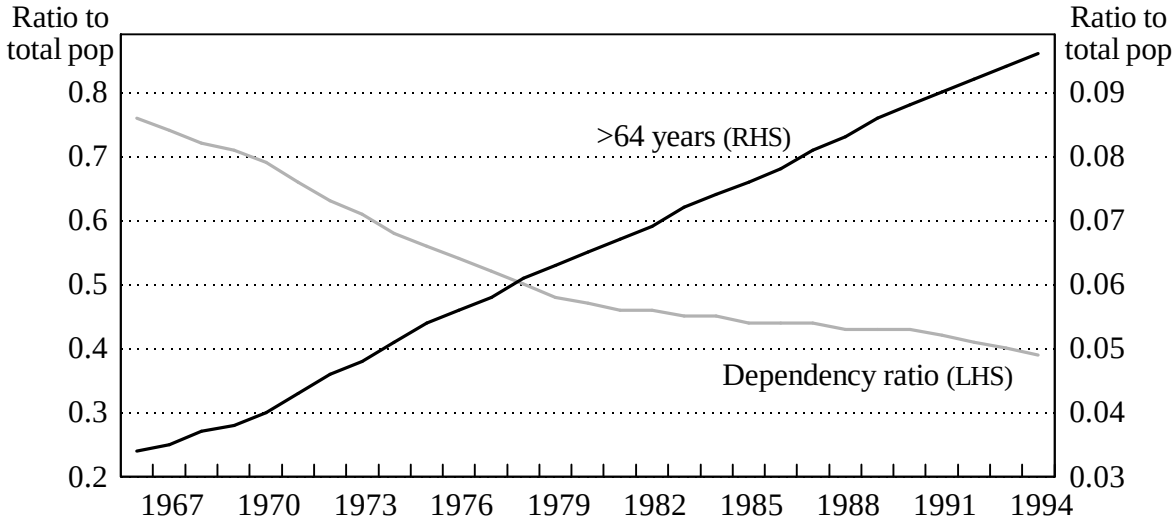


Figure 5: Demographic Change in Hong Kong



Japan

Consumption: non-durables expenditure and total private expenditure 1985 constant prices, Nikkei database.

Income: household disposable income, Nikkei database, deflated by the total private expenditure deflator.

Deposit rate: annual average 3-month fixed deposit rate, IMF *International Financial Statistics*.

Loan rate: annual average loan rate, IMF *International Financial Statistics*.

Money market rate: annual average collateralised overnight call money rate, IMF *International Financial Statistics.*

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: Nikkei database.

Money: M2+CDs, IMF *International Financial Statistics*.

Credit: consumer credit from city and regional banks and mutual loan and saving institutions, Nikkei database.

Residential property prices: residential property prices in Japan, Datastream database.

