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Explaining Household Saving Rates in G7 Countries: Implications for Germany

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ABSTRACT/RÉSUMÉ

Explaining household saving rates in G7 countries: implications for Germany

Many propositions have been made to explain the increase in the German household saving rate since the year 2000 from an individual country perspective but most of them focus on partial aspects. This paper adds to the discussion by analysing whether factors common to other industrial countries help to explain the behaviour of the German household saving rate. We analyse the determinants of household saving rates in the G7 countries since the 1970s in a panel co-integration framework. Unlike many previous studies, our specification allows for heterogeneity in the long- and short-run parameters across countries and explicitly distinguishes between financial liberalisation effects and wealth effects. Apart from finding that income developments as well as real interest rates and inflation are influencing household savings in most countries, results suggest that wealth effects through house and stock prices play a role in many countries, notably over the more recent period. According to the model, the recent increase in the German saving rate is due to two factors: *Firstly*, the actual saving rate was below its estimated equilibrium level at the end of the 1990s, implying an upward correction over the medium term. *Secondly*, the equilibrium saving rate has moved upwards in the first half of the 2000s, largely because of declines in stock prices.

JEL classification: E21; C33
Keywords: Household saving rate; panel co-integration; wealth effects

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Expliquer les taux d'épargne des ménages dans les pays du G7 : implications pour l'Allemagne

Plusieurs propositions ont été faites pour expliquer l'augmentation du taux d'épargne des ménages allemands depuis l'année 2000 à partir d'un point de vue du pays individuel mais la plupart se focalisent sur des aspects partiels. Ce papier étoffe la discussion en analysant si des facteurs communs à d'autres pays industrialisés aident à expliquer le comportement du taux d'épargne des ménages allemands. Nous analysons les déterminants du taux d'épargne des ménages dans les pays du G7 depuis les années 70 à l'aide du système de cointégration de panel. Contrairement à de nombreuses études précédentes, notre spécification permet d'hétérogénéité des paramètres à long et court terme entre les pays et fait explicitement la distinction entre les effets de la libéralisation financière et les effets de richesse. En plus de conclure que l'évolution des revenus ainsi que des taux d'intérêt réels et de l'inflation influent sur l'épargne des ménages dans la plupart des pays, les résultats suggèrent que les effets de richesse à travers les prix immobiliers et les prix des actions jouent un rôle dans de nombreux pays, notamment au cours de la période plus récente. Selon le modèle, deux facteurs expliquent l'augmentation récente du taux d'épargne allemande : *premièrement*, le taux d'épargne réel a été en-dessous de son niveau d'équilibre estimé à la fin des années 90, ce qui implique une correction à la hausse sur le moyen terme. *Deuxièmement*, l'équilibre du taux d'épargne s'est déplacé vers le haut dans la première moitié des années 2000, essentiellement en raison de la baisse des prix des actions.

Classification JEL ; E21 ; C33
Mots clés : Taux d'épargne des ménages ; cointégration en panel ; effets de richesse

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EXPLAINING HOUSEHOLD SAVING RATES IN G7 COUNTRIES: IMPLICATIONS FOR GERMANY

by
Felix Hüfner and Isabell Koske[1]

Introduction

1. In contrast to many other countries – as well as to past developments – German private consumption has remained flat since around the year 2000, notwithstanding changes in the business cycle over time. While low real income growth contributed to this development, it was also due to a continuous increase in the household saving rate from 9.2% in 2000 to around 11½ per cent in 2008. This outcome surprised many forecasters and different propositions have been made regarding the causes of this increase.

2. So far, the explanations focus primarily on country-specific factors. Bartzsch (2006) presents evidence for a precautionary saving motive in an analysis of German micro-data. His results suggest that households with higher income uncertainty (measured as the variation of income) tend to save more. In this regard, the rising saving rate could mirror the significant increase in unemployment and thus income risk, at least until 2005. Also, the labour market reforms from 2002 onwards which arguably made the labour market more flexible, but also cut benefit levels for many, may have raised job and income uncertainty.2 Another argument relates to the widening of the income distribution since 2000. DIW (2006) estimates that the widening income distribution may have raised the saving rate by between 0.3 and 0.6 percentage points. It has also been suggested that reductions in pension entitlements through reforms of the pension system (such as raising the retirement age from 2006 onwards or the introduction of a sustainability factor in the pension indexation formula in 2005) have contributed to saving by households (Deutsche Bundesbank, 2007).[3] This may reflect both a retirement saving motive (adjusting to a known lower new pension benefit level) as well as a precautionary motive driven by the uncertainty of further reforms. Although this rather calls for a one-off increase in the saving level, the observed continuous rise may still be in line with a gradual adjustment process.

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1. Senior Economists in the Economics Department. We are grateful for helpful comments by Andreas Wörgötter, Nigel Pain and participants of an internal OECD Economics Department seminar. We also thank Kai Carstensen (ifo Institute) as well as Elmar Stöss, Britta Hamburg and Bernhard Manzke (Deutsche Bundesbank) for comments on an earlier version.

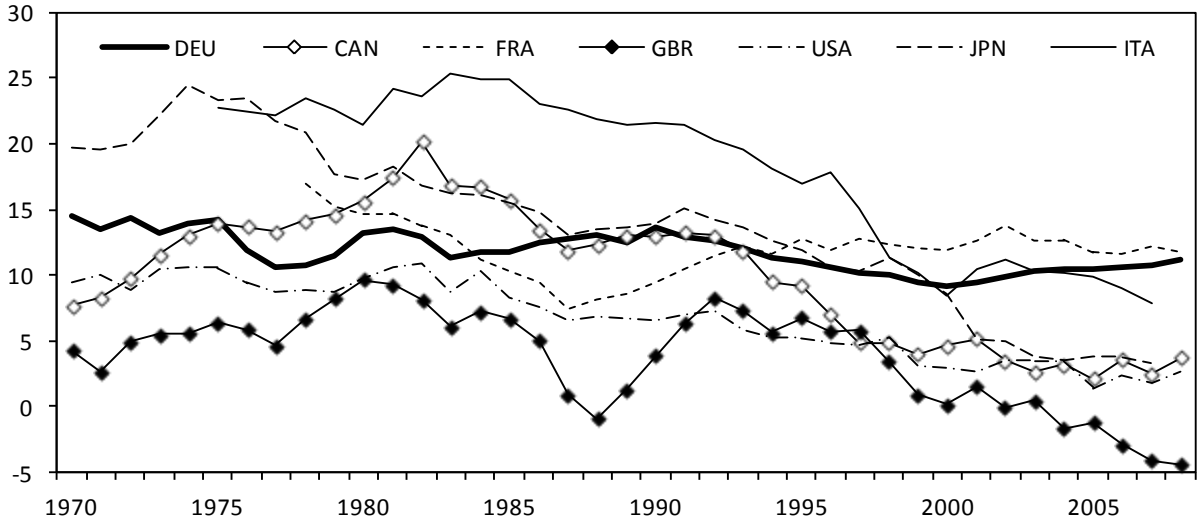
2. At the same time, recipients of the new unemployment benefit II (which merged the previous social assistance and unemployment assistance benefits) have to spend parts of their savings prior to receiving the benefit, which should have a decreasing effect on the aggregate saving rate.

