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Consumption and credit constraints: International evidence

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Abstract

If some consumers are liquidity-constrained, aggregate consumption should be 'excessively sensitive' to credit conditions as well as to income. Moreover, the 'excess sensitivity' may vary over time. Using data for the United States, Canada, the United Kingdom, Japan and France, we find a substantial impact of credit aggregates on consumption in all countries considered. Moreover, the borrowing/lending wedge is a significant determinant of consumption in the United States, Canada and Japan. Using extended Kalman filtering techniques, we show that the excess sensitivity varies over time, with a clear tendency to decline in the United States.

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1. Introduction

The determination of aggregate consumption and its potential role in the monetary transmission mechanism are issues of importance to policy-makers and academic economists alike. Despite this shared interest, however, work by economists in the two sectors tends to differ. Following the seminal work of Hall

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(1978), research in the academic community has often focused on testing the hypothesis that aggregate consumption evolves over time in a way compatible with the 'life cycle-permanent income hypothesis'.[1] One fundamental implication of the permanent income hypothesis (PIH) is that monetary policy can only influence consumption to the extent that it affects permanent income.[2] Since it is difficult to believe that monetary policy has large effects on permanent income, if true, the PIH implies that aggregate consumption does not play a primary role in the transmission of monetary policy.

In central bank circles, in contrast, it is frequently taken for granted that the behavior of consumption is critically influenced by the availability and cost of credit, and that consumption plays an important role in the transmission mechanism. Attention is therefore focused on how alternative monetary policy measures are likely to affect credit conditions, and how, in turn, the induced changes in credit conditions are likely to influence aggregate consumption. One reason why the role of credit is of particular interest to central banks is the widespread perception that financial liberalization and heightened competition in the financial services sector in many countries in the 1980s led to a rapid expansion of credit which triggered a consumption boom.

The fact that variables capturing credit conditions are not normally included in empirical work on the PIH is somewhat surprising. Empirical research has consistently rejected the PIH and found that consumption displays *excess sensitivity* (ES) to income, that is, consumption growth appears significantly correlated with expected income growth. While these rejections may be due to any of a number of possible violations of the assumptions underlying the model, they are often attributed to liquidity constraints. If so, it would seem natural to include variables associated with the tightness of credit conditions in the empirical work on consumption.

This paper examines the relationship between aggregate consumption and measures of the tightness of credit conditions. We consider two simple implications of the hypothesis of liquidity-constrained consumers. First, credit market variables should help predict consumption changes. Secondly, the ES of consumption to income and possibly to other variables is likely to vary over time as the tightness of credit constraints changes. We use a methodology adapted from Campbell and Mankiw (1989, 1990, 1991) (hereafter CM) and data for the United States, Canada, the United Kingdom, Japan and France.

The paper is organized as follows. In Section 2 we spell out our methodology. In lieu of presenting a formal model, we briefly review the theoretical literature

[1] See Muellbauer and Lattimore (1995) and Deaton (1992) for reviews of the literature.

[2] Of course, monetary policy could also affect consumption by influencing real short-term interest rates. However, empirical research has failed to find strong evidence that real interest rates affect consumption. For this reason, it seems implausible that monetary policy affects consumption through this mechanism.

which discusses financial imperfections and consumption. We also consider the empirical literature that has used aggregate data to explore whether liquidity constraints matter for consumption. We conclude that there are good reasons to believe that credit growth and the wedge between borrowing and lending rates, which has been used in the literature as a measure of the tightness of credit conditions, play important roles in determining consumption.

In Section 3 we turn to the data and test whether this is indeed the case. We find that expected future growth rates of income and, more interestingly, mortgage credit and consumer credit are correlated with consumption of non-durable goods and services in all five countries we study. Furthermore, as judged by the significance of the parameters in multivariate regressions, credit growth often appears a more important determinant of consumption than income growth. We also show that the wedge between borrowing and lending rates has predictive power for consumption in the United States, Canada and Japan. Since the wedges we use in the econometric analysis are likely to be rough approximations of true wedges, this result is striking. Finally, we find supporting evidence in the United States by using a more direct indicator of credit supply (the Senior Loan Officer Survey) instead of credit aggregates.

In Section 4 we turn to the question of whether the ES of consumption to income, credit and the borrowing/lending wedge declines over time, as is frequently suggested in the literature. In order to do so, we note that the CM estimates of the ES can be thought of as stemming from a system of two equations. We can, therefore, provide time-varying coefficient estimates of the ES by estimating this system using extended Kalman filter techniques. The estimates show that the ES of consumption does indeed vary over time, and that it tends to decline in the United States. Finally, Section 5 provides our conclusions. Taken together, the empirical results presented in the paper support the hypothesis of liquidity constraints, and suggest that credit growth plays an important role in determining the behavior of consumption.

2. Consumption and liquidity constraints

2.1. Methodology

In this section we motivate our empirical work and review related studies in the consumption literature. The standard model of consumption behavior considers the optimal consumption path of an individual who can borrow and lend freely at the risk-free interest rate. If the interest rate is constant and equal to the subjective rate of time preference, we have

$$E_{t-1}u'(C_t) = u'(C_{t-1}), \tag{1}$$

where C_t is consumption of non-durables and services, $u'()$ is the derivative of a concave one-period utility function, and E_{t-1} is the expectation based on

information available at time $t-1$. If the marginal utility of consumption is linear, consumption growth is unpredictable. Alternatively, assuming an iso-elastic utility function and log-normally distributed consumption levels, the growth in the logarithm of consumption is unforecastable, that is

$$\Delta c_t = \alpha + \varepsilon_t, \tag{2}$$

where c_t represents the log of consumption and ε_t is the innovation in the log of consumption that should be orthogonal to past information. However, a large literature has demonstrated that ε_t is typically predictable. An interpretation of this evidence is given by Campbell and Mankiw, who argue that a proportion of the population consumes its current income so that expected aggregate consumption should depend on expected aggregate income. They consider the following equation:

$$\Delta c_t = \alpha + \beta E_{t-1}\Delta y_t + \varepsilon_t, \tag{3}$$

where y_t is the log of disposable income and β is a coefficient capturing the ES of consumption to income. CM and numerous subsequent studies find that $0 < \beta < 1$ and is statistically significantly different from zero. While several explanations for this finding have been proposed in the literature, it is commonly seen as evidence that a proportion of consumers are liquidity-constrained.

However, the assumption that a fixed proportion of consumers only consume out of their current income appears overly restrictive, even if some consumers are truly liquidity-constrained. First, most consumers are able to borrow, at least to some extent. This suggests that if the liquidity constraint interpretation is to be taken seriously, credit should be incorporated in the analysis. Secondly, the proportion of constrained consumers is unlikely to be constant. It seems plausible that fewer people are constrained in good times or when access to credit is easier. This suggests that β varies over time.

In this paper we focus on the liquidity constraint hypothesis and adopt an approach similar to CM. However, we incorporate credit variables and time-varying ES. Our empirical work is based on equations of the form:

$$\Delta c_t = \alpha_t + \boldsymbol{\beta}_t E_{t-1}\Delta \boldsymbol{x}_t + \varepsilon_t, \tag{4}$$

where $\boldsymbol{x}_t$ is a column vector that includes disposable income as well as credit market indicators and $\boldsymbol{\beta}_t$ is a row vector of time-varying coefficients.

An important issue concerns the choice of the $\boldsymbol{x}_t$ vector. In addition to disposable income, it would be desirable to include a measure of the credit conditions faced by liquidity-constrained consumers. Such data obviously do not exist and proxy variables must be used. Moreover, the variables that can be used are dictated by data availability, both over time and across countries. We consider, first, the aggregate quantity of consumer credit and of mortgage credit. These measures obviously include credit to both constrained and unconstrained

consumers. Thus, we need to assume that credit to constrained consumers is positively correlated to aggregate credit growth.

Furthermore, we consider the wedge between interest rates applied to lenders and to borrowers. This wedge represents a premium charged to borrowers and is likely to increase as credit conditions tighten.[3] Thus, the wedge should be negatively correlated with consumption growth. As a measure of the lending rate, we use a bank prime lending rate. While this rate is not applied directly to consumer loans, it serves as a reference rate for many lending rates. As for the deposit rate, we use either a time deposit rate or a Treasury bill rate.

