

Appendix A: Summary of key forecast assumptions by Iana Liadze and Barry Naisbitt

The forecasts for the world economy and the UK economy reported in this *Review* are produced using the National Institute's global econometric model, NiGEM. NiGEM has been in use at NIESR for forecasting and policy analysis since 1987, and is also used by a group of more than 40 model subscribers, mainly in the policy community. Most countries in the OECD are modelled separately,¹ and there are also separate models for China, India, Russia, Brazil, Hong Kong, Taiwan, Indonesia, Singapore, Vietnam, South Africa, Latvia, Lithuania, Romania and Bulgaria. The rest of the world is modelled through regional blocks so that the model is global in scope. All models contain the determinants of domestic demand, export and import volumes, prices,

current accounts and net assets. Output is tied down in the long run by factor inputs and technical progress interacting through production functions, but is driven by demand in the short to medium term. Economies are linked through trade, competitiveness and financial markets and are fully simultaneous. Further details on NiGEM are available on <http://nimodel.niesr.ac.uk/>.

The key interest rate and exchange rate assumptions underlying our current forecast are shown in tables A1–A2. Our short-term interest rate assumptions are generally based on current financial market expectations, as implied by the rates of return on treasury bills and government bonds of different

Table A1. Interest rates

Per cent per annum

	Central bank intervention rates					10-year government bond yields				
	US	Canada	Japan	Euro Area	UK	US	Canada	Japan	Euro Area	UK
2014	0.25	1.00	0.10	0.16	0.50	2.5	2.2	0.6	1.9	2.5
2015	0.26	0.65	0.10	0.05	0.50	2.1	1.5	0.4	1.0	1.8
2016	0.51	0.50	-0.08	0.01	0.40	1.8	1.3	0.0	0.7	1.3
2017	1.10	0.70	-0.10	0.00	0.29	2.3	1.8	0.1	1.0	1.2
2018	1.78	1.39	-0.11	0.00	0.71	2.7	2.4	0.2	1.2	1.6
2019	2.44	1.94	-0.13	0.09	1.21	3.2	3.0	0.5	1.8	2.3
2020–24	3.41	3.26	0.29	1.24	2.40	3.9	3.9	1.2	3.1	3.5
2016 Q1	0.50	0.50	0.00	0.04	0.50	1.9	1.2	0.1	0.8	1.5
2016 Q2	0.50	0.50	-0.10	0.00	0.50	1.7	1.3	-0.1	0.7	1.4
2016 Q3	0.50	0.50	-0.10	0.00	0.34	1.6	1.1	-0.1	0.4	0.8
2016 Q4	0.55	0.50	-0.10	0.00	0.25	2.1	1.5	0.0	0.8	1.3
2017 Q1	0.80	0.50	-0.10	0.00	0.25	2.4	1.7	0.1	1.1	1.3
2017 Q2	1.05	0.50	-0.10	0.00	0.25	2.3	1.5	0.0	1.0	1.0
2017 Q3	1.25	0.79	-0.10	0.00	0.25	2.2	1.9	0.0	1.0	1.2
2017 Q4	1.30	1.00	-0.10	0.00	0.41	2.4	2.0	0.1	0.9	1.3
2018 Q1	1.50	1.17	-0.10	0.00	0.50	2.5	2.2	0.1	1.0	1.3
2018 Q2	1.67	1.25	-0.11	0.00	0.66	2.7	2.4	0.1	1.2	1.5
2018 Q3	1.84	1.50	-0.11	0.00	0.75	2.8	2.5	0.2	1.3	1.7
2018 Q4	2.10	1.63	-0.12	0.00	0.92	2.9	2.7	0.3	1.5	1.9
2019 Q1	2.19	1.75	-0.12	0.00	1.00	3.1	2.8	0.3	1.6	2.1
2019 Q2	2.36	1.88	-0.13	0.00	1.16	3.2	3.0	0.4	1.7	2.3
2019 Q3	2.53	2.00	-0.14	0.09	1.25	3.3	3.1	0.5	1.9	2.4
2019 Q4	2.70	2.13	-0.14	0.26	1.42	3.4	3.2	0.6	2.0	2.5