3. From 2006 onwards the age threshold for the early pension for unemployed (*Altersrente wegen Arbeitslosigkeit*) was increased gradually. In 2007 it was decided to raise the statutory retirement age gradually from 65 to 67 years starting in 2012 The sustainability factor was included in the benefit indexation formula to account for changes in the relative number of contributors to pensioners

3. Another explanation for the increase in the saving rate has been the introduction of new subsidies and tax incentives for private pensions (the so-called 'Riesterrente'). A rise in household saving could be related to higher opportunity costs of consumption today given the subsidization of this form of retirement saving. Logeay *et al.* (2009) find that a time trend starting in 2001 has a significant impact on the savings rate and interpret this as evidence for an impact of the subsidized private pension. By contrast, Corneo *et al.* (2009) find that this scheme has not raised the saving ratio for low-income recipients, suggesting that households rather substitute their previous saving by the subsidized one. Börsch-Supan *et al.* (2006) also find evidence for such substitution effects.[4] Finally, wealth effects are mentioned as one factor contributing to the rise in household savings, notably the decline of stock prices in the first years of this decade as well as the continuous decline in real house prices. The decline in stock prices in the period 2000 to 2002 amounted to a reduction in household's holdings of financial assets by € 200 bn or one-seventh of disposable income (Deutsche Bundesbank, 2007).[5] Logeay *et al.* (2009) find a significantly negative impact of movements in the German stock market index on the household saving rate.

Figure 1. Development of household saving ratios in the G7 economies

1961-2006



4. While each of the aforementioned factors may play a role in the decision-making process of individual households, so far no coherent framework has been presented that is able to empirically explain not only the recent increase in the saving rate but is able to provide a satisfying fit over a long time period. To fill this gap, this paper addresses the issue from a cross-country perspective. Analyzing the German saving rate simultaneously with those of other G7 countries might yield important insights in understanding the behaviour of German households. As Figure 1 shows, notwithstanding the increase since the year 2000, the behaviour of the German saving rate is substantially less volatile than the average G7 country. This may be explained by the particular stability of saving rates across age cohorts which Börsch-Supan *et al.* (2001) call the 'German savings puzzle' due to its apparent contrast to other countries.

4. In a sample of 150 countries, Samwick (2000) does not find evidence for the hypothesis that moving from a pure defined-benefit pension system to a system based more on defined contributions is associated with higher saving rates.

5. However, the stock of financial holdings declined only in the year 2002; in all other years, the valuation declines did not fully offset the additional saving by households.

5. We determine drivers of household saving rates over time across the G7 countries to explain the behaviour of German household savings, in particular their recent increase. We extend the traditional approaches based on the life-cycle hypothesis by explicitly testing for the relevance of wealth effects, notably by including house and stock prices in the estimation as well as by using a different proxy for financial liberalisation which allows us to more clearly distinguish wealth from financial liberalisation effects. From a methodological point of view, our approach explicitly allows for cross-country heterogeneity in the slope coefficients thereby accounting for the fact that homogeneity of coefficients across countries is usually statistically rejected. Our results suggest that wealth effects through stock prices as well as income and interest rate developments are important drivers of German households' saving decisions. They also indicate that the actual saving rate was below its estimated equilibrium value at the beginning of the decade, requiring an upward adjustment. In addition, the equilibrium value of the saving rate has increased since 2000, mostly on account of falling stock prices in the first years of the decade and lower real interest rates.

6. The rest of the paper is organized as follows. The next section provides a brief overview on the existing empirical literature on saving rates. The following section then presents the empirical analysis. It first briefly discusses some data issues and the empirical strategy and then presents the panel estimation results and draws conclusions for the German saving rate. Finally, the last section summarizes the main findings and concludes.

Literature overview of empirical cross-country studies

7. There is a vast literature on the macroeconomic determinants of household saving behaviour both on an individual country-basis as well as across countries (see Table 1 for a selective overview on panel studies).[6] The starting point for most studies is the permanent income or life-cycle hypothesis, whereby individuals smooth their consumption profile over their lifetime.[7] According to this framework, household savings should be influenced by current real income (richer households tend to save more), demographic effects (older cohorts are expected to save less or even dissave) and the real rate of return (which changes the opportunity costs of current consumption). More recently, the classic approach has been supplemented by relaxing the assumption of perfect capital markets which has implications for the ability of households to smooth their consumption over time. The state of financial liberalisation is often proxied by the extent of loans outstanding (*e.g.* Sarantis and Stewart, 2001; Smith, 2001; Loyaza *et al.*, 2000; Callen and Thimann, 1997).[8] Furthermore, the impact of uncertainty on household savings is usually captured by using the inflation rate as a proxy (the intuition being that increased inflation may raise uncertainty regarding future income growth) and Ricardian equivalence effects are controlled for using measures of the fiscal stance. Other variables used in the literature include the type and design of public pension plans (*e.g.* Disney, 2006; Brugiavini and Padula, 2003; Attanasio and Paiella, 2003) and of the tax and transfer system (Callen and Thimann, 1997), health and longevity (*e.g.* Bloom *et al*., 2003), income inequality (Smith, 2001), the terms-of-trade and labour productivity.[9] Some studies also investigate the role of wealth effects (as

6. Fewer cross-country studies exist that analyze saving rates using micro-data, one example being Kirsanova and Sefton (2007).

7. See Bérubé and Côté (2000) for an overview on variables used in the literature.

8. Other proxies include the loan-to-value ratio obtainable from mortgage finance institutions (Jappelli and Pagano, 1994), or special liberalization indices constructed from the timing of major moves in liberalizing the financial system (Bandiera *et al*., 2000).