Figure 6: Non-Durable and Total Consumption and Income in Japan

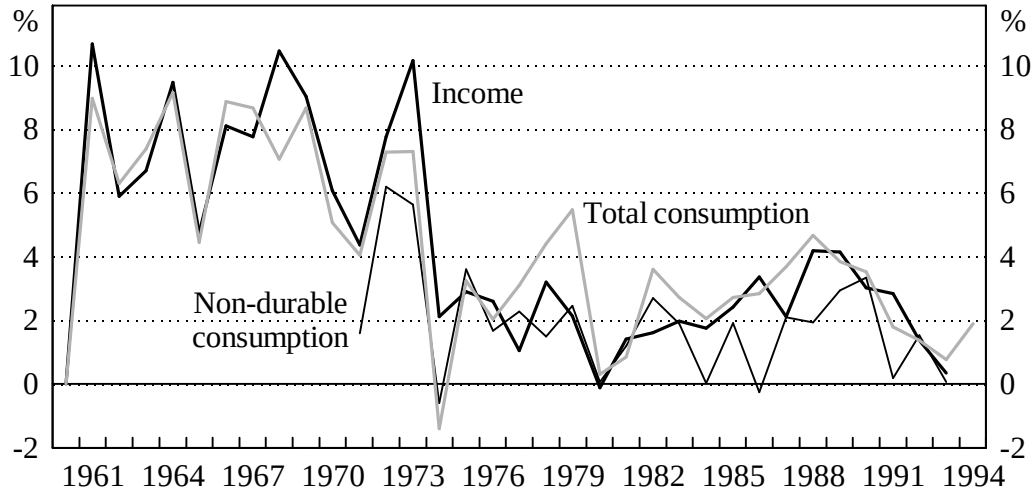


Figure 7: Demographic Change in Japan

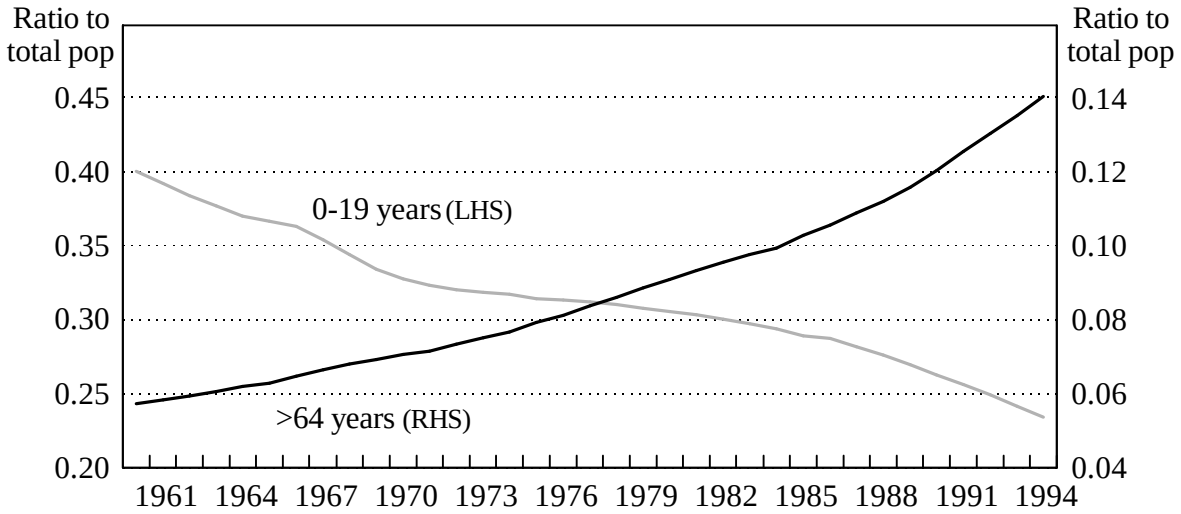
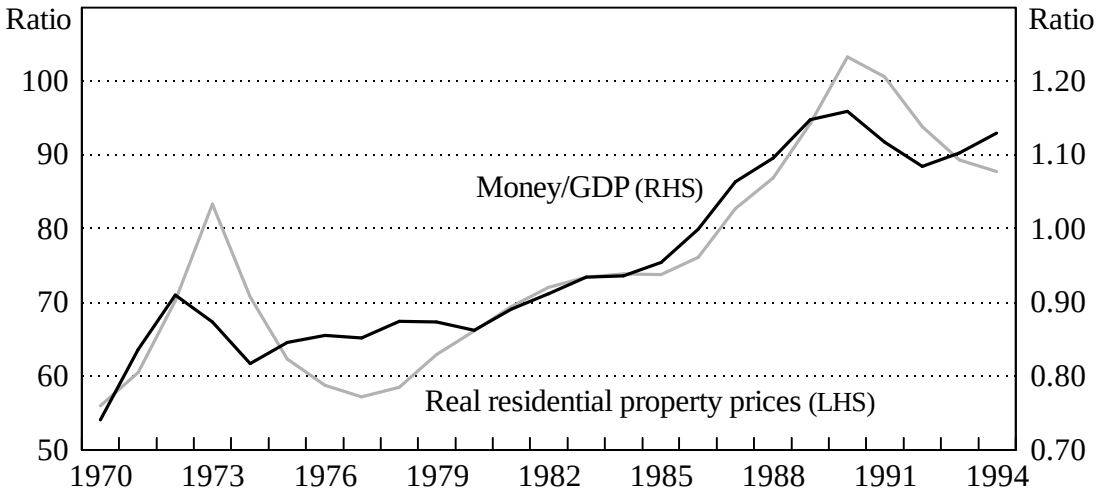


Figure 8: Liquidity Constraints in Japan



Korea

Consumption: non-durables expenditure and total private expenditure 1990 constant prices, Bank of Korea *Annual Statistical Bulletin*.

Income: national factor income, Bank of Korea *Annual Statistical Bulletin*, deflated by the total private expenditure deflator.

Deposit rate: annual average 1-year deposit rate, IMF *International Financial Statistics*.

Loan rate: annual average curb loan rate, unpublished series, Bank of Korea.

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: total population and dependency ratio, World Bank Tables, IEDB Database, ANU; proportion aged 64 and over estimated from Keyfitz and Flieger (1990).

Money: currency and deposits with banks, IMF *International Financial Statistics*.

Credit: household loans, Bank of Korea *Annual Statistical Bulletin*.

