

**ECONOMICS DEPARTMENT  
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**Working Party No. 1 on Macroeconomic and Structural Policy Analysis**

**FINANCE AND INCLUSIVE GROWTH  
ANNEX 1. FINANCE AND ECONOMIC GROWTH IN OECD AND G20 COUNTRIES:  
SUPPLEMENTARY INFORMATION ON THE CHARACTERISTICS OF THE RELATIONSHIP**

*This document has been prepared for the meeting of Working Party No.1 on Macroeconomic and Structural Policy Analysis.*

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## ANNEX 1. FINANCE AND ECONOMIC GROWTH IN OECD AND G20 COUNTRIES: SUPPLEMENTARY INFORMATION ON THE CHARACTERISTICS OF THE RELATIONSHIP

### 1. Introduction and main findings

1. At its last meeting in February 2014, the Working Party discussed the report “The Role of the Financial Sector for Economic Growth in OECD and G20 Countries” (OECD, 2014). This annex complements the previous work on finance and GDP growth with additional robustness checks and supplementary results in light of the guidance provided by the Working Party. The highlights from the analysis are:

- *Different forms of finance have different links with GDP growth:*

Financial-sector credit to the non-financial private sector (henceforth called intermediated credit) has, at the margin, a tight negative link with GDP growth. By contrast, the relationship between stock market capitalisation and GDP growth is strong and positive. The associations between marginal changes in these two measures of finance and GDP growth hold relative to a country’s average level of finance and to its trend.

- *The empirical relationships between finance and GDP growth are very robust:*

The empirical results that intermediated credit has a negative and stock market capitalisation a positive link with GDP growth are very robust to a wide range of robustness checks. They continue to hold in specifications which instrument for finance with financial deregulation indicators, remove business-cycle fluctuations from GDP growth, and control for financial-crisis periods and innovation.

- *The quality of finance is an important determinant of GDP growth:*

Besides a larger quantity of intermediated credit, a lower quality of credit is also related with reduced GDP growth. The evidence from OECD (2014) and this annex suggests that improving borrower screening, shifting more finance from debt to equity and reallocating credit from credit by banks and to households to other types of credit would be conducive to higher GDP growth.

- *More finance is associated with higher GDP growth up to a threshold:*

The relationship between finance (intermediated credit and stock market capitalisation) and GDP growth varies across OECD and G20 countries. Expansions in intermediated credit from a very low level are associated with strong increases in GDP growth, but the link becomes negative for expansions from moderately high levels. Stock market expansions are generally associated with higher GDP growth, but above an elevated point the link becomes negative.

- *Many OECD countries are in the region where credit and GDP growth are negatively linked:*

The threshold at which the link of intermediated credit and stock market capitalisation with GDP growth turns negative in a statistically significant fashion is about 100% of GDP. In 2011, 21 OECD countries had intermediated credit that exceeded this level. By contrast, stock market capitalisation was above this threshold of 100% of GDP in only 8 OECD countries.

2. This annex first examines the overall association of three measures of finance with GDP growth: value added of finance, intermediated credit and stock market capitalisation. It then investigates the role of financial-crisis periods, business-cycle fluctuations, innovation and the quality of finance. The annex ends by exploring heterogeneities across countries and across levels of finance.

## **2. The overall relationship between finance and GDP growth**

3. Based on OLS regressions, OECD (2014) found a statistically significant negative relationship between the value added of finance and intermediated credit to the non-financial private sector and GDP per capita growth. In both cases, finance is defined to include deposit money banks and other financial institutions. This section recaps the most important results, complements them with new specifications and extends them to stock market capitalisation as an additional measure of finance. Control variables are gross fixed capital formation (the investment rate), the stock of human capital proxied by average years of schooling of the adult population and the growth rate of the working age population. Appendix A1 describes the main data sources.

4. The link between each measure of finance and GDP growth is estimated relative to a country's average level of finance and to its trend.<sup>1</sup> The specification without trends includes the natural logarithm of lagged real GDP to reduce the potential spurious correlation between the trend rise of finance and the trend decline of GDP growth in many countries. As OECD (2014) explained, the coefficient on finance needs to be interpreted as capturing the link between changes in the size of finance and changes in GDP growth in one country relative to others. Furthermore, the exogenous covariates, country and year fixed effects and country-specific linear time trends remove several sources of endogeneity. However, causality implications should not be drawn from the OLS regressions beyond this. Instrumental-variables regressions analyse the direction of causality between finance and GDP growth at the end of this section.