9. For example, labour productivity may have an influence on saving rates through its impact on income *per capita* which is likely to benefit workers more than retirees. Given the assumed higher saving rates of workers, the aggregate household saving rate may rise. A decline in the terms-of-trade may lead to lower

households can borrow against higher private wealth). While there are many studies that test for the existence of such effects on private consumption (recent examples include Skudelny, 2009; Slacalek, 2009; and Mody and Ohnsorge, 2010), only few cross-country studies employ wealth variables in saving regressions (Masson *et al.*, 1998; Salotti, 2010).

8. From a theoretical viewpoint, the sign of many of these variables is ambiguous. For example, income growth may raise savings if it accrues mainly to those working relative to those not earning labour income such as pensioners who usually have a lower saving rate. However, if income growth induces individuals to anticipate higher future income, they may choose to consume more today, thereby lowering their saving rate. In the case of real interest rates, there is both a substitution (higher real interest rates induce more saving today) and an income effect. The direction of the latter depends on whether households are in a net lending position (in which case they receive higher investment income, which raises the saving rate if the marginal propensity to consume is less than unity) or a net borrowing situation (in which case their available income declines, leading to a lower saving rate under given consumption). Similarly, financial development both raises returns to savings and enhances access to credit with a priori unclear net effects on savings.[10] As a consequence, the size and direction of the economic impact of these variables on household saving behaviour remains to a large extent an empirical issue. Studies differ regarding the country sample, estimation method and variables included. The following selective overview of cross-country studies focuses on more recent papers (which also provide summaries of earlier studies).

9. Masson *et al.* (1998) study a panel of industrial and developing countries and find evidence that the government's fiscal position, demographic effects, the real interest rate, GDP as well as *per capita* income growth, changes in the terms of trade and inflation significantly affect saving rates, although results differ between the two groups of countries. Similarly, using a large panel covering 150 industrial and developing countries over thirty years, Loayza *et al.* (2000) find a positive effect of real *per capita* income and inflation, while the dependency ratio, budget deficits and financial liberalization have detrimental effects, broadly confirming the results of earlier empirical studies which the authors survey. Hondroyiannis (2006) obtain similar results for a panel of 13 European countries, the main difference being a negative coefficient on the government deficit to GDP ratio for highly indebted countries. Bandiera *et al*. (2000) focus on the role of financial sector reform and find for a panel of eight developing countries that financial liberalization reduces saving. In addition, the authors find evidence for (less-than-perfect) Ricardian equivalence as well as for a positive influence of inflation and real interest rates. Li *et al*. (2007) investigate the influence of longevity and dependency rates and find for a panel of 149 countries that the former has a positive influence on saving rates while the latter has a negative influence. The empirical framework of all these papers assumes parameter homogeneity across countries regarding the influence of explanatory factors (though Bandiera *et al.*, 2000, and Hondroyiannis, 2006, also present country-by-country results). Haque *et al.* (1999) criticize this assumption (as well as the lack of modelling dynamics) and argue that this may lead to misleading interferences. Their own results suggest that fiscal variables are the key determinants of private saving rates, along with changes in the terms of trade. The importance of fiscal policy for private saving decisions is confirmed by de Mello *et al*. (2004).[11]

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saving rates as a fall in the relative value of exports corresponds to a fall in income which is not matched by a drop in consumption given the less-than-unit marginal propensity to consume and save (de Serres and Pelgrin, 2003).

10. See Bandiera *et al*. (2000) for an in-depth discussion of the relationship between financial liberalization and household saving behaviour.

11. As the focus of de Mello *et al*. (2004) is on the influence of public saving, a variable for which slope homogeneity is generally accepted, coefficients are pooled across countries.

Table 1. Determinants of household saving rates in panel studies

	Income or GDP	Real interest rate	Inflation	Depen-dency ratio	Budget balance	Credit to GDP	Terms of trade	Other variables
Ferrucci and Miralles (2007)	+		+	–	–	–	+	Govt. cons.(–)
Li *et al.* (2007)	+			–			+	Fertility (–) Life expectancy (+) School (–) Labour part. (n.s.) Mortality rate (n.s.)
Hondroyiannis (2006)	+	+	+	+	+	–		
De Mello *et al*. (2004)	n.s.	–	n.s.	–	–		+	M2 (n.s./–) House prices (–) Equity prices (–)
de Serres & Pelgrin (2003)		–	n.s.	–	–		+	Labour productivity (+)
Sarantis & Stewart (2001)	+	+		–	–	–		
Loayza *et al.* (2000)	+	n.s.	+	n.s.	–	–	+	Urbanization (n.s.) M2/GNP (+)
Bandiera *et al.* (2000)	+	+	+		–			Index of financial liberalisation (–)
Haque *et al.* (1999)	n.s.	n.s.	n.s.	n.s.	–		+	Govt. curr. exp. (–) Govt. invest. (n.s.) Wealth (n.s.)
Masson *et al.* (1998)	+	+	+	–	–		+	Wealth (+) Govt. curr. exp. (–) Govt. invest. (–)
Callen & Thimann (1997)	+	+	+	–	–	–		Direct taxes (–) Indirect taxes (n.s.) Transfers (–) Corp. saving (–)

Notes: + and – indicate the sign of the estimated coefficient, n.s. indicates that the variable is not significant. If sign and/or significance vary across specifications, the most frequent occurrence is shown. The exact definition of explanatory variables differs across studies and some studies use as dependent variable gross private saving (*e.g.* Loayza *et al.*, 2000; Haque *et al.*, 1999; Masson *et al.*, 1998). For Masson *et al.* (1998) results refer to industrial countries; for Bandiera *et al.* (2000), Hondroyiannis (2006), Ferrucci and Miralles (2007), and Callen and Thimann (1997) results refer to panel estimation; for Loayza *et al.* (2000) results refer to their OECD sample; for Sarantis and Stewart (2001) the sign reported is the one that prevails in the majority of their individual country equations.

10. Several papers explicitly test for the validity of the homogeneity restriction which is usually rejected (*e.g.* Sarantis and Stewart, 2001; de Serres and Pelgrin, 2003; Ferrucci and Miralles, 2007). Sarantis and Stewart (2001) deal with this problem by estimating the relationship on a country-by-country basis without pooling, de Serres and Pelgrin (2003) allow for country-specific short-term coefficients and country-specific long-run coefficients for those variables where homogeneity is rejected, and Ferrucci and Miralles (2007) maintain the homogeneity restriction for the long-run coefficients, but show country-by-country results for comparison purposes. All three papers find evidence for the lifecycle hypothesis as well as for Ricardian effects. De Serres and Pelgrin (2003) also find that private savings are positively related to changes in the terms-of-trade and productivity growth, while Sarantis and Stewart (2001) find evidence for the relevance of credit constraints.