Figure 9: Non-Durable and Total Consumption and Income Growth in Korea

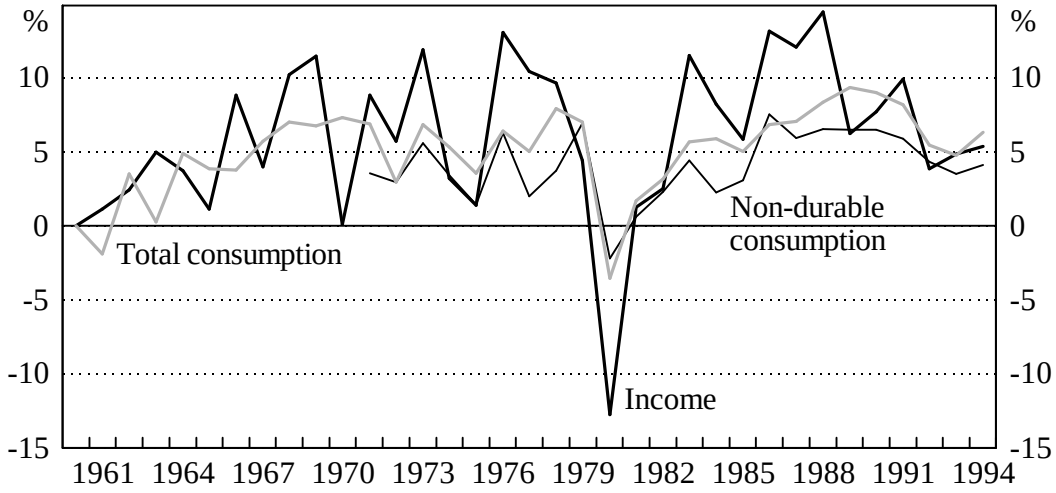


Figure 10: Demographic Change in Korea

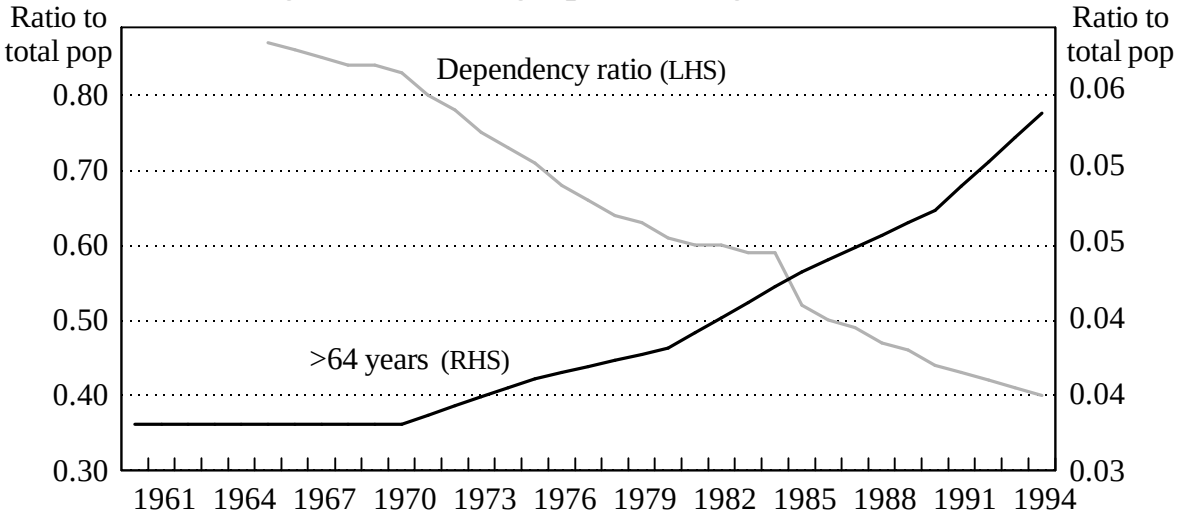
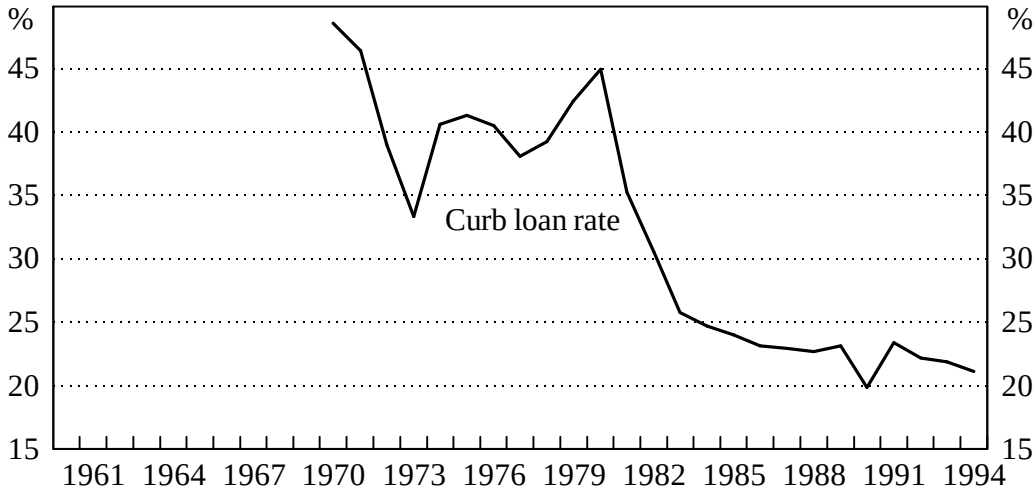


Figure 11: Liquidity Constraints in Korea



Singapore

Consumption: non-durables expenditure and total private expenditure 1985 constant prices, Department of Statistics Singapore.

Income: gross domestic product, Department of Statistics Singapore, deflated by the total private expenditure deflator.

Deposit rate: annual average 6-month fixed deposit rate *Singapore Yearbook of Statistics* and ADB *Key Indicators.*

Loan rate: annual average indicator lending rate *Singapore Yearbook of Statistics* and IMF *International Financial Statistics*.

Money market rate: annual average 3-month interbank market rate, *Singapore Yearbook of Statistics* and IMF *International Financial Statistics*.

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: total population, World Bank Tables, IEDB Database, ANU; age classifications, *Singapore Annual Statistics*.

Money: currency and deposits with banks, IMF *International Financial Statistics*.

Credit: end-year loans to professionals and private individuals, Monetary Authority of Singapore *Statistical Bulletin*.

Residential property prices: spliced index of average annual residential property prices 1975 to 1993, *Singapore Yearbook of Statistics* and *Monthly Digest of Statistics Singapore*, and index of accommodation costs from the CPI 1970 to 1974, *Singapore Yearbook of Statistics*.