Table A2. Nominal exchange rates

	Percentage change in effective rate								Bilateral rate per US \$			
	US	Canada	Japan	Euro Area	Germany	France	Italy	UK	Canadian \$	Yen	Euro	Sterling
2014	5.1	-5.4	-5.3	4.6	1.8	1.6	2.9	7.6	1.112	105.8	0.754	0.607
2015	13.6	-11.0	-6.2	-7.4	-3.7	-3.9	-3.1	5.5	1.299	121.1	0.902	0.654
2016	7.3	0.9	15.7	5.1	2.7	2.7	3.5	-9.7	1.314	108.8	0.904	0.741
2017	1.0	2.3	-2.4	4.2	1.5	2.2	2.3	-5.1	1.292	112.2	0.887	0.776
2018	-2.6	2.6	-1.5	5.8	2.5	2.7	3.3	1.9	1.244	110.7	0.818	0.727
2019	-0.6	0.2	1.8	1.9	0.9	0.9	1.1	0.2	1.239	108.3	0.801	0.718
2016 Q1	2.9	4.6	6.8	2.6	1.5	1.3	1.8	-5.5	1.323	115.2	0.908	0.699
2016 Q2	-1.2	2.2	5.7	1.5	0.6	0.8	0.8	-1.5	1.289	107.9	0.886	0.697
2016 Q3	1.1	-1.1	5.9	-0.4	0.0	0.4	0.0	-7.9	1.310	102.4	0.896	0.762
2016 Q4	3.4	-0.6	-4.2	0.2	-0.1	0.1	0.1	-2.5	1.333	109.5	0.927	0.805
2017 Q1	1.0	-0.1	-2.9	-0.2	-0.4	-0.2	-0.2	0.8	1.339	113.6	0.939	0.807
2017 Q2	-2.2	0.0	1.0	1.6	0.6	0.8	0.8	1.2	1.330	111.1	0.909	0.781
2017 Q3	-2.7	7.4	-1.4	5.4	2.4	2.4	2.9	-1.6	1.229	111.0	0.852	0.764
2017 Q4	1.3	-3.2	-1.7	0.7	0.4	0.4	0.6	1.8	1.271	112.9	0.849	0.753
2018 Q1	-1.0	1.4	-0.4	1.2	0.4	0.6	0.7	0.8	1.248	112.0	0.829	0.735
2018 Q2	-0.9	0.1	0.9	1.1	0.5	0.5	0.6	0.4	1.243	110.5	0.816	0.725
2018 Q3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.243	110.5	0.816	0.725
2018 Q4	-0.1	0.0	0.4	0.4	0.2	0.2	0.3	0.0	1.242	109.9	0.812	0.723
2019 Q1	-0.1	0.1	0.5	0.5	0.2	0.2	0.3	0.0	1.241	109.3	0.808	0.721
2019 Q2	-0.1	0.1	0.5	0.5	0.2	0.2	0.3	0.0	1.240	108.7	0.803	0.719
2019 Q3	-0.1	0.1	0.5	0.5	0.3	0.2	0.3	0.0	1.238	108.0	0.799	0.717
2019 Q4	-0.1	0.1	0.5	0.5	0.3	0.2	0.3	0.0	1.237	107.3	0.794	0.714

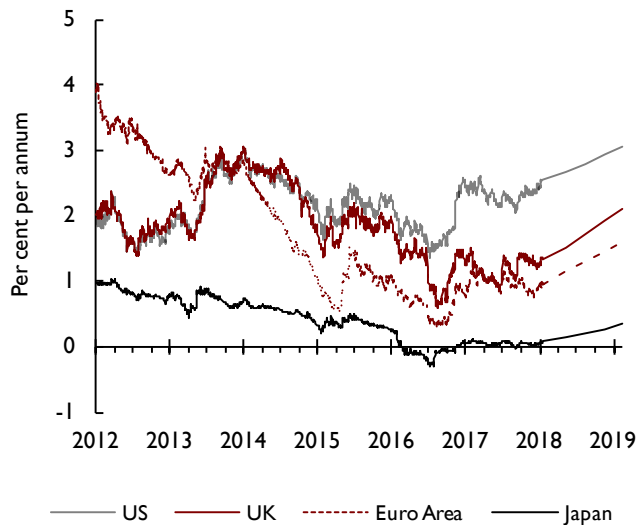
maturities supplemented by any particular information on anticipated policy rates. Long-term interest rate assumptions are consistent with forward estimates from short-term interest rates, allowing for a country-specific term premium. Where term premia do exist, we assume they gradually diminish over time, such that long-term interest rates in the long run are simply the forward convolution of short-term interest rates.