5. Changes in the value added of finance are negatively related with changes in GDP growth (Table 1). This is independent of whether the relationship is estimated relative to a country's average level of financial-sector value added or to its trend. The coefficient on value added is statistically significant when only country fixed effects are included (Column 1). It becomes insignificant with the standard control variables (Column 2). However, introducing year fixed effects increases the (absolute) size of the coefficient, and it turns again statistically significant (Column 3). The addition of country-specific linear time trends yields also a significant estimate (Column 4). This specification is taken to be the baseline, since it most strongly accounts for the concern that the negative coefficient is the result of a spurious correlation between the trend rise of finance and the trend decline of GDP growth.

6. More intermediated credit, defined as credit to the non-financial private sector by financial institutions, is also related with lower GDP growth (Table 2). Again, this negative relationship does not depend on whether it is estimated relative to a country's average level of intermediated credit or to its trend. The coefficient is statistically significant at the 95% confidence level or higher in all specifications: with country fixed effects (Column 1), after including the standard control variables (Column 2), with year fixed effects (Column 3), and with country-specific linear time trends in the sample of OECD countries (Column 4) and OECD and G20 countries (Column 5).

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1. As in OECD (2014), standard errors are clustered at the country-level in all specifications of this annex to account for heteroscedasticity and autocorrelation in the error term for observations from the same country.

**Table 1. The relationship between value added of finance and GDP growth per capita**

Dependent variable:	GDP growth per capita					
	(1)	(2)	(3)	(4)	(5)	(6)
Value added of finance	-0.377*** (0.075)	-0.060 (0.092)	-0.171** (0.066)	-0.261** (0.122)	-0.281** (0.123)	-0.242** (0.107)
Investment rate	-	0.207*** (0.049)	0.195*** (0.050)	0.188*** (0.046)	0.161*** (0.044)	0.179*** (0.050)
School years	-	0.538 (0.337)	-0.179 (0.255)	1.465* (0.799)	1.681** (0.810)	1.370* (0.725)
Population growth	-	-0.700*** (0.207)	-0.472** (0.178)	-0.198 (0.220)	-0.474* (0.244)	-0.223 (0.208)
ln(Lagged GDP per capita)	-	-4.474*** (1.234)	-3.645*** (1.227)	-	-	-
Banking crisis dummy	-	-	-	-	-	-1.205** (0.458)
Year fixed effects	No	No	Yes	Yes	Yes	Yes
Linear country trends	No	No	No	Yes	Yes	Yes
R-squared	0.162	0.251	0.555	0.592	0.510	0.601
Sample period	1970-2011	1970-2011	1970-2011	1970-2011	1970-2006	1970-2011
Observations	948	948	948	948	798	948

*Note:* All regressions are OLS and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. Value added of finance is financial and insurance activities divided by GDP, investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, and population growth is the growth rate of the population aged 15-64. The sample covers 32 OECD countries.

*Source:* OECD Secretariat calculations using OECD Structural Analysis database; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013); Laeven and Valencia (2012).

Table 2. The relationship between intermediated credit and GDP growth per capita

Dependent variable:	GDP growth per capita						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intermediated credit	-0.031*** (0.005)	-0.016** (0.006)	-0.021*** (0.006)	-0.029*** (0.008)	-0.034*** (0.011)	-0.031*** (0.010)	-0.019** (0.009)
Investment rate	-	0.191*** (0.039)	0.211*** (0.040)	0.245*** (0.043)	0.144 (0.095)	0.224*** (0.041)	0.254*** (0.051)
School years	-	0.375 (0.291)	-0.482* (0.246)	-0.008 (0.302)	0.653 (0.448)	0.179 (0.322)	0.222 (0.491)
Population growth	-	-0.476 (0.319)	-0.356 (0.263)	-0.674** (0.311)	-0.990*** (0.267)	-0.696** (0.330)	-0.710* (0.369)
ln(Lagged GDP per capita)	-	-2.661** (1.090)	-4.114*** (1.213)	-	-	-	-
Banking crisis dummy	-	-	-	-	-	-	-1.183** (0.466)
Year fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Linear country trends	No	No	No	Yes	Yes	Yes	Yes
R-squared	0.183	0.242	0.483	0.508	0.429	0.438	0.520
Sample period	1961-2011	1961-2011	1961-2011	1961-2011	1961-2011	1961-2006	1970-2011
Observations	1303	1260	1260	1260	1553	1111	1115

Note: All regressions are OLS and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. Intermediated credit is credit to the non-financial private sector by financial institutions divided by GDP, investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, and population growth is the growth rate of the population aged 15-64. The sample covers 33 OECD countries, apart from Column 5 which also includes the 8 non-OECD G20 countries.

Source: OECD Secretariat calculations using World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013); Laeven and Valencia (2012).