Figure 12: Non-Durable and Total Consumption and Income in Singapore

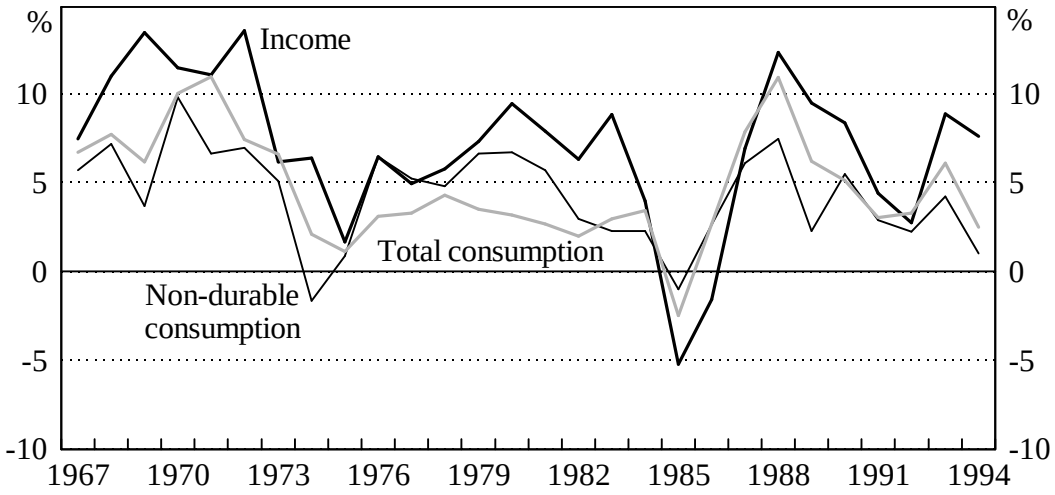


Figure 13: Demographic Change in Singapore

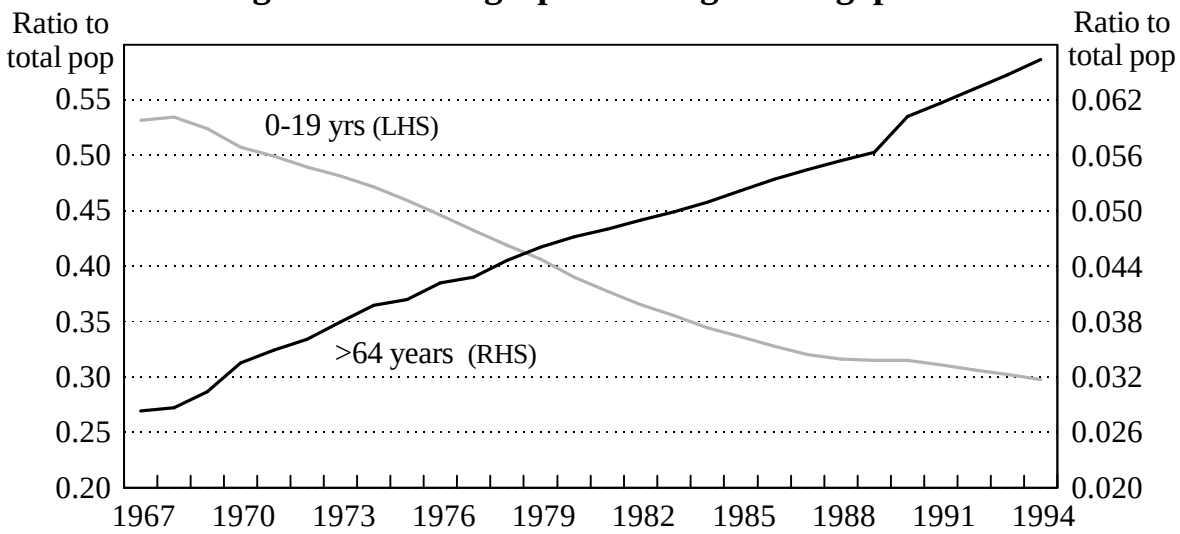
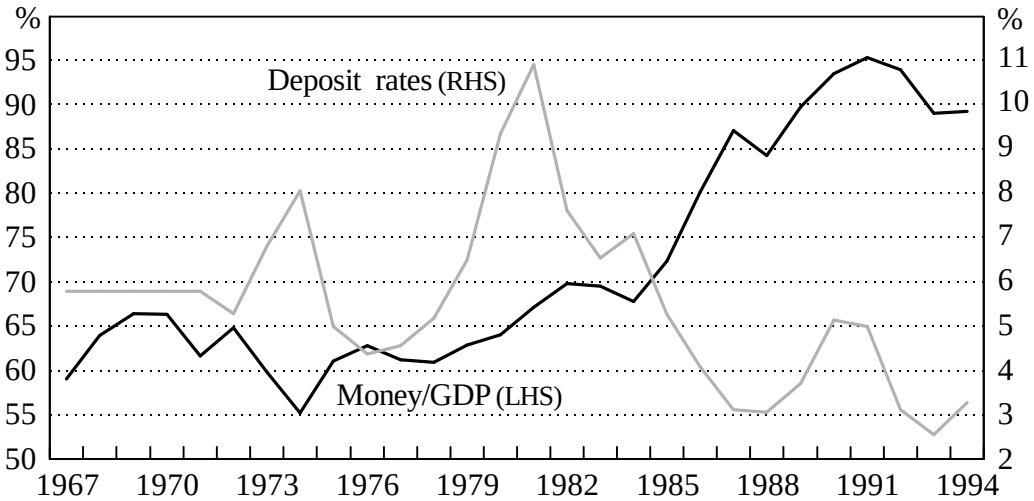


Figure 14: Liquidity Constraints in Singapore



Taiwan

Consumption: non-durables expenditure and total private expenditure 1991 constant prices, *Statistical Yearbook of the Republic of China*.

Income: factor income, *Statistical Yearbook of the Republic of China*, deflated by the total private expenditure deflator.

Deposit rate: end-year 3-month fixed deposit rate *Taiwan Statistical Data Book.*

Loan rate: end-year secured loan rate *Taiwan Statistical Data Book.*

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: *Taiwan Statistical Data Book*, adjusted for break in 1969.

Money: currency and deposits with banks, IMF *International Financial Statistics*.

Credit: end-year loans and discounts of all banks to individuals and others, *Taiwan Statistical Data Book*.