Data and estimation issues

Comparability of household saving rates

11. Our dependent variable, the household saving rate, is defined as household saving net of depreciation (or 'consumption of fixed capital') divided by household disposable income. The household sector includes unincorporated enterprises and, except for France and Japan, also non-profit institutions serving households (NPISH).[12] To ensure comparability across countries regarding the statistical treatment of private pension benefits and contributions, disposable income has been adjusted by adding the change in net equity of households in pension funds (*i.e.* contributions minus benefits) for those countries which have chosen to include contributions to and benefits from private pension funds in household income (Germany, United Kingdom, Japan, Italy).[13]

12. Even though the saving rates data used in this paper thus are comparable from a measurement point of view, differing institutions across countries may still have an impact on their level and potentially also on their variability (OECD, 2004; Catte and Boissinot, 2005). *Firstly*, household consumption of public services may vary across countries, for example depending on the extent the government pays for services like education and health. If such services are privately purchased, taxes will be lower and consumption will be higher, resulting in a lower saving rate. Thus, countries with a lower public provision will tend to have lower saving rates. *Secondly*, the relative importance of social security schemes compared to private pensions differs in whether benefits received minus contributions paid are included in disposable income or not. In case of social security schemes and unfunded employer schemes, this measure is added to disposable income, while it does not change disposable income in the case of funded employer schemes. *Thirdly*, differences in the structure of taxation matter, *i.e.* whether a system relies more on direct or on indirect taxes. Countries with more direct taxation tend to have higher saving rates.

13. Catte and Boissinot (2005) try to adjust for these effects and find that the tax structure and the consumption of public services have only modest effects on saving rates. In their analysis, the impact of adjusting for differences in pension schemes (excluding the accumulation of pension wealth from household sector savings) substantially lowers saving rates, but does not reduce international differences. For those countries where data are available, adjusting for durable goods accumulation narrows some of the level differences across countries.[14] Cumulating the different adjustments, they conclude that accounting adjustments alter the differences in saving rates across countries only modestly, although lack of data availability limits the possibilities for fully taking account of institutional differences. As most of the adjustments have an effect on the level of saving rates and in general do not impact their trend, they should be captured by the country-specific constant in an empirical framework.

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12. Catte and Boissinot (2005) show that the effect of excluding NPISH for France and Japan is minuscule (the adjustment changes their saving rate by only 0.1 pp over the period 1996-2003).

13. SNA93/ESA95 changed the concept of disposable income for households (compared with SNA68/ESA79) so as to include private pension benefits and subtract private pension contributions. This new treatment of disposable income is not consistent with another SNA notion, namely that assets of private pension funds are actually owned by the household sector. In order to reconcile the new disposable income concept with the correct saving concept (where private pension benefits and contributions should have no influence on the magnitude of saving) it is necessary to adjust disposable income by adding back contributions and subtract benefits. For more information see *Sources & Methods of the OECD Economic Outlook* (http://www.oecd.org/document/14/0,3343,en_2649_34573_1847822_1_1_1_1,00.html).

14. Under SNA, expenditures on durable consumer goods are treated as current consumption (unlike expenditures for constructing a house), even though they have an economic life that can extend over several years. Applying an estimated depreciation rate to the existing durables stock to gauge actual consumption raises saving to the extent that the excess of durables expenditure over their consumption constitutes net investment (Catte and Boissinot, 2005).

Model specification

14. We follow the literature in using the standard variables in our benchmark setup: real income, the inflation rate, the real interest rate and the old-age dependency ratio. In contrast to the literature, we use outstanding liquid liabilities as a measure of financial development instead of domestic credit to the private sector. *Firstly*, this is the broadest available indicator of financial intermediation since it includes all banks, bank-like and non-bank financial institutions and is the traditional indicator of financial depth in the finance and growth literature (Beck and Demirgüç-Kunt, 2009). *Secondly*, changes in domestic credit to the private sector may also reflect higher household borrowing through wealth effects, notably in the last years when households in many countries borrowed against higher values of their assets, for example using mortgage equity withdrawal. Therefore, using the domestic credit variable may capture more than just financial liberalisation effects. To explicitly account for the existence of wealth effects, we include real stock and house prices as a proxy. To capture Ricardian equivalence effects, we include the stock of government debt (as opposed to the budget deficit) as this should primarily drive household's concerns about future higher taxes.[15]

15. The countries covered in the analysis are the G7 economies. Both the end point and the starting point of the sample period vary across countries according to data availability (a description of data sources and construction can be found in Annex A.1). The time series of France start in 1978, those of Italy in 1975, and those of all other countries in 1970. The end point is 2008 for all countries but Italy and Japan where the time series end already in 2007. The time series for Germany are constructed by using West-German data until 1990 and pan-German data afterwards and splicing the growth rates.[16] Since panel unit root tests indicate that the time series are non-stationary (Table 2), the data are analysed by exploring the existence of a cointegrating relationship between the saving ratio and the set of explanatory variables.[17] The *t*-test by Kao (1999) clearly rejects the null-hypothesis of no cointegration (the *p*-value is 0.025). The cointegrating vector is obtained by estimating an error correction model which relates the saving ratio *SRATIO* to a vector *X* of explanatory variables:

$$\Delta SRATIO_{i,t} = \alpha_i (SRATIO_{i,t-1} - \beta_i' X_{i,t-1}) + \sum_{p=0}^{q_i} \gamma_{i,p}' \Delta X_{i,t-p} + \delta_i UGAP_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where ε is an error term and the subscripts *i* and *t* denote country and time. As discussed above, the set of explanatory variables includes the log of real household disposable income (*YDHR*), the real long term interest rate (*IRLR*), the inflation rate (*INFL*), the old-age dependence ratio (*ODEP*), the GDP share of liquid liabilities of banks and other financial intermediaries (*LIQU*), the GDP share of general government net financial liabilities (*GNFLQ*), and, to explore the role of wealth effects, real stock prices (*STOCK*) and real house prices (*HOUSE*), both in log form.[18] To control for cyclical factors, the unemployment gap (*UGAP*) is also included in the specification.

15. We do not include a measure of income inequality in the empirical analysis due to the lack of sufficiently long time series data.

16. The data from 1980 onwards are in line with those published in *Destatis Fachserie 18 Reihe 1.5*.

17. This procedure is applied also in several other studies (*e.g.* Sarantis and Stewart, 2001).

18. The empirical setup does not control for a potential endogeneity of some of the explanatory variables. Pair-wise Granger causality tests suggest that the explanatory variables are generally not Granger caused by the savings ratio. Exceptions include real household disposable income and the real interest rate for Canada and the United States, the GDP share of general government net financial liabilities for Canada, Germany and Japan, house prices for Canada and stock and house prices for Italy.