7. Greater stock market capitalisation exhibits a highly significant link with stronger GDP growth (Table 3), in stark contrast to the value added of finance and intermediated credit. This result holds relative to a country's average level of stock market capitalisation (Columns 1-3) and to its trend (Columns 4-5). According to the estimate in the baseline specification, an increase in stock market capitalisation by 10% of GDP is, at the margin in OECD countries, associated with a rise of GDP growth by 0.2 percentage points.

8. When the three measures of finance are simultaneously included in the baseline specification with country-specific linear time trends, intermediated credit is negatively and stock market capitalisation positively related with GDP growth (Table 4). The two coefficients are estimated with high precision, whereas that on the value added of finance, although negative, is statistically insignificant at conventional levels (Column 1).

9. In an additional analysis of the financial structure, the value added of finance (comprising finance and insurance and pension funding) is decomposed into: *i*) the value added of banking; *ii*) the value added of insurance and pension funding; and *iii*) the value added of auxiliary financial activities. Including these three components individually in the baseline specification yields negative coefficients for banking as well as insurance and pension funding and a positive coefficient for auxiliary financial activities (Column 2). The relative size of the coefficients does not reflect the large negative contribution of the value added of banking to the link between the overall value added of finance and GDP growth, since banking has a much larger value added than the other two sub-sectors. The empirical results in the two columns are broadly in line. Credit by banks and other financial institutions exhibits the tightest correlation with the value added of banking and the value added of insurance and pension funding. By contrast, stock market capitalisation is arguably most closely associated with the value added of auxiliary financial activities.

10. The regressions thus far have reported correlations between finance and GDP growth, conditional on exogenous covariates, country and year fixed effects and country-specific linear time trends. Taking the investigation one step further, OECD (2014) proposed and employed a novel empirical methodology to estimate the causal effect of finance on GDP growth. It exploits cross-country differences in financial regulation, reflected in the indicator by Abiad et al. (2010), as a plausible source of exogenous variation in the size of finance. The estimations, which control for year fixed effects and country-specific linear time trends, use the set of interaction terms between the financial regulation indicator and year dummies as instrumental variables. The identifying assumption is that financial deregulation has not been driven by policy responses to the GDP growth path.

11. The data indicate that causality runs from more intermediated credit to weaker GDP growth and from greater stock market capitalisation to stronger GDP growth (Table 5). The OLS estimate for the value added of finance switches signs and becomes insignificant in the instrumental-variables specification (Column 1). By contrast, the IV estimates for intermediated credit and stock market capitalisation are of the same sign as the OLS estimates and statistically significant at the 1% level, in the sample without (Columns 2 and 5) and with non-OECD G20 countries (Columns 3 and 6). The first stage of the instrumental-variables regression is strong with the value added of finance and intermediated credit; it is somewhat less strong with stock market capitalisation.

**Table 3. The relationship between stock market capitalisation and GDP growth per capita**

Dependent variable:	GDP growth per capita						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Stock market capitalisation	0.019*** (0.004)	0.034*** (0.005)	0.017*** (0.004)	0.018*** (0.005)	0.015*** (0.005)	0.021*** (0.007)	0.015*** (0.004)
Investment rate	-	0.275*** (0.060)	0.232*** (0.063)	0.277*** (0.074)	0.291*** (0.077)	0.216*** (0.076)	0.245*** (0.081)
School years	-	0.287 (0.400)	-0.209 (0.359)	0.874 (1.154)	1.658 (1.522)	0.215 (1.233)	0.588 (1.151)
Population growth	-	-0.982*** (0.265)	-0.623** (0.283)	-0.476 (0.393)	-0.610** (0.248)	-0.494 (0.471)	-0.467 (0.384)
ln(Lagged GDP per capita)	-	-8.296*** (1.435)	-7.107*** (2.024)	-	-	-	-
Banking crisis dummy	-	-	-	-	-	-	-1.207** (0.511)
Year fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Linear country trends	No	No	No	Yes	Yes	Yes	Yes
R-squared	0.162	0.346	0.572	0.596	0.562	0.499	0.605
Sample period	1989-2011	1989-2011	1989-2011	1989-2011	1989-2011	1989-2006	1989-2011
Observations	705	702	702	702	871	536	702

*Note:* All regressions are OLS and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. Stock market capitalisation is the value of all shares listed in a stock market divided by GDP, investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, and population growth is the growth rate of the population aged 15-64. The sample covers all OECD countries, apart from Column 5 which also includes the 8 non-OECD G20 countries.

*Source:* OECD Secretariat calculations using World Bank Global Financial Development database; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013); Laeven and Valencia (2012).