Figure 15: Non-Durable and Total Consumption and Income in Taiwan

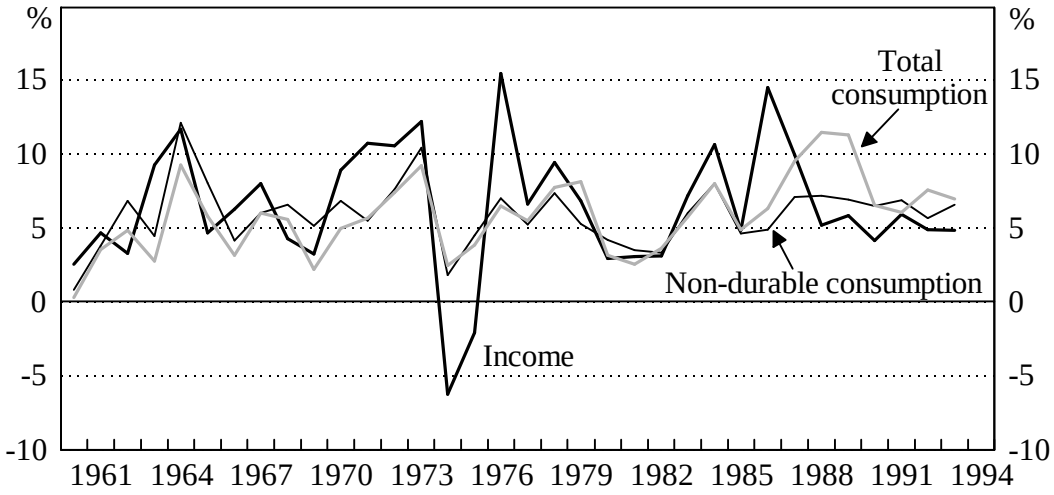


Figure 16: Demographic Change in Taiwan

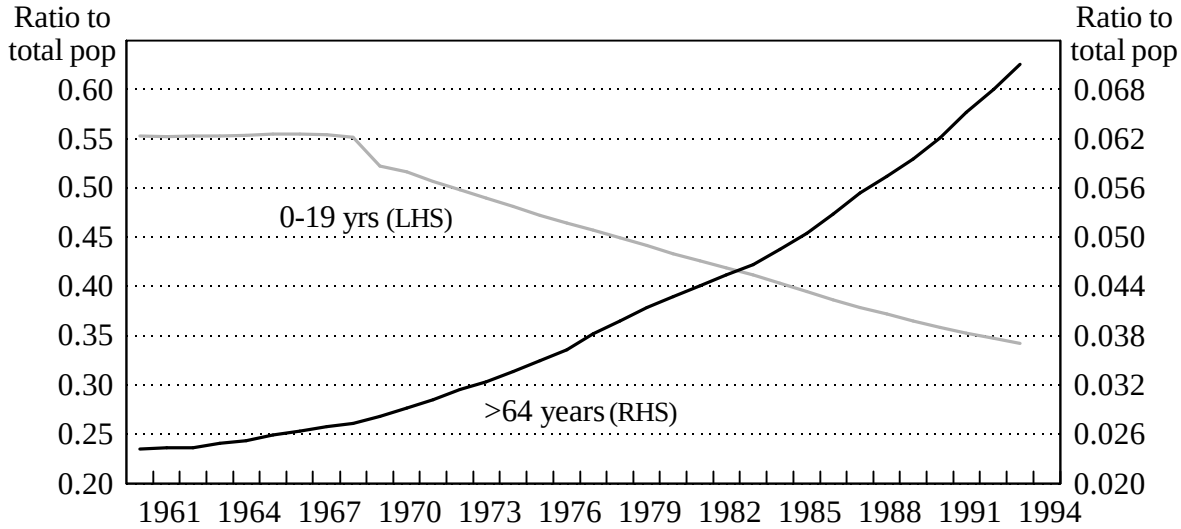
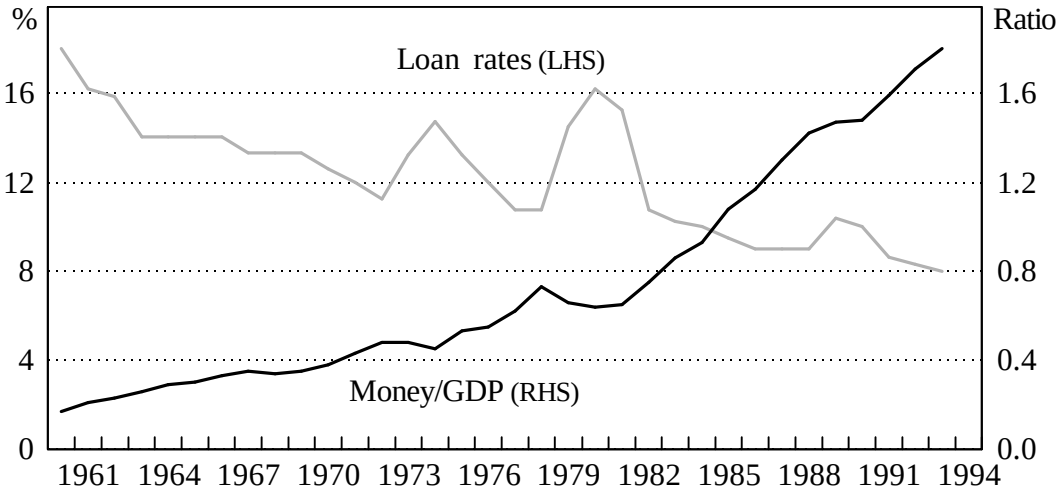


Figure 17: Liquidity Constraints in Taiwan



Thailand

Consumption: non-durables expenditure and total private expenditure 1988 constant prices, *Statistical Yearbook Thailand*, ADB *Key Indicators* and United Nations *National Accounts*.

Income: personal disposable income, *Statistical Yearbook Thailand*, deflated by the total private expenditure deflator.

Deposit rate: annual average 3-6-month fixed deposit rate, Bank of Thailand *Monthly Statistical Bulletin* and ADB *Key Indicators.*

Loan rate: annual average maximum lending rate, Bank of Thailand *Monthly Statistical Bulletin* and ADB *Key Indicators.*

Money market rate: annual average weighted interbank market rate, Bank of Thailand *Monthly Statistical Bulletin*.

Inflation: deflator(t)/deflator(t-1)-1 from the total private expenditure deflator.

Population statistics: total population and dependency ratio, World Bank Tables, IEDB Database, ANU; proportion aged 64 and over estimated from Keyfitz and Flieger (1990).

Money: currency and deposits with banks, IMF *International Financial Statistics*.

Credit: end-year loans for personal consumption, Bank of Thailand *Monthly Statistical Bulletin*.