2.2. *Relation to the literature*

While we do not present a theoretical model in this paper, the impact of credit conditions on consumption has been derived analytically in the literature. Since solving a general equilibrium model of consumer behavior with credit constraints is a challenging undertaking, the models considered in the literature are typically partial equilibrium models and incorporate an ad hoc specification of the credit market or the liquidity constraint. The most common assumption is that consumers cannot borrow at all. If we denote by D_t the net stock of debt owed by consumers, we simply have $D_t \leqslant 0$ (see, for instance, Deaton (1991)). When the constraint is binding, consumption is simply equal to income, which is the case considered by CM and many others. In this case, credit variables do not appear explicitly in the analysis.

Credit matters explicitly when credit constraints are time-varying. This case has been considered by several authors. Chah et al. (1995) assume that consumers can borrow against their stock of durables, so that the constraint depends on the value of durables. Alessie et al. (1997) take a similar approach. Ludvigson (1996) models the credit limit as depending on current income Y_t, $D_t \leqslant \nu Y_t$, where ν is a constant. Other authors assume that the borrowing/lending wedge varies over time. King (1986) examines a model of asymmetric information between borrowers and lenders where the borrowing rate is determined by the endogenous composition of the pool of borrowers. Wirjanto (1995) studies the case where the borrowing rate is an increasing function of D_t. Similarly, Scott (1996) allows the borrowing rate to increase with the debt/income ratio, D_t/Y_t.[4] In all these cases, credit conditions are obviously crucial in determining consumption.

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[3] Asymmetric information between lenders and borrowers usually implies two potential types of credit contract: borrowers are either credit-constrained or charged a premium on their loan rate. See, for example, Bacchetta and Caminal (1996) for a model of credit to firms where the two types of outcome can occur.

[4] See also Hayashi (1987) and Lawrance (1995) for models of credit-constrained consumers based on asymmetric information in credit markets.

Before turning to our empirical analysis, it is useful also to review briefly the empirical literature on liquidity constraints and consumption. We focus on studies based on aggregate data since these are the data we use.[5] In addition to showing that the ES of consumption to income is significant for most countries, three aspects of the liquidity constraint hypothesis have been explored: (i) whether the ES differs across countries with different financial systems; (ii) whether the ES in a given country varies over time in conjunction with changes in the financial system; and (iii) whether financial variables such as credit aggregates or interest rates predict consumption.

With regard to the first question, Jappelli and Pagano (1989) show that the degree of ES to income is inversely related to the debt level. Countries in which the estimated ES with respect to income is low (for instance, Sweden and the United States) tend to have the highest consumer debt levels. The authors argue that low debt levels are more likely to come from the supply side (credit rationing) than from the demand side. On the other hand, they do not find any relationship between the ES and the average wedge between mortgage rates and Treasury bill rates.

The second issue of whether the ES of consumption varies over time has also been explored. Campbell and Mankiw (1991) find no evidence of a time trend in the ES for several countries. On the other hand, Bayoumi and Koujianou (1989) and Blundell-Wignall et al. (1992, 1995) estimate ES parameters by decade and find a decline in the 1980s for many countries. Campbell and Mankiw (1991) and Bayoumi and Koujianou (1989) also estimate rolling regressions that tend to confirm these results. Bayoumi (1993) finds that the ES declines with the level of consumer credit/GDP ratio in regions in the United Kingdom. Finally, McKiernan (1996), using Kalman filtering, finds for the United States that while the ES of consumption to income has varied considerably over time, it has not tended to decline.

Turning to the ability of financial variables to predict consumption, there is apparently no systematic cross-country study addressing this question. However, there is scattered evidence for individual countries. For the United States, nominal interest rates (Mankiw (1982) using prime rates, and Wilcox (1989) using the borrowing rate on automobile loans) and consumer credit (Ludvigson, 1996) have been found significant.[6] The borrowing/lending wedge has also been found significant in the United Kingdom (King, 1986) and Canada (Wirjanto, 1995). Furthermore, de Brouwer (1996) finds that various financial variables, including nominal interest rates and the borrowing/lending wedge, are significant for a group of East Asian countries.

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[5] See Deaton (1992) and Muellbauer and Lattimore (1995) for a more detailed survey. See also Hayashi (1987) for an earlier survey.

[6] It is interesting to note that Ludvigson's (1996) and our approach are similar, but were developed independently.

In sum, the existing empirical literature also suggests that financial variables may be useful in predicting consumption. Below we present more systematic international evidence suggesting that this is indeed the case.

3. Fixed coefficient estimates

Since the overwhelming part of the empirical literature has estimated consumption equations assuming that the coefficients are constant (that is, $\boldsymbol{\beta}_t = \boldsymbol{\beta}$), we start the review of our empirical work by presenting estimates of Eq. (4) under this assumption. We thus estimate

$$\Delta \boldsymbol{x} c_t = \alpha + \boldsymbol{\beta} E_{t-1} \Delta \boldsymbol{x}_t + \varepsilon_t. \tag{5}$$

To motivate the time-varying coefficient approach we discuss in Section 4, it is useful to consider the estimation of Eq. (5) in some detail. As expectations are not observable, the issue of how to treat the expectations term in Eq. (5) arises. We assume that $\Delta \boldsymbol{x}_t$ is related linearly to a set of forecasting variables $\boldsymbol{z}_t$, which are known to the consumer at time $t-1$:

$$\Delta \boldsymbol{x}_t = \boldsymbol{\Gamma} \boldsymbol{z}_t + \boldsymbol{\eta}_t, \tag{6}$$

where $\boldsymbol{\Gamma}$ is a matrix of coefficients and $\boldsymbol{z}_t' = [1 \quad z_{1t} \quad \ldots \quad z_{kt}]$. The expectation $E(\Delta \boldsymbol{x}_t \mid \boldsymbol{z}_t)$ can be obtained by estimating Eq. (6) with OLS. We can then replace $E_{t-1} \Delta \boldsymbol{x}_t$ by $\hat{\boldsymbol{\Gamma}} \boldsymbol{z}_t$ in Eq. (5) to estimate $\boldsymbol{\beta}$. In practice, of course, this procedure is implemented by estimating $\boldsymbol{\beta}$ using $\boldsymbol{z}_t$ as instruments (see Campbell and Mankiw). As usual in the literature, we use variables lagged at least twice as instruments.[7]

We apply the instrumental variable (IV) estimation procedure using quarterly data for five countries: Canada, France, Japan, the United Kingdom and the United States. Depending on the country, the estimation starts between 1970 and 1980 and ends in 1995. We employ four $\boldsymbol{x}_t$ variables: the logarithms of real disposable income, real mortgage credit and real consumer credit; and a borrowing/lending wedge. We do not include real interest rates since preliminary estimates indicated that they were not significant (as is typically the case in the literature).

[7] The main reason for using instruments dated $t-2$ rather than $t-1$ is that if the permanent income hypothesis held in continuous time, measured consumption is the time average of a random walk. The results of Working (1960) then suggest that the errors should obey a first-order MA-structure. Campbell and Mankiw (1990) list three additional reasons why it is desirable to use instruments lagged twice: reporting lags may prevent variables dated $t-1$ from being in agents' information sets at t; some goods classified as non-durable may in fact be durable, which would also induce first-order MA errors (see Mankiw, 1982); and there may be white-noise errors (due to measurement problems or 'transitory consumption') in the level of consumption.

3.1. Some empirical regularities

Before turning to the formal econometric estimates, it is useful first to review the behavior of the time series used in the estimation part.[8] Below we present plots of the data, consider the results from Granger causality tests, and briefly touch upon issues regarding the seasonality and stationarity of the data.

3.1.1. Consumption and credit growth

Fig. 1 ((a)–(e)) contain plots of the growth of real consumption of non-durables and services, and real consumer and mortgage credit over four quarters for the five countries we study. Consider first the figure for the United States (Fig. 1(a)). As can be seen, both consumer and mortgage credit growth are correlated with consumption growth. These correlations are likely to arise from a combination of movements in consumption which affect the demand for credit and shifts in the availability of credit which relax credit constraints and thereby affect consumption.

While the plots for Canada (Fig. 1(b)) are similar to those for the United States, the plots for the United Kingdom (Fig. 1(e)) are more interesting in that credit growth rose to high levels in 1982 and remained there until late 1988. To a considerable extent, this credit expansion was caused by changes in the regulatory environment, in particular the relaxation of the 'corset' and the authorities' encouragement of greater competition between building societies and banks in the provision of mortgage credit. The impact of financial liberalization on credit growth is clearer still in Japan, where the process of financial deregulation that started in the mid-1980s coincided with rapid growth of consumer credit.[9] The lifting of the ceilings on bank credit in France – the encadrement du crédit – in 1987 was also associated with rapid growth of consumer credit and some increase in the growth rate of mortgage credit. In sum, we draw two conclusions from the plots of credit and consumption growth. First, in the United States and Canada there are close relationships between consumption and credit expansion. Secondly, in the United Kingdom and, in particular, Japan and France this relationship is less apparent, largely because the growth rate of credit reflects regulatory changes that have affected the availability of credit.[10]

Next we turn to the borrowing/lending wedge. Unfortunately, there is little data available on the rates at which banks lend, so that any empirical measure of the wedge will necessarily be subject to potentially considerable measurement error. With this caveat in mind, we computed several measures of the wedge,

[8] The data definition and sources are described in Appendix A.