**Table 4. Supplementary evidence on the role of the structure of finance for the relationship with GDP growth**

Dependent variable:	GDP growth per capita	Dependent variable:	GDP growth per capita
	(1)		(2)
Value added of finance	-0.142 (0.140)	Value added of banking etc.	-0.219 (0.136)
Intermediated credit	-0.033*** (0.010)	Value added of insurance and pensions	-0.528 (0.363)
Stock market capitalisation	0.022*** (0.006)	Value added of auxiliary finance	0.966* (0.532)
Investment rate	0.299*** (0.077)	Investment rate	0.247*** (0.062)
School years	0.368 (1.008)	School years	1.826** (0.849)
Population growth	-0.560 (0.377)	Population growth	-0.527* (0.282)
Year fixed effects	Yes	Year fixed effects	Yes
Linear country trends	Yes	Linear country trends	Yes
R-squared	0.663	R-squared	0.664
Sample period	1989-2011	Sample period	1970-2011
Observations	620	Observations	592

*Note:* All regressions are OLS and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. On the left-hand side, value added of finance is financial and insurance activities divided by GDP, intermediated credit is credit to the non-financial private sector by financial institutions divided by GDP, and stock market capitalisation is the value of all shares listed in a stock market divided by GDP. On the right-hand side, value added of banking etc. is financial activities, except insurance and pension funding, divided by GDP: this item comprises banks and financial activities of holding companies, trusts, funds and similar financial entities. Value added of insurance and pensions is insurance and pension funding, except compulsory social security, divided by GDP: this item comprises the activities of life insurance, non-life insurance, reinsurance and pension funds. Value added of auxiliary finance is auxiliary financial activities divided by GDP: this item comprises the administration of financial markets, security and commodity contracts brokerage, risk and damage evaluation, and activities of insurance agents, brokers and fund managers. Investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, and population growth is the growth rate of the population aged 15-64. The sample covers 32 (Column 1) and 26 (Column 2) OECD countries.

*Source:* OECD Secretariat calculations using OECD Structural Analysis database; World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013).

Table 5. The causal effect of finance on GDP growth per capita

Dependent variable:	GDP growth per capita						
Measure of finance:	Value added of finance	Intermediated credit			Stock market capitalisation		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Measure of finance	0.548 (0.559)	-0.115*** (0.031)	-0.098*** (0.035)	-0.095** (0.040)	0.105*** (0.030)	0.086*** (0.031)	0.098*** (0.028)
Investment rate	0.116*** (0.038)	0.239*** (0.080)	0.277*** (0.066)	0.216*** (0.084)	0.118 (0.091)	0.221 (0.174)	0.067 (0.085)
School years	1.799** (0.837)	-0.211 (0.788)	0.423 (0.666)	0.038 (0.772)	0.509 (1.416)	0.285 (1.583)	0.290 (1.229)
Population growth	-0.574*** (0.200)	-0.500** (0.220)	-0.566** (0.229)	-0.514** (0.236)	-0.512 (0.628)	-0.470 (0.536)	-0.447 (0.626)
Banking crisis dummy	-	-	-	-0.779 (0.898)	-	-	-1.410* (0.830)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Linear country trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistics	74.20	76.38	24.82	15.19	5.25	2.24	4.83
Sample period	1973-2005	1973-2005	1973-2005	1973-2005	1989-2005	1989-2005	1989-2005
Observations	658	782	963	782	453	565	453

*Note:* All regressions are IV and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. Value added of finance is financial and insurance activities divided by GDP, intermediated credit is credit to the non-financial private sector by financial institutions divided by GDP, and stock market capitalisation is the value of all shares listed in a stock market divided by GDP. Investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, and population growth is the growth rate of the population aged 15-64. The estimations use the set of interaction terms between the financial regulation indicator by Abiad et al. (2010) and year dummies as instrumental variables for the measure of finance. The first-stage F-statistics are those on the instruments in the (otherwise not shown) first stage. The sample covers 28-29 OECD countries, apart from Columns 3 and 6 which also include 7 non-OECD G20 countries.

*Source:* OECD Secretariat calculations using OECD Structural Analysis database; World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; Abiad et al. (2010); World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013); Laeven and Valencia (2012).

### 3. The role of financial crises, the business cycle, innovation and the quality of finance

12. This section examines the role of financial-crisis periods, business-cycle fluctuations, housing investment, innovation, the quality of finance and the labour share for the finance and growth relationships.