Figure 18: Non-Durable and Total Consumption and Income in Thailand

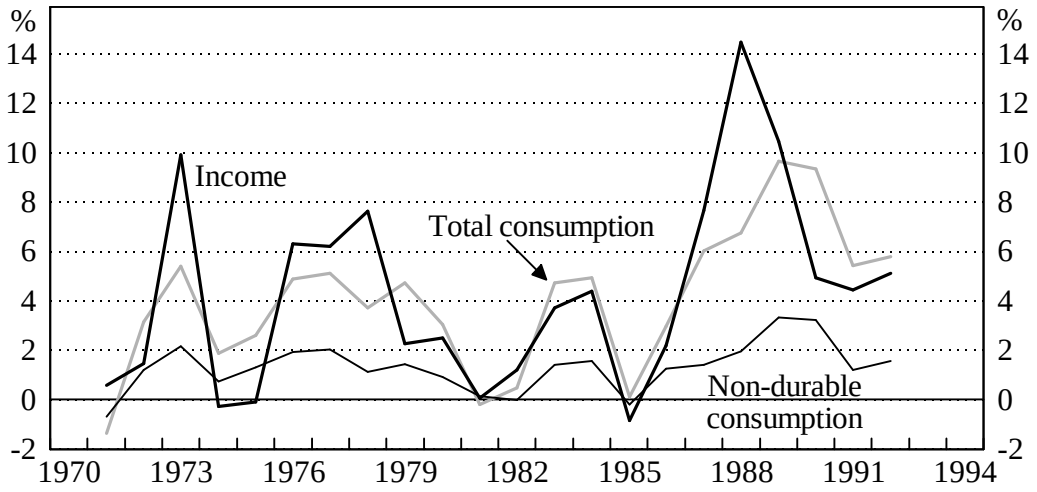


Figure 19: Demographic Change in Thailand

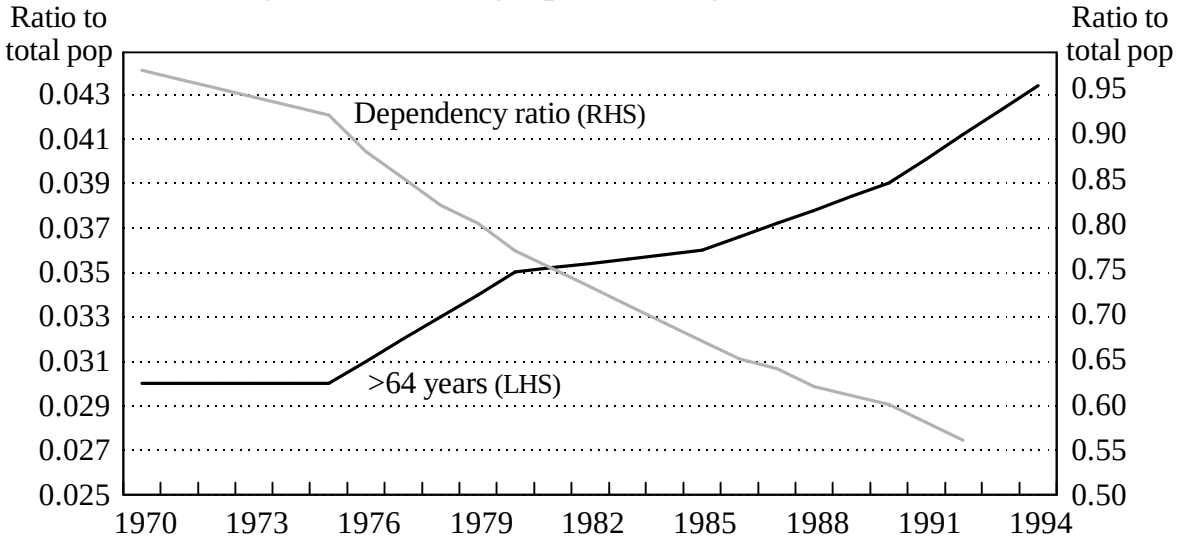
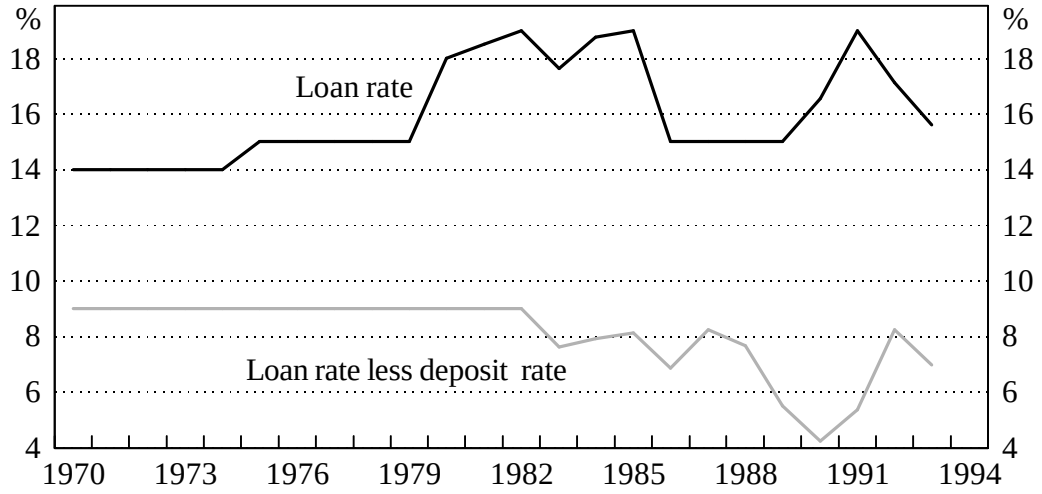


Figure 20: Liquidity Constraint in Thailand



Appendix B: Estimation Results

Table B.1: Australia Non-Durable and Total Consumption Growth

	(1) Non-dur (PFC def) constraint defined as income growth 1970-1994	(2) Non-dur & services, constraint defined as income growth 1975-1994	(3) Total consumption, constraint defined as income growth 1965-1994	(4) Total consumption, constraint defined as income growth 1965-1994	(5) Total consumption, constraint defined as income growth 1965-1994
Constant	1.61 (1.52)	0.012** (0.003)	-0.25 (0.17)	-0.01 (0.13)	0.14 (0.18)
Log income (t-1)	0.14** (0.05)		0.44** (0.17)	0.19* (0.10)	0.38** (0.17)
Log consumption (t-1)	-0.37 (0.22)		-0.41** (0.15)	-0.18* (0.09)	-0.37** (0.16)
Inflation rate (t)			-0.30** (0.12)		-0.24* (0.13)
Age 20-29 / age 20-64 (t)				-0.34* (0.19)	
Liquidity constraint (t)		0.32* (0.163)	0.43** (0.12)	0.56** (0.12)	
Liquidity constraint (t)(70s)	0.55** (0.24)				0.41** (0.16)
Liquidity constraint (t)(80s)	0.38 (0.30)				0.66** (0.24)
R-bar-squared	0.186	0.198	0.511	0.480	0.563
Standard error	0.0151		0.0098	0.0100	0.092
Misspecification	$\chi^2(10)=4.2$ (0.939)	$\chi^2(4)=1.0$ (0.918)	$\chi^2(10)=15$ (0.120)	$\chi^2(11)=18$* (0.092)	$\chi^2(6)=2.7$ (0.841)
Serial correlation ($\chi^2(1)$)	1.10 (0.294)	1.98 (0.159)	2.05 (0.152)	0.09 (0.765)	0.26 (0.612)
Functional form ($\chi^2(1)$)	0.00 (0.968)	0.32 (0.574)	0.00 (0.999)	0.93 (0.335)	0.01 (0.915)
Normality ($\chi^2(2)$)	0.24 (0.886)	0.79 (0.674)	1.52 (0.469)	0.12 (0.943)	1.02 (0.600)
Heteroscedasticity ($\chi^2(1)$)	0.41 (0.520)	0.01 (0.904)	1.57 (0.219)	0.69 (0.405)	0.20 (0.658)

Note: Value in parenthesis after estimated coefficient is standard error, value in parenthesis after chi-square diagnostic statistic is marginal significance level; ** indicates significant at 5%,* indicates significant at 10%.