[9] For a review of financial deregulation in Japan, see Takeda and Turner (1992).

[10] For an overview of financial deregulation in the 1980s, see BIS (1992).

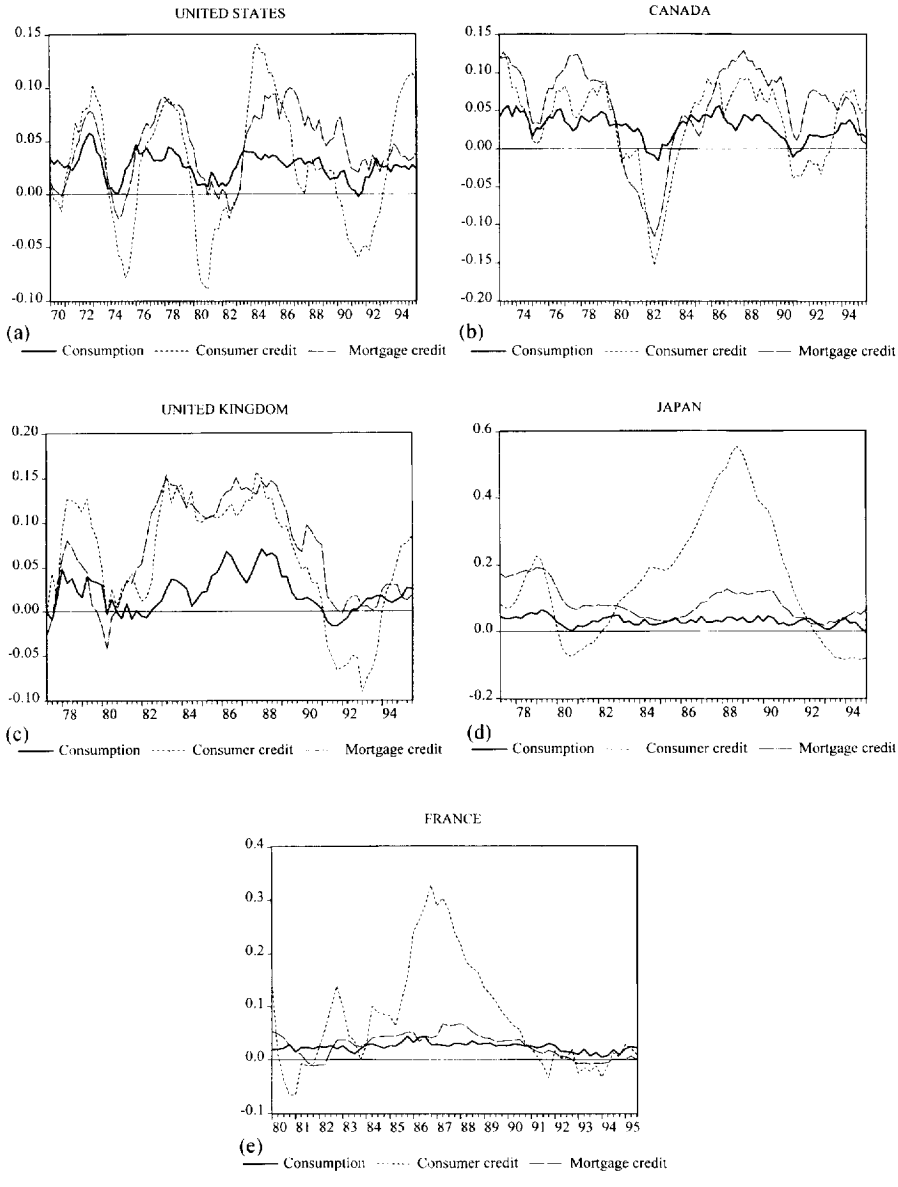

Fig. 1. Growth in consumption and credit over four quarters.

using the difference between a prime lending rate and either a three-month Treasury bill rate or a time deposit rate. Empirically, it turned out that the wedge between the prime rate and the Treasury bill rate was more significant in the United States and Japan, while the wedge between the prime rate and the time deposit rate was better in Canada. These wedges are plotted in Fig. 2 ((a)–(c)).[11] In the United States and Canada, the wedges increased substantially during the recessions following the first and second oil shocks in 1973–74 and in 1980–82. It can also be seen that there has been a trend increase in the wedge in the United States.[12] Turning to the wedge in Japan, there is also evidence of a tightening of credit standards in the early 1980s and, more interestingly, in the early 1990s. Note also that there is some tendency for the wedge to grow over time in Japan.

3.1.2. Granger causality

As mentioned above, consumption growth and credit growth are in some cases contemporaneously strongly correlated. One possible interpretation of this finding is that it stems from credit adjusting to changes in consumption, which in turn is due to shifting expectations of future income. Alternatively, the correlation could arise because of shifts in the tightness of credit constraints that are reflected in consumption. While the relative importance of these explanations cannot be settled by Granger causality tests, such tests are of interest for two reasons. First, a finding that credit lags consumption would be difficult to reconcile with the notion that shifts in credit are largely due to changes in credit constraints. Secondly, Granger causality tests contain information useful for the interpretation of the estimates reported below. For instance, if credit is a better predictor of future income growth than lagged income growth, credit could be significant in the regressions even if agents are not credit-constrained.

Before turning to the Granger tests, we must deal with the issues of seasonality and stationarity of the variables. In several cases, there was substantial seasonality in the credit series. However, since the seasonal pattern tended to shift over time, we use fourth differenced credit in the empirical work below.[13] To purge the trend increase in the wedge, we also used the fourth-difference of

[11] Since the wedges in the United Kingdom and France were highly insignificant in the regressions run, we do not plot them for space reasons.

[12] One possible explanation for this is that since loans in practice are priced relative to the prime rate, the difference between the actual interest rates paid and the posted prime rate may have fallen over time in response to compositional changes in the borrowing pool. For instance, while prime rates used to apply largely to corporate borrowers, recently consumer loans and, in particular, mortgage loans have increasingly become priced in relation to prime rates. As a consequence, the unobserved true wedge would have been falling relative to the observed wedge.

[13] However, extensive checking indicated that the results in the empirical work reported below would not be materially changed if first-differenced credit was used.

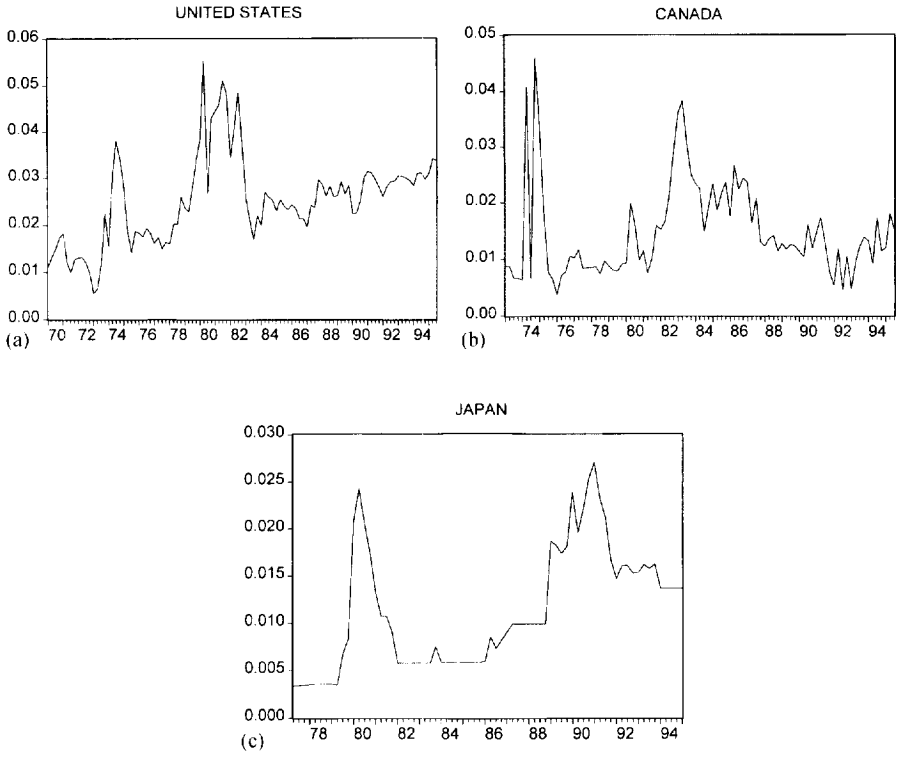

Fig. 2. Borrowing lending wedge.

this variable. Furthermore, estimating Augmented Dickey–Fuller and Phillips–Perron tests, we concluded that first-differenced consumption and income and fourth-differenced credit and the wedge are all stationary.