Table 2. Panel unit root test

		Country-specific constants		Country-specific constants and country-specific linear trends	
		Levels	First differences	Levels	First differences
SRATIO	Levin, Lin & Chu (2002)	2.079	-13.656***	-1.351*	-13.526***
	Im, Pesaran, Shin (2003)	1.939	-13.202***	-0.161	-12.734***
	Maddala and Wu (1999)	9.600	159.429***	11.628	173.782***
INFL	Levin, Lin & Chu (2002)	-2.590***	-10.925***	0.857	-6.901***
	Im, Pesaran, Shin (2003)	-1.848**	-9.662***	-1.177	-7.272***
	Maddala and Wu (1999)	10.982	145.848***	17.669	133.432***
GNFLQ	Levin, Lin & Chu (2002)	-2.006**	-3.917***	-0.802	-2.621***
	Im, Pesaran, Shin (2003)	-0.225	-6.195***	0.026	-4.787***
	Maddala and Wu (1999)	7.161	58.705***	4.868	43.833***
ln(*HOUSE*)	Levin, Lin & Chu (2002)	1.083	-4.633***	-1.176	-3.563***
	Im, Pesaran, Shin (2003)	0.877	-5.932***	-1.504	-5.054***
	Maddala and Wu (1999)	3.616	37.536***	4.007	22.496**
IRLR	Levin, Lin & Chu (2002)	-2.603***	-10.947***	-1.367*	-9.656***
	Im, Pesaran, Shin (2003)	-2.022**	-9.757***	0.378	-9.369***
	Maddala and Wu (1999)	20.026	153.686***	9.682	389.379***
LIQU	Levin, Lin & Chu (2002)	3.483	-2.521***	4.313	-1.875**
	Im, Pesaran, Shin (2003)	3.982	-5.001***	4.47	-4.588***
	Maddala and Wu (1999)	7.967	45.021***	3.279	37.013***
ln(*YDHR*)	Levin, Lin & Chu (2002)	-3.434***	-7.582***	-1.673**	-7.631***
	Im, Pesaran, Shin (2003)	-0.557	-7.170***	-0.967	-6.764***
	Maddala and Wu (1999)	33.974***	75.194***	11.642	66.807***
ODEP	Levin, Lin & Chu (2002)	11.935	-1.355*	1.662	0.025
	Im, Pesaran, Shin (2003)	8.328	-2.007**	1.214	-1.744**
	Maddala and Wu (1999)	43.477***	22.256*	27.475**	18.123
ln(*STOCK*)	Levin, Lin & Chu (2002)	0.701	-12.720***	-0.995	-11.967***
	Im, Pesaran, Shin (2003)	1.891	-11.588***	-0.615	-10.509***
	Maddala and Wu (1999)	5.168	147.535***	15.377	140.766***

Note: *, **, and *** denote rejection of the null hypothesis of a unit root at the 10%, 5%, and 1% significance level.

16. In a first step, we test whether the coefficients of the cointegrating vector and the short-run dynamics can be constrained to be equal across countries so that $\beta_I = \beta$ and $\gamma_{i,p} = \gamma_p$ for all i. Such a specification would be in the spirit of Loyaza *et al.* (2000) and Callen and Thimann (1997) who also assume homogeneous slope coefficients across countries. However, as argued by Haque *et al.* (1999), slope homogeneity is unlikely to hold in the current setting as different countries are characterized by different institutions, customs and social norms. This is particularly true of the short-run effects as institutional constraints tend to be more binding in the short-run and may thus cause saving ratios across countries to respond differently to changes in the underlying fundamentals. Wald tests indeed strongly reject slope homogeneity for the set of countries considered in this study, both for the short-run dynamics and the cointegrating vector. The restriction of equal coefficients is therefore relaxed. To obtain a parsimonious model, the parameters are restricted subsequently to be equal across subsets of countries as the data permit (the *p*-value of a Wald test that the set of constraints is valid is equal to 0.334).[19] The

19. While imposing cross-country constraints increases the efficiency of the estimation, the point estimates of the final common coefficients of course deviate from the point estimates of country-specific coefficients.

groups that are formed are ones that are data acceptable, so they do not necessarily have a direct economic interpretation. Variables for which coefficients are found to be insignificant at conventional significance levels are excluded from the final specification.

Empirical results

Panel estimation results

17. Estimates of the cointegrating vectors and the error correction coefficients are presented in Table 3. The error correction coefficients are significantly negative for all countries considered, supporting the results of Kao's (1999) *t*-test that the variables are cointegrated. The magnitudes of the estimated error correction coefficients vary considerably across countries. While for the United States, Canada and France, a deviation of the actual saving rate from its equilibrium level is reduced by half within less than half a year, this process takes more than 1½ years for the other four countries.

Table 3. Estimation results

	USA	JPN	DEU	FRA	ITA	GBR	CAN
EC-Term	-0.830***	-0.347***	-0.347***	-0.830***	-0.347***	-0.347***	-0.830***
	(0.078)	(0.033)	(0.033)	(0.078)	(0.033)	(0.033)	(0.078)
ln(*YDHR*)		2.976***	2.976**	19.927***	19.927***		2.976**
		(1.252)	(1.252)	(4.045)	(4.045)		(1.252)
IRLR		0.870***	-0.434**	-0.434**	0.530***		0.870***
		(0.063)	(0.171)	(0.171)	(0.147)		(0.063)
∆ln(*PCP*)	136.649***	136.649***		179.824***	136.649***		136.649***
	(6.082)	(6.082)		(19.593)	(6.082)		(6.082)
ODEP	-80.463***	-80.463***				-80.463***	
	(10.711)	(10.711)				(10.711)	
LIQU				-35.227***			
				(7.004)			
GNFLQ	0.197***			0.197***			
	(0.020)			(0.020)			
ln(HOUSE)	-8.652***			-4.756***	-4.756***	-4.756***	
	(1.228)			(0.815)	(0.815)	(0.815)	
ln(STOCK)	-1.221***		-1.221***		-1.221***	-1.221***	-1.221***
	(0.346)		(0.346)		(0.346)	(0.346)	(0.346)

Note: *, **, and *** denote rejection of the null hypothesis of a unit root at the 10%, 5%, and 1% significance level.