Table B.2: Hong Kong Non-Durable Consumption Growth

	Constraint defined as loan rate
Constant	1.16 (0.70)
Log income (t-1)	0.24* (0.12)
Log consumption (t-1)	-0.38* (0.19)
Liquidity constraint (t)	-0.95** (0.43)
R-bar-squared	0.234
Standard error	0.0534
Misspecification	$\chi^2(7)=11.37$ (0.123)
Serial correlation ($\chi^2(1)$)	6.32 (0.012)
Functional form ($\chi^2(1)$)	0.36 (0.547)
Normality ($\chi^2(2)$)	1.02 (0.601)
Heteroscedasticity ($\chi^2(1)$)	0.00 (0.995)

Note: Value in parenthesis after estimated coefficient is standard error, value in parenthesis after chi-square diagnostic statistic is marginal significance level; ** indicates significant at 5%,* indicates significant at 10%.

Table B.3: Japan Non-Durable Consumption Growth

	(1) Constraint defined as income growth	(2) Constraint defined as money/GDP	(3) Constraint defined as real land prices	(4) Constraint defined as income growth	(5) Constraint defined as real land prices
Constant	1.32** (0.25)	1.95** (0.31)	2.18** (0.26)	0.95** (0.32)	2.35** (0.29)
Log income (t-1)	0.32** (0.10)	0.16 (0.11)	0.32** (0.08)	0.37** (0.11)	0.39** (0.09)
Log consumption (t-1)	-0.60** (0.15)	-0.53** (0.16)	-0.76** (0.13)	-0.61** (0.18)	-0.86** (0.14)
Real deposit rate (t)	0.24** (0.07)	0.24** (0.08)	0.39** (0.07)	0.26** (0.08)	0.39** (0.07)
Ddepend (t)	-5.18* (2.45)	-4.59* (2.59)	-3.04 (2.11)		
Liquidity constraint (t)	0.36** (0.15)	0.13** (0.05)	0.001** (0.0002)		
Liquidity constraint (t)(70s)				0.55** (0.13)	0.0010** (0.0002)
Liquidity constraint (t)(80s)				0.40* (0.20)	0.0011** (0.0002)
R-bar-squared	0.762	0.716	0.829	0.660	0.803
Standard error	0.0074	0.0081	0.0062	0.0088	0.0067
Misspecification	$\chi^2(5)=3.20$ (0.669)	$\chi^2(6)=6.50$ (0.370)	$\chi^2(6)=6.32$ (0.388)	$\chi^2(12)=7.4$ (0.687)	$\chi^2(12)=10$ (0.615)
Serial correlation ($\chi^2(1)$)	0.51 (0.475)	0.04 (0.844)	0.17 (0.684)	0.84 (0.559)	0.10 (0.741)
Functional form ($\chi^2(1)$)	0.00 (0.991)	0.22 (0.642)	0.02 (0.879)	0.71 (0.400)	0.35 (0.556)
Normality ($\chi^2(2)$)	1.47 (0.479)	1.15 (0.563)	1.12 (0.572)	0.14 (0.934)	0.87 (0.647)
Heteroscedasticity ($\chi^2(1)$)	0.10 (0.757)	2.97* (0.085)	0.73 (0.392)	1.03 (0.311)	0.92 (0.337)

Note: Value in parenthesis after estimated coefficient is standard error, value in parenthesis after chi-square diagnostic statistic is marginal significance level; ** indicates significant at 5%,* indicates significant at 10%.

Table B.4: Korea Non-Durable Consumption Growth

	(1) Constraint defined as income growth	(2) Constraint defined as loan rate (OLS estimation)	(3) Constraint defined as income growth
Constant	0.52**	1.13**	0.49**
	(0.23)	(0.38)	(0.23)
Log income (t-1)	0.18**	0.23**	0.19**
	(0.06)	(0.09)	(0.06)
Log consumption (t-1)	-0.29**	-0.43**	-0.29**
	(0.11)	(0.16)	(0.10)
Liquidity constraint (t)	0.20**	-0.22**	
	(0.09)	(0.08)	
Liquidity constraint (t)(70s)			0.39**
			(0.08)
Liquidity constraint (t)(80s)			0.35**
			(0.08)
R-bar-squared	0.654	0.337	0.686
Standard error	0.0137	0.0189	0.0130
Misspecification	$\chi^2(5)=1.20$	n/a	$\chi^2(6)=8.34$
	(0.945)		(0.214)
Serial correlation	0.59	0.78	0.50
($\chi^2(1)$)	(0.443)	(0.378)	(0.478)
Functional form	2.42	0.00	3.15*
($\chi^2(1)$)	(0.120)	(0.953)	(0.076)
Normality	1.28	0.24	6.44**
($\chi^2(2)$)	(0.526)	(0.889)	(0.040)
Heteroscedasticity	0.28	2.24	1.35
($\chi^2(1)$)	(0.594)	(0.134)	(0.245)

Note: Value in parenthesis after estimated coefficient is standard error, value in parenthesis after chi-square diagnostic statistic is marginal significance level; ** indicates significant at 5%,* indicates significant at 10%.