Table 1 provides the results from multivariate Granger causality tests, which are estimated using four lags. Several findings are of interest. First, note that consumption predicts consumer credit growth in the United States. This finding is of particular interest in the light of the fact that the empirical work on credit and consumption in the United States has focused on the role of consumer credit.[14] However, in none of the other nine cases does consumption lead credit (see the first column of Table 1). In contrast, credit predicts future consumption in four cases, including that of mortgage credit in the United States. Thus, we conclude that consumption tends to lag credit.

[14] See, for example, Ludvigson (1996) and Antzoulatos (1997).

Table 1
Granger causality tests

Marginal significance levels (%)

		Consumption	Disposable income	Consumer credit
United States 1970:1–1995:3	Consumption	0.0	30.1	25.4
	Disposable income	2.2	3.7	4.9
	Consumer credit	4.7	18.9	0.0
Canada 1973:1–1995:3	Consumption	41.8	17.8	2.1
	Disposable income	66.6	10.3	56.6
	Consumer credit	14.3	46.6	0.0
United Kingdom 1977:2–1995:3	Consumption	22.9	0.0	12.9
	Disposable income	0.2	14.6	30.8
	Consumer credit	9.9	74.0	0.0
Japan 1977:2–1995:1	Consumption	8.5	73.4	51.6
	Disposable income	32.2	0.0	0.3
	Consumer credit	19.8	11.4	0.0
France 1980:1–1995:3	Consumption	2.7	31.8	44.2
	Disposable income	89.9	24.8	56.7
	Consumer credit	29.2	83.6	0.0

		Consumption	Disposable income	Mortgage credit
United States 1970:1–1995:3	Consumption	1.0	60.4	1.0
	Disposable income	2.2	3.3	6.5
	Mortgage credit	26.8	35.9	0.0
Canada 1973:1–1995:3	Consumption	12.8	16.2	26.8
	Disposable income	77.6	8.1	45.0
	Mortgage credit	42.6	39.3	0.0
United Kingdom 1977:2–1995:3	Consumption	35.6	0.0	65.3
	Disposable income	0.3	39.5	74.4
	Mortgage credit	23.2	8.7	0.0
Japan 1977:2–1995:1	Consumption	0.3	48.2	2.0
	Disposable income	29.9	0.0	52.3
	Mortgage credit	13.8	87.7	0.0
France 1980:1–1995:3	Consumption	0.4	14.7	4.4
	Disposable income	97.3	19.5	47.4
	Mortgage credit	19.6	5.5	0.0

Note: Consumption and disposable income are in quarterly differences, while the credit variables are in four-quarter differences. The Granger causality tests (F tests) are computed from three-variable VARs (with four lags) incorporating the growth rates of consumption, disposable income and either credit variables. The upper part of the table shows the marginal significance levels for the VAR with consumer credit, while the lower part presents the significance levels for the VAR with mortgage credit. The rows indicate the dependent variables and the columns the explanatory variables.

Secondly, it can be seen that credit on average does a much worse job of predicting future income than does consumption (or past income). This finding suggests that movements in credit do not contain much information about future income, so that, if credit is significant in the regression we estimate below, it is probably not because it is correlated with expected income growth.

3.2. Results

Tables 2–6 present the results for IV estimates of Eq. (5) for the five countries we examine. For each country, we use the same set of instruments (which are provided in the tables) for all regressions. It should be noted that a frequent problem in estimating consumption equations of the CM type is that it may be difficult to find good instruments for x_t. This problem appears serious in the case of income growth in Japan and France, for which we cannot reject the hypothesis that the instruments are jointly insignificant in the first-step regressions for income. The estimates for these variables should therefore be interpreted with caution. On the other hand, credit variables are highly correlated with the instruments in all countries.[15]

Given that a large part of the literature has focused on the United States, we start by reviewing the results for this country.

United States. We first estimate the standard CM regression using a single x_t variable, with data spanning 1970:1–1995:3. The first four regressions in Table 2 show that consumption displays ES to all four x_t variables considered.[16] Next, we re-estimate the regressions including income combined with another variable. The results indicate that the credit variables and the wedge remain significant when income is included, and that income remains significant when a second variable is introduced. We therefore estimate the regression with income, one of the credit aggregates and the wedge. Somewhat surprisingly, the credit variables and the spread remain highly significant, while the significance of income falls. All in all, the results for the United States suggest that movements in credit and the borrowing/lending wedge have had a significant impact on consumption during the sample period.

Canada. Next we turn to the results for Canada using data for the period 1973:1–1995:3 (see Table 3). One striking finding is that all four variables are

[15] However, the results are not sensitive to the exact choice of instruments.

[16] The borrowing/lending wedge is measured here by the spread between the prime rate and the three-month Treasury bill rate. The results using the wedge between the prime and the time deposit rate are similar.

Table 2
IV estimates of $\Delta c_t = \alpha + \beta \Delta x_t + \varepsilon_t$ for United States, 1970:1–1995:3

Income	Mortgage credit	Consumer credit	Wedge	$\bar{R}^2$
0.309*** (0.069)				16.9
	0.144** (0.058)			10.0
		0.106*** (0.032)		11.8
			− 1.269*** (0.265)	14.3
0.283*** (0.071)	0.110* (0.049)			23.4
0.243*** (0.078)		0.077*** (0.029)		26.5
0.177** (0.072)			− 1.031*** (0.233)	31.6
0.133* (0.076)	0.137*** (0.045)		− 1.114*** (0.249)	34.8
0.112 (0.076)		0.076*** (0.025)	− 1.025*** (0.226)	36.5

Note: Newey–West standard errors in parentheses, assuming MA(1) errors.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Consumption and disposable income are in quarterly differences, while the other variables are in four-quarter differences. The instruments are lags two to four of changes in disposable income, consumption, mortgage credit, consumer credit, the spread between ten-year and three-month interest rates, the wedge and the consumption/income ratio lagged twice.

significant at the 1% level when considered individually. However, as judged by the $\bar{R}^2$, there are considerable variations in explanatory power: consumer credit appears quite important while the wedge and disposable income seem to matter less. When income is included together with either credit variable or the wedge, it is always significant, as are consumer credit and the wedge. Finally, we re-estimate the equation using income, one of the credit aggregates and the wedge. The results indicate that the wedge is always significant at the 10% level. When mortgage credit is included, it is insignificant while income remains significant. However, when consumer credit is used, it is significant while income is not. Overall, the results indicate that variables that are likely to be correlated with the severity of credit constraints also affect consumption in Canada.

Table 3
IV estimates of $\Delta c_t = \alpha + \boldsymbol{\beta}\Delta \boldsymbol{x}_t + \varepsilon_t$ for Canada, 1973:1–1995:3

Income	Mortgage credit	Consumer credit	Wedge	$\bar{R}^2$
0.349***				2.9
(0.070)				
	0.164***			14.4
	(0.048)			
		0.210***		22.4
		(0.046)		
			−0.884***	2.8
			(0.312)	
0.252***	0.099			19.1
(0.097)	(0.064)			
0.166*		0.156**		29.3
(0.097)		(0.061)		
0.305***			−0.578*	6.4
(0.078)			(0.308)	
0.230**	0.084		−0.471*	18.9
(0.099)	(0.066)		(0.285)	
0.144		0.145**	−0.467*	28.7
(0.095)		(0.062)	(0.260)	

Note: Newey–West standard errors in parentheses, assuming MA(1) errors.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Consumption and disposable income are in quarterly differences, while the other variables are in four-quarter differences. The instruments are lags two to four of changes in disposable income, consumption, mortgage credit, consumer credit, the short-term interest rate, the spread between ten-year and three-month interest rates, the wedge and the consumption/income ratio lagged twice.