18. The estimates of the cointegrating vectors show that the eight variables included in the set of explanatory factors have indeed a significant influence on the saving ratio for most of the countries considered. *Per capita* real disposable income is positively related to the saving rate in Canada, Japan, Germany, France and Italy, with the size of the impact notably larger for France and Italy than for the other countries. For the United States and the United Kingdom the variable does surprisingly not turn out as significant. The real long-term interest rate is found to have a significant influence on the saving rate of all countries except for the one of the United States and the United Kingdom. The coefficient is negative for Germany and France, suggesting that in these countries the income effect outweighs the substitution effect.

These deviations may be particularly pronounced in cases in which the country-specific coefficients are very imprecisely estimated.

For Japan, Italy and Canada, by contrast, the real interest rate exerts a positive influence on the saving ratio.

19. In line with earlier research (*e.g.* Loyaza *et al.*, 2000), the inflation rate is found to have a positive effect on the saving ratio in most countries considered except for Germany and the United Kingdom, suggesting that more macroeconomic uncertainty induces households to save a larger fraction of their income for precautionary motives.[20] The point estimates vary across countries and suggest that a one percentage point increase in inflation raises the saving ratio by between 1.4 and 1.8 percentage points. The coefficient on the old-age dependency ratio is significantly negative for Japan, the United States and the United Kingdom, but insignificant for the other four countries in the sample.[21] The negative sign is consistent with the standard life-cycle model of consumption, implying that individuals will save during their working lives in order to accumulate sufficient wealth for their retirement years and dissave (or at least save less) during retirement. The insignificance of the German coefficient might be related to the fact that saving rates are relatively flat across age profiles in Germany (*e.g.* Börsch-Supan *et al.*, 2001).

20. The GDP share of liquid liabilities of banks and other financial intermediaries, which is supposed to capture the financial sophistication of the economy, does generally not come out as significant. The only exception is France, where the coefficient has the expected negative sign, so that a better developed financial system induces households to save less. The insignificance of this variable for the majority of countries differs from the findings of Loyaza *et al.* (2000), Callen and Thimann (1997), Sarantis and Stewart (2001) who all find a significantly negative relationship between financial sophistication and the saving ratio. One potential reason for the difference lies in the use of a different proxy. Whilst this paper uses the GDP share of liquid liabilities of financial intermediaries, the other three studies employ the GDP share of domestic credit to the private sector.[22] Although to some extent both proxies entail the risk of not only capturing financial sophistication but also wealth effects (to the extent that wealthier households borrow against collateral), this risk is more limited for the proxy used in this paper as the association with household borrowing is only an indirect one. In this sense, the finding of a negative association between the financial sophistication proxy and the savings ratio by the other studies might simply be due to wealth effects. This is even more likely as these other studies do not control for wealth effects as this study does.

21. The coefficient on the GDP share of general government net financial liabilities is significantly positive for the United States and France, so that a worsening of the fiscal position induces households to save a larger share of their income, which is in line with the Ricardian equivalence hypothesis. The point estimates imply that if the general government reduces net financial liabilities by one percentage point of GDP, households in the United States and France reduce their saving rate by 0.2 percentage points. This finding of less-than-complete Ricardian equivalence is in line with most previous studies, an exception being Haque *et al.* (1999). For the remaining countries in the sample no evidence of Ricardian effects is found.

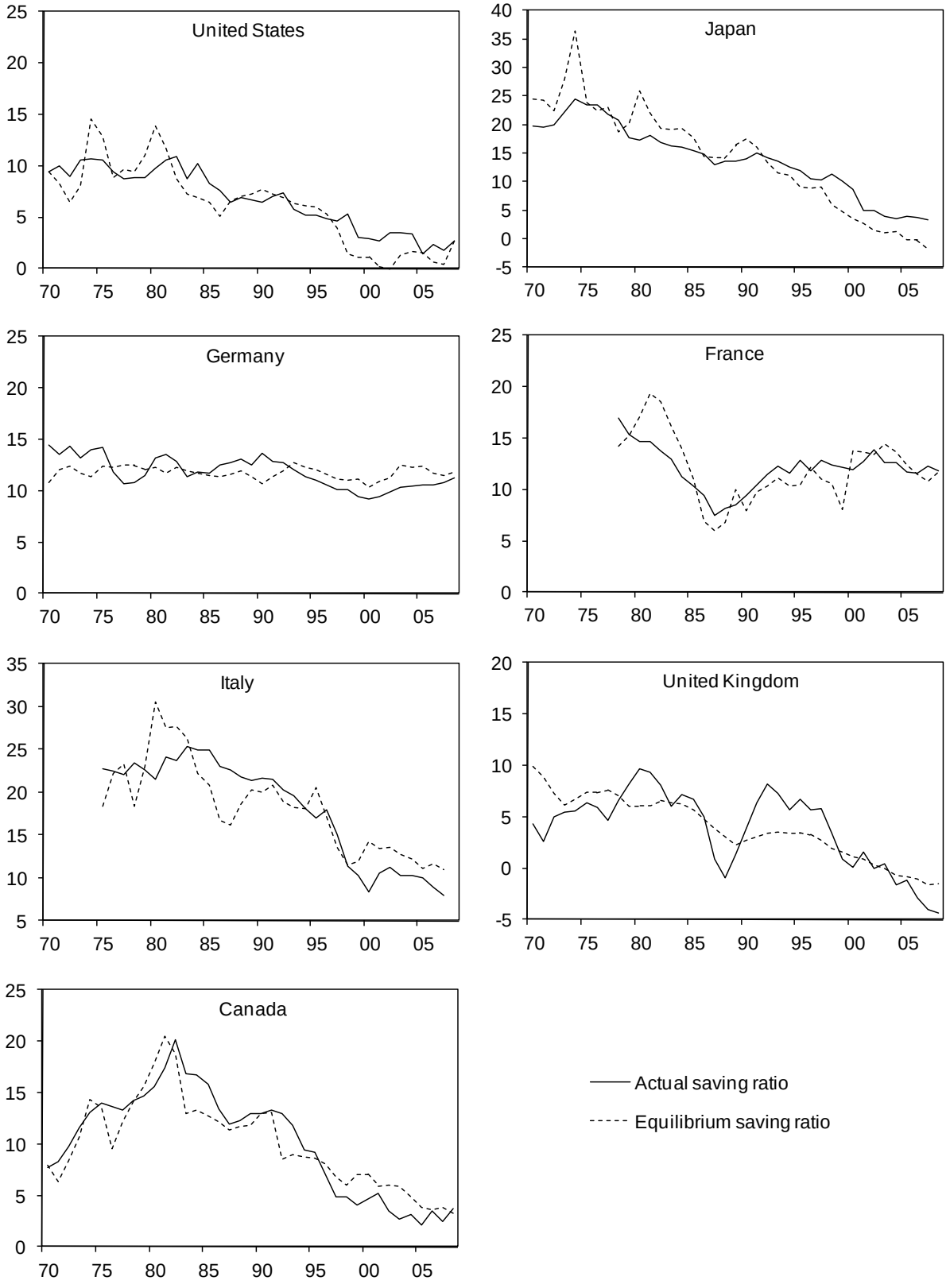
20. When measuring macroeconomic uncertainty alternatively by the variance of inflation (calculated as the standard deviation of quarterly inflation rates over a 10-year moving interval) the coefficient does generally not come out as significant.