Short-term interest rates in the US, UK and Canada are expected to continue rising in 2018, but remain unchanged in the Euro Area and Japan. Interest rates in the US are broadly consistent with the path signalled by the most recent Federal Open Market committee (FOMC) minutes, which is stronger than current implied market expectations. As discussed in the UK chapter in this *Review*, we expect the UK economic growth to stabilise at a level that is close to its potential. Given that inflation is expected to exceed the BoE's target of 2 per cent for the next two years, we expect two further 25 basis point increases in policy rates this year. Bank Rate is expected to reach 2 per cent in the second half of 2021, this being the point at which the MPC is assumed to stop reinvesting the proceeds from maturing gilts it currently holds, allowing the Bank of England's balance sheet to shrink 'naturally'.²

Figure A1 illustrates the recent movement in, and our projections for, 10-year government bond yields in the US, Euro Area, the UK and Japan. Since February 2014, the margin between Euro Area and US bond yields has widened, reaching a maximum of about 176 basis points at the end of December 2016. At the time of writing the gap between US and Euro Area 10-year government bond yields was fluctuating around 150 basis points. In the second half of 2014, US and UK government bond yields started to diverge, and have remained within the range of about 90–140 basis points since December 2016. The levels of 10-year sovereign bond yields in the fourth quarter of 2017 have increased slightly since the third quarter in the UK and the US – by about 10 basis points – but decreased marginally in the Euro Area – by about 10 basis points – while remaining unchanged in Japan. Expectations for bond yields for the end of 2018 are marginally lower for the Euro Area, the UK and Japan, compared to expectations formed just three months ago, but are largely unchanged for the US. For the Euro Area and the UK they are down by about 20 basis points, and by about 10 basis points for Japan.

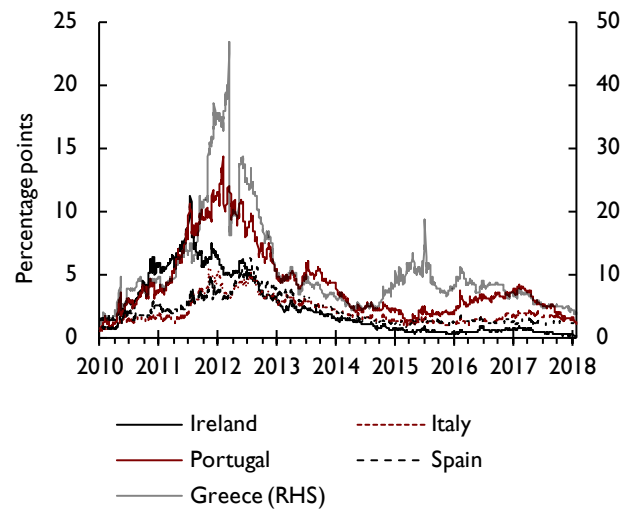
The forecast implies gradual increases for 10-year bond yields but, given the risks around the forecast,

Figure A1. 10-year government bond yields



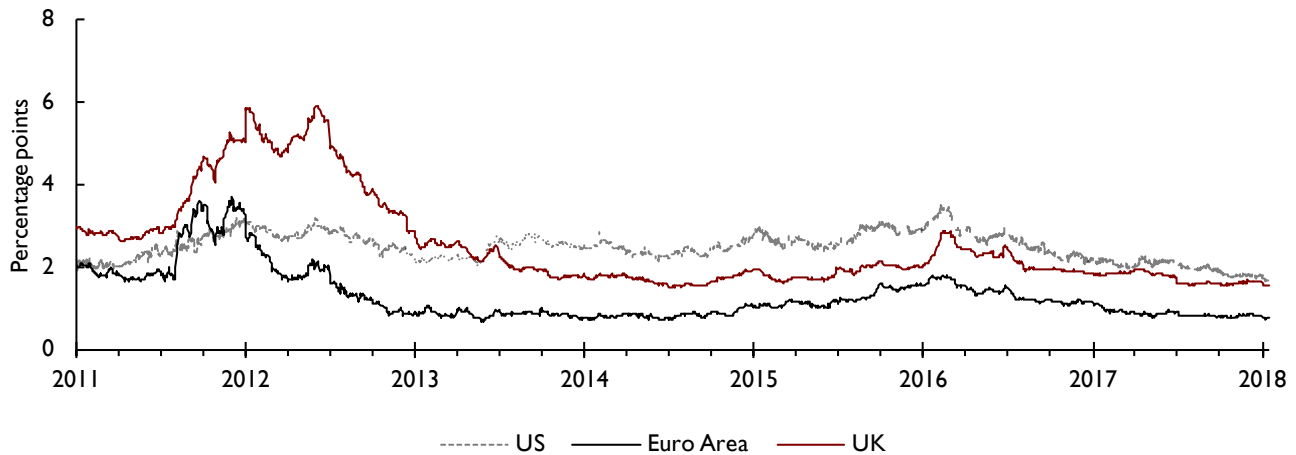
Source: Datastream and NIESR projections.