United Kingdom. The results for the United Kingdom are presented in Table 4 and are based on the estimation period 1977:2–1995:3. A major difference compared with the previous two countries is that the borrowing/lending wedge is never significant. On the other hand, the ES of consumption to income and to the two credit aggregates are significant when considered individually. When we estimate the equation using income and either of the two credit series, the credit aggregates remain significant, but the significance of the income coefficient falls or disappears. In sum, consumption also displays ES to credit also in the United Kingdom. Indeed, consumption growth seems to be more strongly associated with credit growth than income growth.

Japan. Table 5 contains the results for Japan, estimated using data for the period 1977:2–1995:1. We first estimate the ES of consumption to income and

Table 4
IV estimates of $\Delta c_t = \alpha + \boldsymbol{\beta}\Delta \boldsymbol{x}_t + \varepsilon_t$ for United Kingdom, 1977:2–1995:3

Income	Mortgage credit	Consumer credit	Wedge	$\bar{R}^2$
0.244**				1.4
(0.104)				
	0.204***			16.1
	(0.061)			
		0.214***		19.9
		(0.051)		
			0.043	0.0
			(0.659)	
0.182*	0.153***			14.9
(0.100)	(0.060)			
0.116		0.174***		19.3
(0.107)		(0.050)		
0.248**			−0.232	0.0
(0.109)			(0.726)	
0.178	0.154**		0.025	14.0
(0.109)	(0.063)		(0.605)	
0.116		0.174***	−0.010	18.1
(0.113)		(0.051)	(0.632)	

Note: Newey West standard errors in parentheses, assuming MA(1) errors.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Consumption and disposable income are in quarterly differences, while the other variables are in four-quarter differences. The instruments are lags two to four of changes in disposable income, consumption, mortgage credit, consumer credit, the short-term interest rate, the spread between ten-year and three-month interest rates, the wedge and the consumption/income ratio lagged twice.

obtain an insignificant parameter.[17] Re-estimating the equation using mortgage credit as a regressor, we find the ES parameter to be positive and significant at the 1%. The significance of the ES parameter falls somewhat, but the size of the parameter falls considerably if consumer credit is employed instead of mortgage credit. Using the wedge results in a negative, but insignificant, excess sensitivity.

Including income as a second regressor and re-estimating the equation we find that mortgage credit remains significant at the 1% level, while consumer credit is now significant at the 10% level. The borrowing/lending wedge remains negative, but insignificant. However, if the equation is estimated using income,

[17] In interpreting this finding, it should be recalled that income growth is very poorly correlated with the instruments.

Table 5
IV estimates of $\Delta c_t = \alpha + \boldsymbol{\beta}\Delta \boldsymbol{x}_t + \varepsilon_t$ for Japan, 1977:2–1995:1

Income	Mortgage credit	Consumer credit	Wedge	$\bar{R}^2$
− 0.017 (0.106)				− 3.1
	0.158*** (0.057)			7.5
		0.030** (0.015)		2.7
			− 0.634 (0.491)	0.9
− 0.049 (0.108)	0.162*** (0.061)			0.8
− 0.063 (0.118)		0.033* (0.017)		− 5.7
− 0.000 (0.113)			− 0.634 (0.546)	− 0.6
− 0.026 (0.076)	0.184*** (0.059)		− 1.016* (0.528)	6.3
− 0.046 (0.118)		0.045*** (0.017)	− 1.216*** (0.433)	0.4

Note: Newey–West standard errors in parentheses, assuming MA(1) errors.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Consumption and disposable income are in quarterly differences, while the other variables are in four-quarter differences. The instruments are lags two to four of changes in disposable income, consumption, mortgage credit, consumer credit, the spread between ten-year and three-month interest rates, the wedge and the consumption/income ratio lagged twice.

either credit aggregate and the wedge, the credit variables are always significant at the 1% level while income is insignificant. The wedge is also significant – at the 10% level if mortgage credit is used and at the 1% level if consumer credit is employed – in these regressions. The Japanese data thus also suggest that measures of the tightness of credit conditions are strongly correlated with future consumption growth.

France. Finally, in Table 6 we consider the results for France, which are obtained using data for the 1980:1–1995:3 period. As for the United Kingdom, the wedge is never significant. On the other hand, when the equation is estimated using income or either credit variable, the excess sensitivity is always significant at the 5% level and positive. Re-estimating the equation using both

Table 6
IV estimates of $\Delta c_t = \alpha + \boldsymbol{\beta}\Delta \boldsymbol{x}_t + \varepsilon_t$ for France, 1980:1–1995:3

Income	Mortgage credit	Consumer credit	Wedge	$\bar{R}^2$
0.266**				−1.1
(0.116)				
	0.190**			4.7
	(0.078)			
		0.045**		3.4
		(0.020)		
			0.181	0.5
			(0.227)	
0.243**	0.167**			3.4
(0.118)	(0.076)			
0.248**		0.041**		2.3
(0.113)		(0.018)		
0.263**			0.167	−1.3
(0.118)			(0.216)	
0.243**	0.159***		0.059	2.1
(0.118)	(0.073)		(0.213)	
0.246**		0.040**	0.147	1.8
(0.115)		(0.018)	(0.194)	

Note: Newey–West standard errors in parentheses, assuming MA(1) errors.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Consumption and disposable income are in quarterly differences, while the other variables are in four-quarter differences. The instruments are lags two to four of changes in disposable income, consumption, mortgage credit, consumer credit, the wedge and the consumption/income ratio lagged twice.

income and one of the credit variables, we find that these variables remain significant at the 5% level.

3.3. Discussion

Several aspects of these results are noteworthy. First, consumption consistently displays ES to credit growth. There does not appear to be a systematic difference between the significance of consumer credit and mortgage credit. Secondly, when income and credit are both incorporated in the regressions, the presence of credit reduces the estimated ES of consumption to income and often renders it insignificant. Thirdly, the borrowing/lending wedge is significant in the United States, Canada and (less so) Japan. These results are supportive of the notion that changes in credit conditions have important effects on consumption.

In interpreting the results, it should be kept in mind that credit growth and the wedge should be viewed as proxies for the severity of credit constraints. One potential problem with this strategy is that the positive correlation between consumption and aggregate credit may stem uniquely from borrowing undertaken by financially unconstrained households in advance of expected income increases, rather than from shifts in credit availability as hypothesized. While we have used instrumental variables techniques to overcome this endogeneity of credit, the validity of the instruments can always be questioned. Here we briefly review this issue.

As a preliminary, note that if the correlation between credit and consumption stemmed largely from borrowing by unconstrained households, one would not expect the borrowing/lending wedge to be negatively related to consumption. The finding that it is so in the United States, Canada and Japan, despite the fact that it is likely to suffer from measurement error, provides support to the hypothesis of credit-constrained consumers.

To get a firmer view of the sources of this correlation, we need to know whether slow credit growth is due to an unwillingness of lenders to extend credit, or to the unwillingness of borrowers to increase their debt. Some information on the willingness of lenders to extend credit is available in the case of the United States in the Federal Reserve's Senior Loan Officer Survey.[18] While this information is limited to the United States, this country is a particularly interesting case for two reasons. First, it is the only country where consumption leads (consumer) credit. Secondly, financial liberalization came much earlier to the United States than to most of the other countries in the study, so that it is less clear that the variation of credit growth over time stems from changes on the supply side of the credit market.

To assess the usefulness of the survey, we first performed Granger causality tests on consumption, income, either of the two credit aggregates and the survey.[19] Several findings are of interest. First, consumption does not predict future movements in the survey responses. This finding – which is notable in the light of our earlier one that consumption leads consumer credit in systems comprising consumption, income and credit – suggests that the survey contains information about credit availability, rather than credit demand.[20] Secondly,

[18] The survey, entitled the 'Senior Loan Officer Opinion Survey on Bank Lending Practices', is conducted by the Division of Monetary Affairs at the Board of Governors of the Federal Reserve System. We use the 'net percentage of domestic respondents indicating more willingness to make consumer installment loans' in the empirical work below. Duca and Garrett (1995) model econometrically the determination of the survey responses and find that the survey reflects shifts in banks' willingness to lend, rather than changes in the demand for credit. Furthermore, they show that the survey responses are significantly related to three measures of the stance of monetary policy.

[19] See McCarthy (1996) for a discussion of the relationship between the survey responses and consumption spending.

[20] See also Hamdani et al. (1994).

the survey does not lead income; the hypothesis that the survey is a proxy for changes in expected future income is thus not likely to be correct. Thirdly, the survey predicts future growth of consumer and mortgage credit, which implies that the survey can be usefully included in the z_t vector to predict credit growth. These findings are compatible with the hypothesis that the survey captures shifts in lenders' willingness to provide credit, but are difficult to reconcile with the notion that changes in the survey responses largely stem from movements in the demand for credit from unconstrained households.