21. An in-depth analysis of the role of demographics for the decline in the Japanese saving rate is provided by Braun *et al.* (2009).

22. Callen and Thimann (1997) use the GDP share of the value of outstanding consumer debt.

Figure 2. Actual and implied equilibrium saving ratios

1970-2008



22. As discussed in the previous section, a number of recent studies have pointed out that changes in wealth might have an important influence on the saving behaviour of households. This hypothesis is explored through the inclusion of real stock and house prices in the specification. House prices are found to have a negative influence on the household saving ratio in the United States, France, Italy and the United Kingdom, but are insignificant for the other countries in the sample. Stock prices appear to play a role in the United States, Canada, Italy, the United Kingdom and also in Germany. Although direct equity holdings of households are generally seen as being relatively limited in Germany, it is noteworthy that households' holdings of investment fund shares have increased sharply during the second half of the 1990s, doubling as a size of GDP from 10% in 1995 to 20% in 2000, which was 3 percentage points above the OECD average.[23] The size of the estimated coefficient implies that an increase in the German MSCI equity index (deflated with the GDP deflator) by 1 % reduces the household saving ratio by about 0.01 percentage points. As would be expected, the impact of real house prices on saving rates is significantly larger, amounting to 0.05 percentage points for a 1% change in real prices (0.09 percentage points in the case of the United States).

23. The unemployment gap, defined as the difference between the actual unemployment rate and the NAIRU, is included in the short-term dynamics. It is significant in the specifications for Canada, Germany and France but with varying signs. For Canada and France, the unemployment gap is estimated to have a negative impact on the saving rate, suggesting that the effect of lower savings by those who become unemployed outweighs the effect of higher savings by those who do not lose their job but save more for precautionary purposes. In Germany, however, results show a positive relationship, suggesting that the latter effect dominates.

24. Figure 2 plots the actual household saving ratios of the G7 countries against their equilibrium levels implied by the estimation.[24] In general, the estimated equilibrium saving ratios track the actual saving ratios very well. This is especially the case for the United States and France, where misalignments were mostly short-lived and also not very pronounced in terms of their magnitude. For Germany, Japan and Italy, by contrast, the estimates suggest that the household saving ratio has been above its equilibrium level for more than a decade.

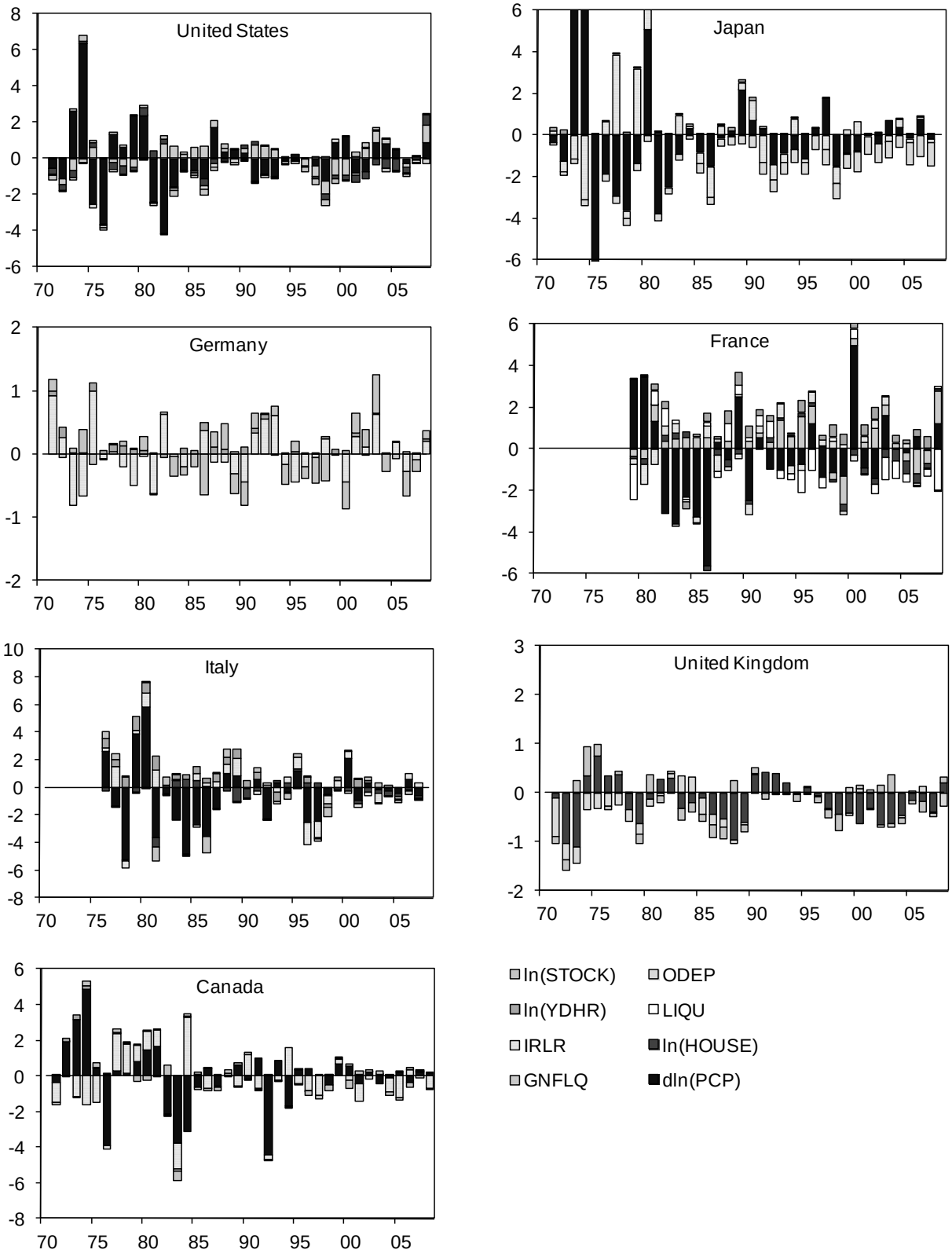
Implications for the German saving ratio

25. In the case of Germany, estimation results suggest that the increase in household savings observed since around the turn of the century is due to two factors. *Firstly*, the actual saving rate was below its estimated equilibrium level at the end of the 1990s, implying an upward correction over the medium term. In fact, the deviation of the actual rate from equilibrium was longer-lasting than at any time since the 1970s. *Secondly*, the equilibrium saving rate has moved upwards in the first half of the 2000s, thereby increasing the misalignment of the actual rate and requiring an even larger adjustment of the actual rate. According to the estimation results, the necessary upward adjustment of the saving rate was almost completed in 2008 (the last year of the sample period) when the actual saving rate (which equaled 11¼ per cent in that year) was only around half of percentage point below the level implied by economic fundamentals.