Figure A2. Spreads over 10-year German government bond yields



Source: Derived from Datastream series.

Figure A3. Corporate bond spreads. Spread between BAA corporate and 10-year government bond yields



Source: Derived from Datastream series.

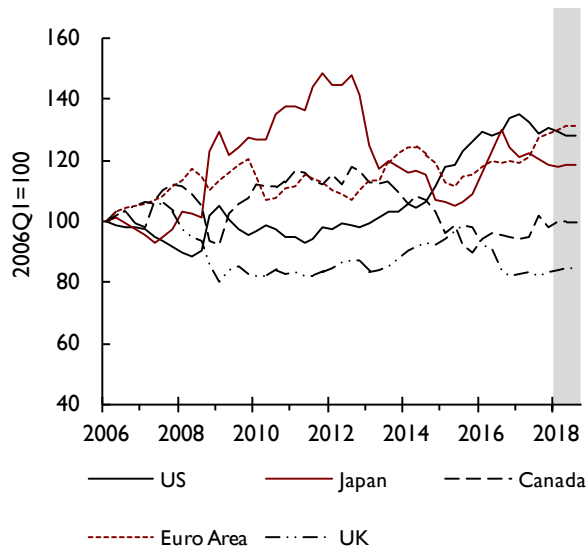
more volatile paths could emerge. Projected US yields are higher than implied market yields as a result of the assumed higher path for short-term interest rates than implied by market rates.

Sovereign risks in the Euro Area have been a major macroeconomic issue for the global economy and financial markets at times during the past five years. Figure A2 depicts the spread between 10-year

government bond yields of Spain, Italy, Portugal, Ireland and Greece over Germany's. Currently in our forecast, we have assumed that spreads over German bond yields continue to narrow slightly for Euro Area countries.

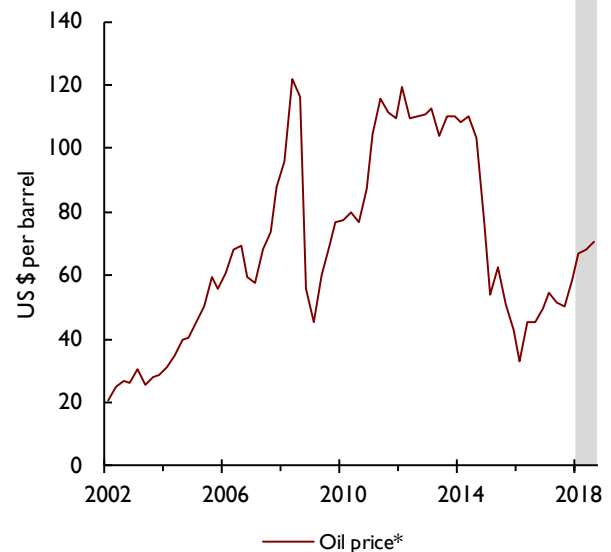
Figure A3 shows the spreads of corporate bond yields over government bond yields in the US, UK and Euro Area. This acts as a proxy for the margin between private sector and 'risk-free' borrowing costs. Corporate

Figure A4. Effective exchange rates



Source: NiGEM database and NIESR forecasts. Weights based on 2010 goods and services trade shares.