Since the validity of the instruments used in the regressions reported in Table 2 can be questioned, we re-estimated Eq. (5) using solely lagged values of the survey responses and the borrowing/lending wedge as instruments (see Table 7). A comparison of Table 7 with Table 2 shows that the estimates using the survey and the wedge as instruments are very similar. The only exception is the estimates of the ES to income when additional explanatory variables are incorporated in the equation: the results indicate that the income variable is frequently insignificant.[21]

To explore further the information in the Senior Loan Officer Survey data, note that if it is an indicator of credit conditions, it could also be included in the x_t vector in Eq. (5). Table 8 presents the results when the survey variable is included in the regression. This variable is significant both with and without income changes. It becomes less significant when the wedge is included.

Of course, it is difficult to generalize these results for the other countries in our sample. However, it is encouraging to note that the results incorporating the survey support our earlier findings for the United States.[22]

4. Time-varying coefficient estimates

The econometric analysis above indicates that expected future income, credit growth and the wedge predict consumption, which is consistent with the hypothesis that liquidity constraints play an important role in determining consumption. Next we turn to a second potential implication of liquidity constraints, namely that the ES is likely to vary over time. We first describe our methodology and then present the results.

In the existing literature, three main strategies have been used to model the possible time variation in β. The most common of these involves estimating the

[21] This simply reflects the fact that the survey and the wedge are poor instruments for income.

[22] Another extension we considered is adding a consumer confidence index in the x_t vector to estimate the equations of Table 2. However, our results were not significantly affected by its presence in the regressions. This contradicts Carroll and Dunn (1997), who argue that the evolution credit variables may mainly reflect consumer sentiment.

Table 7
IV estimates of $\Delta c_t = \alpha + \boldsymbol{\beta}\Delta \boldsymbol{x}_t + \varepsilon_t$ (with the Senior Loan Officer Survey and the wedge as instruments) for United States, 1970:1–1995:3

Income	Mortgage credit	Consumer credit	Wedge	$\bar{R}^2$
0.269**				20.6
(0.124)				
	0.256***			9.3
	(0.090)			
		0.126***		11.5
		(0.047)		
			− 0.985***	18.0
			(0.328)	
0.003	0.255**			9.1
(0.152)	(0.107)			
0.003		0.126**		11.3
(0.169)		(0.054)		
0.187*			− 0.906***	33.1
(0.106)			(0.240)	
− 0.047	0.232**		− 0.822***	16.3
(0.144)	(0.093)		(0.316)	
− 0.047		0.114**	− 0.823***	18.8
(0.158)		(0.047)	(0.323)	

Note: Newey–West standard errors in parentheses, assuming MA(1) errors.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Consumption and disposable income are in quarterly differences, while the credit variables are in four-quarter differences. The instruments are lags two to four of the survey variable in levels and of changes in the wedge.

consumption function over subsamples, normally a decade, and letting the ES vary between subsamples; the second strategy allows the ES to follow a deterministic trend; and the third strategy estimates the ES using rolling regressions (see Section 2.2 for references). While the results differ across studies, they broadly suggest that the degree of ES has evolved over time in important ways.

However, while the three strategies may provide useful information, there are reasons to doubt their ability to capture the time series behavior of the ES. For example, the subsample estimates assume that the ES follows a step function with known transition dates. This is clearly implausible. Furthermore, the estimates incorporating a deterministic time trend assume that the ES is shifting at a constant rate. This assumption is difficult to reconcile with the notion that the ES could increase temporarily – for instance, in response to tight monetary policy – and with the fact that financial deregulation is often not gradual.

Table 8
IV estimates of $\Delta c_t = \alpha + \boldsymbol{\beta}\Delta \boldsymbol{x}_t + \varepsilon_t$ for united States, 1970:1–1995:3

SLO survey	Income	Wedge	$\bar{R}^2$
0.013***			13.6
(0.003)			
0.016**	− 0.193		− 42.8
(0.007)	(0.193)		
0.013*	− 0.131	− 0.330	− 16.1
(0.007)	(0.208)	(0.419)	

Note: Newey–West standard errors in parentheses, assuming MA(1) errors.
***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Consumption and disposable income are in quarterly differences, the wedge between banks' prime lending and three-month Treasury bill rates is in four-quarter differences, and the Senior Loan Officer Survey variable is in levels. The instruments are lags two to four of the survey variable and of changes in the wedge.

Finally, the rolling regression approach, which assumes, paradoxically, that the parameter is constant in the estimation 'window', but nevertheless moving over time, seems unlikely to capture short-lived fluctuation in the ES. In this section, we use time-varying coefficient techniques to estimate consumption functions of the Campbell and Mankiw type. Somewhat surprisingly, with the exception of McKiernan (1996), such methods have apparently not been used to study the question in hand.

4.1. Estimation strategy

The objective in this section is to estimate Eq. (4). For simplicity, we consider only a single $\boldsymbol{x}_t$ variable at a time so that $\boldsymbol{\beta}_t$ and $\Delta \boldsymbol{x}_t$ are scalars (β_t and Δx_t):

$$\Delta c_t = \alpha_t + \beta_t E_{t-1}\Delta x_t + \varepsilon_t. \tag{7}$$

A natural way to allow the ES to vary over time is to posit a time series model for β_t and to estimate it using Kalman filtering techniques. We assume that α_t and β_t obey independent random walks, that is

$$\alpha_t = \alpha_{t-1} + \upsilon_t^{\alpha} \tag{8}$$

and

$$\beta_t = \beta_{t-1} + \upsilon_t^{\beta}, \tag{9}$$

where υ_t^{α} and υ_t^{β} are independent Gaussian random variables. The standard Kalman filtering approach is not directly applicable to the system (Eqs. (7)–(9)) since $E_{t-1}\Delta x_t$, which is unknown and has to be estimated, enters in Eq. (7). We proceed as in the constant coefficient case and assume a prediction

equation for Δx_t:[23]

$$\Delta x_t = \gamma z_t + \eta_t, \tag{10}$$

where γ is a vector of coefficients. Taking expectations of both sides of Eq. (10), and using Eq. (7), we have

$$\Delta c_t = \alpha_t + \beta_t \gamma z_t + \varepsilon_t. \tag{11}$$

Our strategy is to estimate the system of Eqs. (10) and (11) jointly. Since γ is unknown and is estimated along with α_t and β_t, the system is non-linear in the parameters and we therefore use non-linear filtering to estimate the model. This approach applies a version of the Kalman filter to a linearized version of the model.[24] There are two potential drawbacks with this approach. First, the estimation of a system of equations is usually more sensitive to misspecification. In particular, the lack of good instruments for some variables (a misspecification of Eq. (10)) may imply a serious bias in the estimate of β_t. The second drawback is that the filter is only approximate and suboptimal, and that little is known about its properties in samples of the size we use here.[25]

4.2. Estimates

Now we turn to the estimates. We start by reviewing the results for the United States and then consider the other countries.

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[23] This assumption attributes the time variation solely to changes in the parameters in Eq. (7), and not to changes in the ability of the instruments to predict Δx_t. Of course, an alternative approach would also allow γ to vary over time.

[24] See Harvey (1989) for a discussion of non-linear filtering and Chow (1983) for the estimation of more general systems of equations with time-varying parameters. To estimate the model, we write the state vector, Θ_t, as $[\alpha_t \ \beta_t \ \gamma]'$, with innovations given by $[v_t^{\pi} \ v_t^{\beta} \ \mathbf{0}]'$. The matrix of derivatives (equation (3.7.12b) on page 161 in Harvey (1989)) is then given by

$$\begin{bmatrix} 1 & \gamma_{t|t-1} z_t' & \beta_{t|t-1} z_t' \\ 0 & 0 & z_t' \end{bmatrix}$$

(recall that $\beta_{t|t-1}$ is a scalar). We initialize the filter by assuming that the initial state, Θ_0, is random and that its covariance matrix equals κI, where $\kappa \to \infty$. Since the model is non-linear in the parameters and the accuracy of the approximations depends on how far from the true parameters we are, we use OLS estimates of γ and IV estimates of α and β to form Θ_0. Furthermore, we use the residuals from these regressions to form an estimate of $E(\varepsilon_t \ \eta_t)$. The estimates of β_t are computed using a fixed interval smoother, that is, we plot $\beta_{t|T}$.