Table B.5: Singapore Non-Durable Consumption Growth

	(1) Liquidity constraint defined as income growth	(2) Liquidity constraint defined as money/GDP ratio	(3) Liquidity constraint defined as the deposit rate	(4) Liquidity constraint defined as income growth
Constant	2.57** (0.71)	0.72 (0.89)	-0.20 (1.02)	2.15** (0.75)
Log income (t-1)	0.19** (0.06)	-0.04 (0.08)	-0.08 (0.08)	0.18** (0.06)
Log consumption (t-1)	-0.56** (0.16)	-0.05 (0.20)	0.13 (0.23)	-0.46** (0.17)
Real interest rate (t)	0.34** (0.08)	0.30** (0.12)	0.38** (0.13)	0.35** (0.09)
Liquidity constraint (t)	0.56** (0.09)	0.16** (0.07)		
Liquidity constraint (t-1)			-0.74** (0.32)	
Liquidity constraint (t)(70s)				0.60** (0.17)
Liquidity constraint (t)(80s)				0.46** (0.10)
R-bar-squared	0.723	0.465	0.388	0.716
Standard error	0.0140	0.0199	0.0204	0.0144
Misspecification	$\chi^2(5)$=4.46 (0.486)	–	–	$\chi^2(10)$=9.94 (0.446)
Serial correlation ($\chi^2(1)$)	0.42 (0.518)	1.01 (0.314)	1.45 (0.228)	0.31 (0.579)
Functional form ($\chi^2(1)$)	2.43 (0.119)	0.36 (0.549)	0.36 (0.547)	0.12 (0.725)
Normality ($\chi^2(2)$)	0.87 (0.646)	0.30 (0.860)	0.45 (0.798)	15.87** (0.000)
Heteroscedasticity ($\chi^2(1)$)	0.95 (0.329)	2.45 (0.115)	2.17 (0.140)	2.09 (0.491)

Note: Value in parenthesis after estimated coefficient is standard error, value in parenthesis after chi-square diagnostic statistic is marginal significance level; ** indicates significant at 5%,* indicates significant at 10%.

Table B.6: Taiwan Non-Durable Consumption Growth

	(1) Constraint defined as current income growth	(2) Constraint defined as money/GDP ratio	(3) Constraint defined as loan rate	(4) Constraint defined as current income growth
Constant	1.99** (0.51)	1.77** (0.58)	1.42** (0.43)	1.58** (0.45)
Log income (t-1)	0.27** (0.06)	0.22** (0.07)	0.19** (0.08)	0.28** (0.06)
Log consumption (t-1)	-0.49** (0.11)	-0.43** (0.13)	-0.34** (0.12)	-0.46** (0.11)
D dependency ratio (t)	5.21** (1.45)		1.87 (1.42)	4.70** (1.57)
Loan-deposit rates (t)	-1.34** (0.55)			-0.78* (0.38)
Liquidity constraint (t)	0.34** (0.08)	0.06** (0.03)	-0.80** (0.31)	
Liquidity constraint (t)(60s)				0.38** (0.14)
Liquidity constraint (t)(70s)				0.36** (0.06)
Liquidity constraint (t)(80s)				0.15 (0.10)
R-bar-squared	0.625	0.350	0.390	0.652
Standard error	0.0145	0.0191	0.0185	0.0140
Misspecification	$\chi^2(8)=6.46$ (0.596)	$\chi^2(9)=8.09$ (0.525)	$\chi^2(11)=17.20$ (0.102)	$\chi^2(22)=16.22$ (0.805)
Serial correlation ($\chi^2(1)$)	1.33 (0.249)	0.00 (0.970)	0.67 (0.411)	1.56 (0.212)
Functional form ($\chi^2(1)$)	0.32 (0.572)	0.44 (0.508)	2.63 (0.105)	0.39 (0.533)
Normality ($\chi^2(2)$)	0.00 (1.000)	1.02 (0.599)	1.79 (0.409)	0.48 (0.785)
Heteroscedasticity ($\chi^2(1)$)	0.54 (0.462)	0.26 (0.609)	0.00 (0.980)	0.59 (0.320)

Note: Value in parenthesis after estimated coefficient is standard error, value in parenthesis after chi-square diagnostic statistic is marginal significance level; ** indicates significant at 5%,* indicates significant at 10%.

Table B.7: Thailand Non-Durable Consumption Growth

	(1) Liquidity constraint defined as current income growth	(2) Liquidity constraint defined as money/GDP ratio	(3) Liquidity constraint defined as loan rate	(4) Liquidity constraint defined as loan-deposit rate	(5) Liquidity constraint defined as current income growth
Constant	1.94** (0.41)	0.38 (0.68)	1.17** (0.52)	0.09** (0.03)	1.99** (0.41)
Log income (t-1)	0.50** (0.09)	0.41** (0.12)	0.37** (0.12)		0.51** (0.09)
Log consumption (t-1)	-0.77** (0.14)	-0.52** (0.19)	-0.52** (0.19)		-0.78** (0.14)
D age ratio (t)	14.92** (6.66)				16.00* (8.18)
Real interest rate (t)	0.15** (0.06)	0.31** (0.11)	0.16* (0.09)		0.15** (0.05)
Liquidity constraint (t)	0.32** (0.06)	2.13** (0.029)	-0.62** (0.26)	-0.71** (0.34)	
Liquidity constraint (t)(70s)					0.30** (0.12)
Liquidity constraint (t)(80s)					0.30** (0.07)
R-bar-squared	0.800	0.581	0.588	0.261	0.786
Standard error	0.0093	0.0136	0.0134	0.0180	0.0097
Misspecification	$\chi^2(7)$=7.94 (0.338)	$\chi^2(7)$=8.19 (0.316)	$\chi^2(7)$=11.3 (0.126)	$\chi^2(6)$=9.03 (0.172)	$\chi^2(10)$=12 (0.259)
Serial correlation ($\chi^2(1)$)	2.29 (0.130)	0.02 (0.899)	0.00 (0.957)	1.21 (0.272)	2.59 (0.107)
Functional form ($\chi^2(1)$)	0.44 (0.507)	0.44 (0.505)	2.02 (0.155)	0.56 (0.454)	0.06 (0.811)
Normality ($\chi^2(2)$)	0.67 (0.716)	1.47 (0.479)	1.05 (0.593)	0.85 (0.654)	0.74 (0.691)
Heteroscedasticity ($\chi^2(1)$)	0.01 (0.927)	1.05 (0.306)	0.44 (0.507)	0.42 (0.517)	0.04 (0.834)

Note: Value in parenthesis after estimated coefficient is standard error, value in parenthesis after chi-square diagnostic statistic is marginal significance level; ** indicates significant at 5%,* indicates significant at 10%.

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