Figure A5. Oil prices

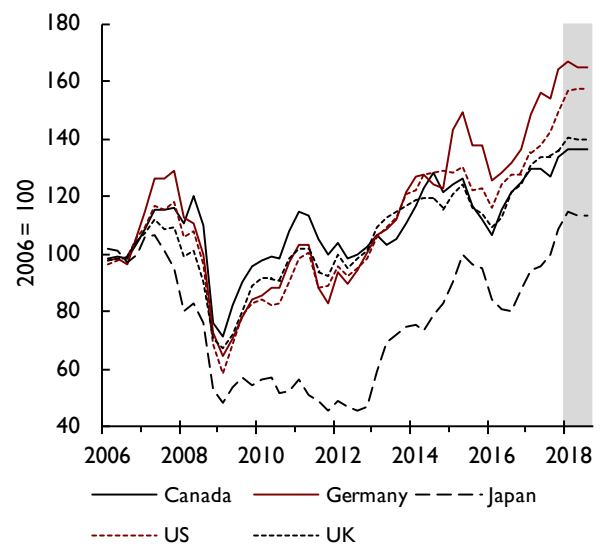


Source: NiGEM database and NIESR forecast.
Note: *Average of Dubai and Brent spot prices.

bond spreads widened at the beginning of 2016, but subsequently have narrowed somewhat barring the jump observed around the period of the UK's decision to leave the EU. Since the second half of 2016 corporate bond spreads in the US, UK and Euro Area had been on a slightly declining trend, as private sector borrowing costs have fallen more than the observed reduction in risk-free rates. Our forecast assumption for corporate spreads is that they gradually converge towards their long-term equilibrium level.

Nominal exchange rates against the US dollar are generally assumed to remain constant at the rate prevailing on 16 January 2018 until the end of September 2018. After that, they follow a backward-looking uncovered-interest parity condition, based on interest rate differentials relative to the US. Figure A4 plots the recent history as well as our short-term projections for the effective exchange rate indices for Canada, the Euro Area, Japan, UK, and the US. Between January and October 2017 the US dollar depreciated slightly, by about 1.2 per cent, in trade-weighted terms, and remained at about 8 per cent below the 14-year peak reached in late 2016. The euro continued to strengthen in the fourth quarter of 2017, gaining about 8 per cent in effective terms over the course of last year. Among the emerging market currencies, the largest movement in trade-weighted terms between the third and fourth quarter of 2017 has been the depreciation of the Turkish

Figure A6. Share prices



Source: NiGEM database and NIESR forecast.

lira (by about 8 per cent) partly reflecting unanchored inflation expectations.

Our oil price assumptions for the short term generally follow those of the US Energy Information

Table A3. Government revenue assumptions

	Average income tax rate (per cent) ^(a)			Effective corporate tax rate (per cent)			Gov't revenue (% of GDP) ^(b)		
	2017	2018	2019	2017	2018	2019	2017	2018	2019
Australia	15.3	15.5	15.2	25.7	25.7	25.7	33.3	32.6	32.4
Austria	31.0	30.8	30.5	21.8	21.8	21.8	42.3	41.5	40.8
Belgium	34.5	34.3	33.5	21.7	21.7	21.7	43.1	42.5	42.2
Canada	20.2	20.1	20.1	20.8	20.8	20.8	36.1	35.6	35.5
Denmark	34.0	34.0	33.6	17.9	17.9	17.9	43.9	44.3	44.9
Finland	33.5	32.6	31.3	23.1	23.1	23.1	46.1	45.7	44.8
France	31.6	31.6	31.5	32.7	31.7	30.1	45.3	45.2	44.9
Germany	29.7	29.7	29.4	19.4	19.4	19.4	41.0	40.8	40.3
Greece	22.7	22.3	21.3	13.5	13.5	13.5	41.0	38.8	37.5
Ireland	26.4	25.2	24.2	9.8	9.8	9.8	22.6	22.5	22.5
Italy	29.1	29.1	28.7	26.9	26.9	26.9	42.2	41.5	40.5
Japan	24.0	24.0	23.9	29.6	29.6	29.6	33.9	33.9	34.0
Netherlands	33.4	33.4	33.1	8.4	8.4	8.4	41.0	41.6	41.4
Portugal	22.4	22.4	22.2	20.1	20.1	20.1	38.7	37.9	37.7
Spain	24.9	24.9	24.7	16.4	16.4	16.4	37.4	36.8	36.3
Sweden	25.6	25.3	24.2	23.1	23.1	23.1	45.5	45.8	45.5
UK	22.0	21.9	22.0	12.3	12.1	12.1	36.9	36.6	36.5
US	19.4	19.0	18.7	29.0	23.3	24.3	29.8	29.0	28.9

Notes: (a) The average income tax rate is calculated as total income tax plus both employee and employer social security contributions as a share of personal income. (b) Revenue shares reflect NiGEM aggregates, which may differ from official government figures.