[25] An alternative strategy is to estimate β_t using the fitted value of Δx_t in a way analogous to the two-step IV estimation procedure. In the first step, Δx_t is regressed on the instruments (Eq. (10)) and, in the second step, Kalman filtering is used to study the relationship between the change in consumption and $\Delta \hat{x}_t = \hat{\gamma} z_t$, using Eqs. (8) and (9). This strategy, however, neglects the fact that γ is not known with certainty. This approach was adopted by McKiernan (1996), who assumes that $\beta_t = \beta + \rho(\beta_{t-1} - \beta)$. We tried to estimate this model, but failed to replicate McKiernan's findings.

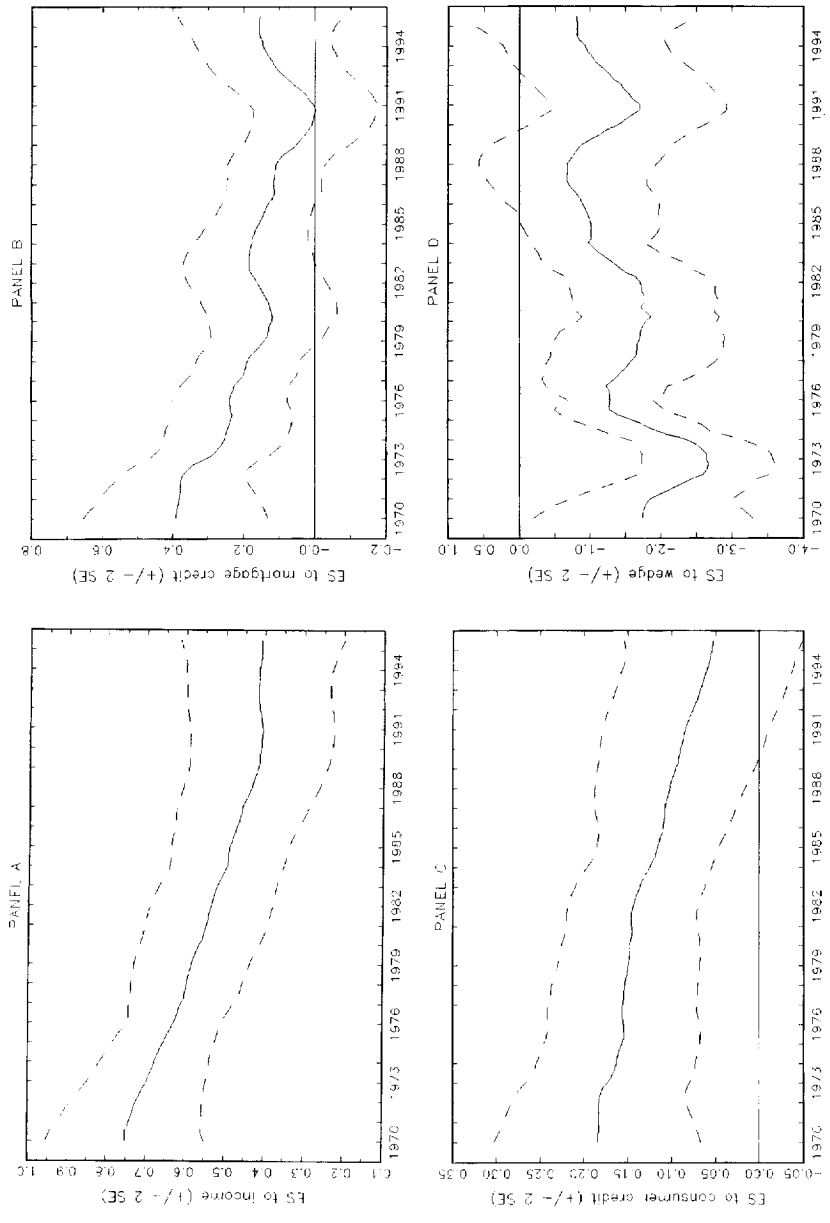

Fig. 3. United States – Time-varying coefficients.

United States. Panel A of Fig. 3 contains the smoothed estimates of the ES of consumption to income, together with a plus/minus two standard errors confidence band. The estimate indicates that the ES fell gradually over the sample from about 0.75 in the early 1970s to about 0.4 in the early 1990s. While there is a significant decline in the ES parameter, its value is consistently higher than with constant coefficient estimation (0.3 in Table 2). However, this is the only case where the difference between the time-varying coefficients estimates and the constant coefficient estimates is large.

Panel B of Fig. 3 contains the results for mortgage credit. As can be seen, the ES has in this case also gradually declined over time. However, the parameter becomes insignificant (at the 5% level) after the late 1970s. A similar decline is observed for the ES to consumer credit in Panel C, but the coefficient remains significant throughout the estimation period.

The results for the ES to the wedge in Panel D are perhaps the most interesting. First, the ES is significant except for a brief period in the late 1980s and since 1993. Secondly, while the ES tends to become less important over time (that it, it rises towards zero), it increases in absolute value in periods of weak economic activity. Thus, the period around the first oil shock in 1973, the 1979–82 period, and the 1990–92 period are all characterized by an increased sensitivity of consumption to the spread.

Overall, these results for the United States suggest that the ES has indeed varied over time as frequently hypothesized.

United Kingdom. Fig. 4 provides the results for the United Kingdom.[26] The estimates in Panel A indicate that the ES to income rose in the first part of the sample and reached about 0.5 in 1987, falling modestly since then. It is also significant during most of the sample period. While this finding is striking, a number of authors have found evidence that the ES has risen over time in the United Kingdom (e.g. Muellbauer and Lattimore, 1995). The ES to mortgage credit, in Panel B, also peaked in the 1986–87 period, and has since declined. The time-path for the ES to consumer credit rose until 1986–87, and fell thereafter. Finally, the results for the wedge in Panel D do not reveal any evidence that it affects consumption.

The time pattern of the ES to income and credit in the United Kingdom may appear surprising, as an increase is observed in the period of faster financial liberalization. One possible explanation is that the liberalization process substantially increased the level of desired consumption by relaxing borrowing constraints. In the adjustment period, consumption grows faster than usual,

[26] For the United Kingdom and Canada, we experienced convergence problems and had to relax the convergence criterion.

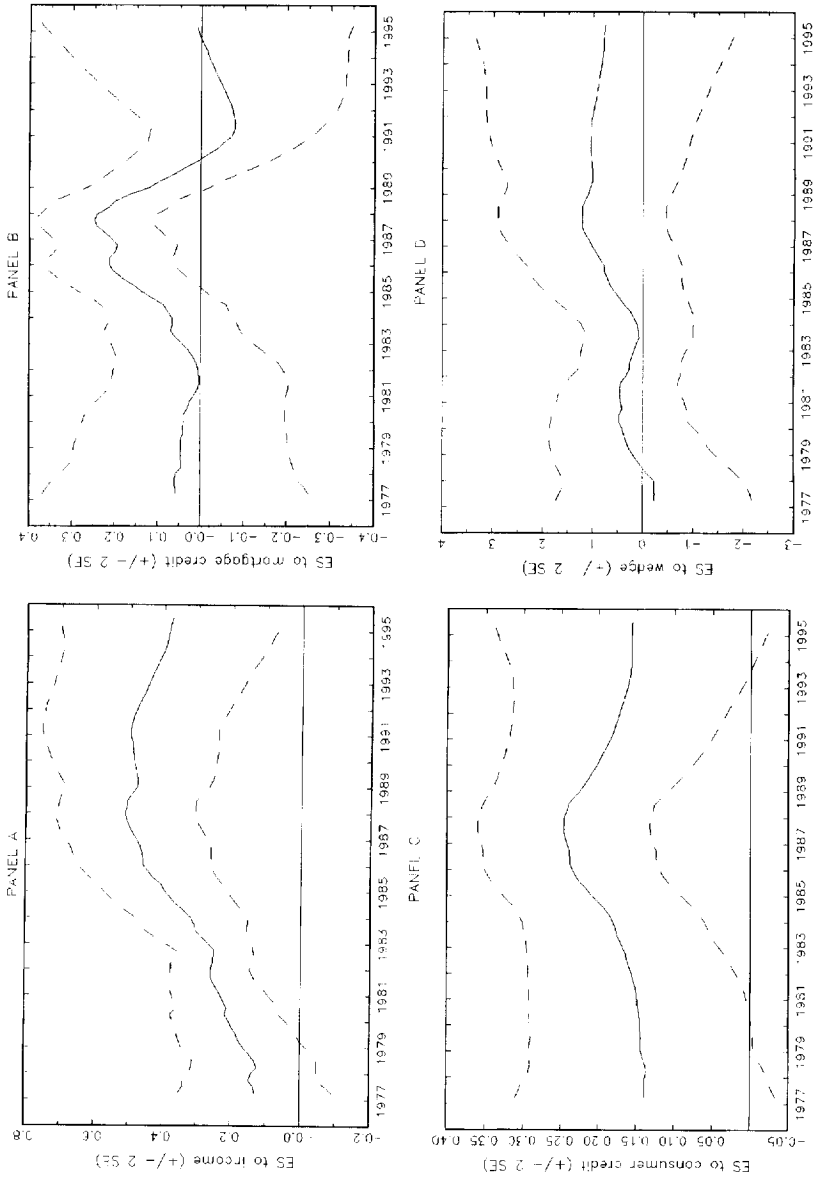

Fig. 4. United Kingdom – Time-varying coefficients.