23. According to the OECD's *Households' Financial and Non-financial Assets and Liabilities Database*, the unweighted OECD average amounted to 9% in 1995 and 17% in 2000 with the US, Canada and Belgium accounting for the largest shares.

24. As the estimation technique does not allow to estimate separate constants for the long-run and the short-run, the constant of the long-run relationship is derived by assuming that the saving rate was on average in equilibrium over the sample period.

Figure 3. Contributions of explanatory variables to changes in the saving ratios



26. The main drivers of the change in the equilibrium value of the saving rate, in particular since the mid-1990s, were movements in real stock prices and in real interest rates, albeit to a lesser extent (Figure 3). In the second half of the 1990s the equilibrium value was driven downwards mostly by rising stock prices and the actual saving rate was following this trend. In addition, higher real interest rates contributed to the downward trend in some years. The sharp falls in stock prices in the years after 2000 then contributed to an increase in the equilibrium saving rate up to 2003 and lower real interest rates added to this movement. Over this period the model predicts a rise in the equilibrium saving rate by 2¼ percentage points. The subsequent rise in share prices lowered the estimated equilibrium saving rate by around 1 percentage point.

27. Wealth effects are also found to be important drivers in Italy, the US and the United Kingdom - in the latter importantly driven by house price developments. In contrast to Germany, demographics are found to play a large role in Japan, explaining most of the decrease in the savings rate over the last years. This is in line with Horioka (2009) who finds evidence for significant dissaving of pensioners in survey data which has increased substantially since 2000. While an increasing share of older cohorts in the population is also a characterizing feature of Germany, savings rates across age profiles tend to be much flatter, which may explain why this variable does not have an influence on the aggregate German savings rate.

Summary and conclusions

28. We study household saving rates in G7 countries since the 1970s in a panel co-integration framework. Our approach differs from many previous cross-country studies in our selection of variables that allow for a more precise identification of wealth effects (disentangling them from financial liberalization effects) as well as in applying a methodology that allows for heterogeneity in the estimated coefficients across countries. We find that disposable income, real interest rates and inflation are important determinants of household saving in most of the countries. Demographics, government indebtedness, the depth of the financial system and wealth effects (through house and stock prices) are found to play a role in a smaller number of countries. The actual saving rates tend to track these estimated long-run equilibrium rates fairly well in all cases.

29. The results add a new dimension to the discussion about movements in the German saving rate, in particular over the most recent decade. They suggest that financial variables such as stock prices and real interest rates can explain both the fall of the saving rate in the late 1990s as well as the continuous upswing afterwards. In addition, the upward movement of the actual saving rate also represents the correction of a previous disequilibrium situation. Thus, macroeconomic factors that also impact saving decisions in other G7 countries are well able to explain the saving decisions by German households. This is not to say that country-specific factors, such as pension reforms or income uncertainty, are not helpful in explaining the recent increase in the German saving rate. However, to our knowledge so far no empirical framework has been able to incorporate these factors to fully explain not only the recent movements in the German saving rate, but also its development over a long time period.

30. The prominent role of stock price movements in determining recent household saving decisions in our study may seem surprising at first glance. Such findings are usually expected more for Anglo-Saxon countries, and indeed our results show that they have been important drivers of household savings in the United Kingdom and the US (along with Italy). However, as mentioned above, the wealth losses through stock market investments at the beginning of the decade were indeed quite sizable, amounting to one-seventh of household’s disposable income in Germany. This is a reflection of the increased holdings of investment fund shares and this heightened exposure to stock market fluctuations may also imply a more volatile saving ratio going forward.

31. An important avenue for future research is to analyze household saving behaviour using micro-economic data instead of focusing only on the aggregate saving rate. The studies by Corneo *et al.* (2009) and Stein (2009) are first steps in analyzing these issues for Germany. This allows for a more detailed view how saving behaviour of different household groups is determined. Such an approach is also more useful in analyzing country-specific aspects such as pension reform or income uncertainty and how they interact and influence the macroeconomic aggregates. However, due to the lack of comparable cross-country micro-data such studies may necessarily be limited to one country.

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ANNEX A1

DATA SOURCES AND CONSTRUCTION

Household saving ratio (SRATIO): Net saving ratio (*i.e.* excluding consumption of fixed capital). Source: *OECD Analytical database*.

Private consumption deflator (PCP): Private consumption deflator in log-differences. Source: *OECD Analytical database*.

Real disposable income per capita (YDHR): Nominal disposable income is deflated by the personal consumption deflator, divided by population (in 1000 persons), and converted into US$ using PPPs. For all countries except France, Canada and the United States, the change in net equity of households in pension funds (EQPF) has been added to nominal disposable income before deflating to ensure consistency. Source: *OECD Analytical database*.

Long-term real interest rate (IRLR): Real long-term interest rate based on lagged GDP deflator. Source: *OECD Analytical database*.

Old-age dependency ratio (ODEP): Ratio of the population aged 65+ to the population aged 20-64. Source: *OECD Demography and Labour Force Database*.

Liquid liabilities in % of GDP (LIQU): Currency plus demand and interest-bearing liabilities of banks and other financial intermediaries divided by GDP. Data is taken from the *World Bank Financial Structure Database*. Data for 1990/91 for Germany for 1998/99 for France have been constructed by linear interpolation.

Government borrowing (GNFLQ): General government net financial liabilities as % of GDP. Source: *OECD Analytical database*.

Real house prices (HOUSE): Nominal house price indices deflated by the consumer price index. Source: *OECD Analytical database*.

Real equity prices (STOCK): MSCI equity index for each country deflated by the GDP deflator. Source: Datastream and *OECD Analytical database*.

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