Table A4. Government spending assumptions^(a)

	Gov't spending excluding interest payments (% of GDP)			Gov't interest payments (% of GDP)			Deficit projected to fall below 3% of GDP ^(b)
	2017	2018	2019	2017	2018	2019	
Australia	33.2	32.5	32.0	1.6	1.6	1.5	–
Austria	41.0	40.4	40.0	1.8	1.5	1.3	–
Belgium	42.2	41.2	40.9	2.5	2.1	1.8	2015
Canada	34.2	34.0	33.9	2.8	2.7	2.7	–
Denmark	45.1	44.9	45.1	1.3	1.1	1.1	–
Finland	45.5	44.5	44.1	0.9	0.8	0.7	2015
France	46.5	46.2	45.8	1.7	1.4	1.3	2017
Germany	38.7	38.5	38.3	1.2	1.0	0.9	–
Greece	40.3	37.8	35.6	2.7	2.3	2.0	2016
Ireland	20.1	20.4	21.2	2.0	1.9	1.8	2015
Italy	40.3	39.8	39.1	3.5	2.8	2.3	2015
Japan	37.2	36.9	36.8	1.5	1.3	1.1	–
Netherlands	38.9	39.2	39.3	0.9	0.7	0.6	–
Portugal	36.5	36.3	36.0	3.9	3.6	3.3	2016
Spain	38.5	37.6	37.1	2.2	1.6	1.3	2018
Sweden	43.9	43.8	44.0	0.5	0.4	0.3	–
UK	34.5	34.1	33.3	2.1	2.2	2.2	2016
US	31.0	30.3	30.1	3.5	3.5	3.6	2024

Notes: (a) Expenditure shares reflect NiGEM aggregates, which may differ from official government figures. (b) The deficit in Australia, Austria, Canada, Denmark, Germany, Netherlands and Sweden is not expected to exceed 3 per cent of GDP within our forecast horizon. In Japan the deficit is not expected to fall below 3 per cent of GDP within our forecast horizon.

Administration (EIA), published in January 2018, and updated with daily spot price data available up to 16 January 2018. The EIA uses information from forward markets as well as an evaluation of supply conditions. As illustrated in figure A5, oil prices, in US dollar terms, increased by about 17 per cent between the third and fourth quarters of last year. Expectations of oil prices by the end of 2018 and 2019 are about 26 per cent higher, compared to the expectation three months ago, which still leaves oil prices about \$38 lower than their nominal level in mid-2014.

Our equity price assumptions for the US reflect the expected return on capital. Other equity markets are assumed to move in line with the US market, but are adjusted for different exchange rate movements and shifts in country-specific equity risk premia. Figure A6 illustrates the key equity price assumptions underlying our current forecast. Between the third and fourth quarters of 2017 equity prices in most countries continued their buoyant performance observed in the first half of the year. Among the advanced economies, the largest increase in stock market prices was in Japan, followed by Germany, Canada and the US.

Fiscal policy assumptions for 2018 follow announced policies as of 6 January 2018. Average personal sector tax rates and effective corporate tax rate assumptions underlying the projections are reported in table A3, while table A4 lists assumptions for government spending. Government spending is expected to continue to decline as a share of GDP between 2017 and 2018 in the majority of Euro Area countries reported in the table. A policy loosening relative to our current assumptions poses an upside risk to the short-term outlook in Europe. For a discussion of fiscal multipliers and the impact of fiscal policy on the macroeconomy based on NiGEM simulations, see Barrell *et al.* (2012).

NOTES

- 1 With the exception of Iceland and Israel.
- 2 Interest rate assumptions are based on information available for the period to 16 January 2018.

REFERENCE

Barrell, R., Holland, D. and Hurst, I. (2012), 'Fiscal multipliers and prospects for consolidation', *OECD Journal, Economic Studies*, pp. 71–102.