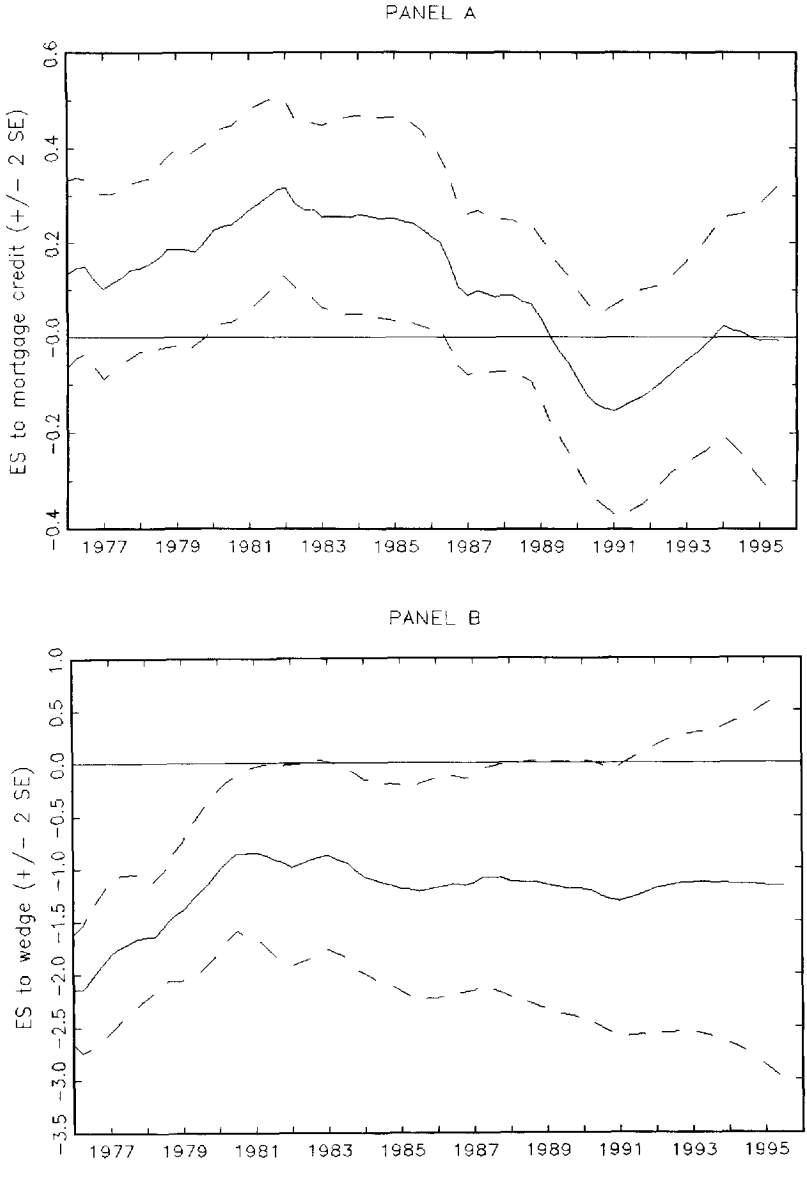

Fig. 5. Canada – Time-varying coefficients.

potentially leading to an increase in the ES (see Antzoulatos (1994) for an analysis of this issue).

Turning to the other countries, the estimated ES are either insignificant or do not suggest any time variation in β_t, and we therefore do not present them here. The two exceptions are the ES with respect to mortgage credit and the wedge in Canada, which are plotted in Fig. 5. Panel A shows that the ES to mortgage credit has varied over time, but that it has generally been insignificant, except in the first half of the 1980s. In contrast, the ES to the wedge has typically been significant, and decreased in absolute value between 1973 and the early 1980s, since when it has been broadly constant.

5. Conclusions

The cross-country empirical evidence presented in this paper provides considerable support for the hypothesis that credit constraints have influenced aggregate consumption in the countries we study. We stress three aspects of the results. First, the ability of credit to predict consumption is considerable in all five countries examined and is often stronger than that of income. This result is striking given that aggregate credit is only a proxy for credit to liquidity-constrained consumers. Secondly, while borrowing/lending wedges are likely to be subject to measurement error, they are significant in the United States, Canada and, to some extent, Japan.[27] This suggests that credit restrictions are reflected in the cost of borrowing. Thirdly, the evolution of the ES of consumption over time is consistent with the notion that financial deregulation has affected the determination of aggregate consumption. It is interesting to note that the ES declines consistently solely in the United States, which arguably is the country where financial deregulation has proceeded the furthest. In interpreting this decline, it should be kept in mind, as the results for the United Kingdom illustrate, that financial liberalization does not necessarily reduce the ES of consumption, in particular in the short run.

To gain a firmer understanding of the impact of financial factors on consumption, it would be of interest to extend the empirical analysis in various directions. In this paper, we have focused on consumption of non-durables and services, but durables and housing expenditure also deserve attention. An examination of the importance of other financial variables, including asset prices reflecting collateral values, would also be desirable. Moreover, it would be worthwhile to use microeconomic data to examine the evidence at the consumer level. Finally,

[27] A potential explanation for why the wedge had no impact in the United Kingdom or France may be that the measures of the wedge we used for these countries are poorer proxy variables for the true (unobserved) wedge than those used in the other countries.

further research is needed to determine to what extent our findings are due to the episodes of financial liberalization that the economies in our sample underwent in the estimation period.

The evidence presented in this paper is potentially important for monetary policy-makers. First, credit variables are shown to be useful predictors of future consumption. Secondly, Hall (1978) in his seminal contribution concluded that "... policy affects consumption only as much as it affects permanent income". Our results lead us to believe that this view is incorrect, and that monetary policy could exert powerful effects on consumption by affecting credit. This is obviously the case for direct credit controls,[28] but may well also be true for more traditional monetary policy measures.[29]

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Appendix A. Data appendix

All data, except where noted, are from national sources and were taken from the BIS database.

Consumption and income data. Consumption is measured by real consumption expenditure by households on services and non-durable goods in the domestic market. Income is measured by household or personal disposable income, which has been rendered real by using the consumption deflator. Source: OECD National Accounts, Volume II.

[28] The experience of credit controls in the United States in the Spring of 1980 with the subsequent decline in consumption is a good illustration.

[29] See Bernanke and Gertler (1995) for a discussion of monetary policy, credit and consumption.

Interest rates. Short-term interest rates all have a maturity of three months. Canada: prime corporate paper; France: Paris interbank offered rate; Japan: repos on bonds (Gensaki); United Kingdom: interbank deposits; United States: Treasury bills.

Long-term interest rates are of varying maturity. Canada: government bonds with a maturity over ten years; France: public and semi-public sector bonds; Japan, the United Kingdom and the United States: ten-year government bonds.

Borrowing/lending wedge. Canada: bank prime lending rate minus 90-day time deposits; France: base rate for bank loans minus rate on savings book deposits at savings banks; Japan: bank prime rate on short-term loans minus interest rates on short-term government securities (60 days); United Kingdom: bank base rate minus 91-day Treasury bill allotment rate; United States: bank prime lending rate minus three-month Treasury-bill rate.

Credit. All credit aggregates have been rendered real using the consumption deflator for non-durables and services.

Consumer credit. Canada: total consumer credit; France: credits to individuals; Japan: total outstanding consumer credit by 'all banks' (including trust accounts), Sogo and Shinkin banks; United Kingdom: consumer credit and other personal sector borrowing; United States: credit market debt owed by the private domestic non-financial sector, consumer credit.

Mortgage credit. Canada: total residential mortgage credit; France: housing credit; Japan: total outstanding housing credit; United Kingdom: loans for house purchases; United States: credit market debt owed by the private domestic non-financial sector, mortgage credit.

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