13. For each measure of finance, two tests are conducted to study the role of financial-crisis periods (Tables 1-3): the sample period is restricted up to 2006, before the global financial crisis, and financial-crisis periods are controlled for with the indicator of Laeven and Valencia (2012). The estimates from the baseline specification in Column 4 remain statistically significant when the sample period is restricted up to 2006 (Column 5 in Table 1 and Column 6 in Tables 2-3) and when the financial-crisis dummy is introduced (Column 6 in Table 1 and Column 7 in Tables 2-3). The size of the coefficients is generally not very sensitive to these checks, perhaps with the exception of intermediated credit where the coefficient falls by about one third when financial crises are controlled for. Financial crises themselves are negatively related with GDP growth. The results for intermediated credit and stock market capitalisation in the instrumental-variables specification are robust to the inclusion of the financial-crisis indicator (Columns 4 and 7 in Table 5).

14. The relationships between finance and GDP growth remain similar when using alternative measures for GDP to isolate the structural growth path. This confirms that the associations between finance and growth estimated in Tables 1-3 are not primarily related to business-cycle fluctuations.

- In a first robustness check, potential GDP is substituted for actual GDP (Table 6). Regressions are run relative to levels (Columns 1, 3 and 5) and to trends (Columns 2, 4 and 6). The coefficients are smaller in absolute value than when using actual GDP, but remain statistically significant apart from the value added of finance.
- In a second robustness check, five-year averages are calculated for all variables (Table 7) as in many papers studying the finance-growth link including Beck et al. (2000), Rousseau and Wachtel (2011), Arcand et al. (2012) and Law and Singh (2014). The five-year averaging seriously reduces the number of observations. Regressions are run without year fixed effects (Columns 1, 3 and 5) and with them (Columns 2, 4 and 6). The coefficients are very close to those when using actual GDP and are of similar statistical significance, again apart from the value added of finance.

15. Empirical evidence indicates that one source of the negative link between intermediated credit and GDP growth is that more intermediated credit is associated with an inefficiently high level of housing investment. The average share of housing investment in total investment is 24% in OECD countries. When the investment share of housing is regressed on intermediated credit, as well as country and year fixed effects, the coefficient on intermediated credit is positive and statistically significant at the 10% level.<sup>2</sup> A rise of intermediated credit by 10% of GDP is related with an increase in the share of housing investment in total investment by 0.4 percentage points.

16. No evidence is detected that innovation changes the estimated relationships of finance with GDP growth (Table 8). Two measures for innovation, common in the literature, are used: the natural logarithm of patent applications (Columns 1, 3 and 6) and business R&D expenditure relative to GDP (Columns 2, 4 and 7). Fewer observations are available for R&D expenditure, which likely explains the lower significance of the R&D results for the value added of finance and stock market capitalisation. Innovation is itself not linked with GDP growth in most specifications.

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2. Regressing the share of housing investment in total investment on intermediated credit (% of GDP), plus country and year fixed effects, yields a coefficient of 0.039 (when both are expressed as percentages) and a p-value of 0.088 (clustering the standard errors by country). The number of observations is 1253 and the R-squared 0.701.

Table 6. The relationship between finance and growth of potential GDP per capita

Dependent variable: Measure of finance:	Growth of potential GDP per capita					
	Value added of finance		Intermediated credit		Stock market capitalisation	
	(1)	(2)	(3)	(4)	(5)	(6)
Measure of finance	-0.060 (0.053)	-0.072 (0.049)	-0.010* (0.006)	-0.019** (0.007)	0.008** (0.003)	0.008** (0.003)
Investment rate	0.094** (0.039)	0.115*** (0.032)	0.121*** (0.034)	0.107*** (0.035)	0.117** (0.053)	0.132*** (0.036)
School years	-0.115 (0.164)	0.745 (0.475)	-0.249 (0.176)	0.448 (0.351)	-0.088 (0.256)	0.024 (0.434)
Population growth	0.108 (0.256)	0.023 (0.289)	0.175 (0.264)	0.095 (0.301)	-0.402 (0.266)	-0.395 (0.253)
ln(Lagged potential GDP per capita)	-2.311*** (0.817)	-	-1.149 (0.864)	-	-3.858* (2.249)	-
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Linear country trends	No	Yes	No	Yes	No	Yes
R-squared	0.716	0.829	0.658	0.790	0.706	0.889
Sample period	1970-2008	1970-2008	1967-2008	1967-2008	1989-2008	1989-2008
Observations	784	784	874	874	553	553

Note: All regressions are OLS and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. Value added of finance is financial and insurance activities divided by GDP, intermediated credit is credit to the non-financial private sector by financial institutions divided by GDP, and stock market capitalisation is the value of all shares listed in a stock market divided by GDP. Investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, and population growth is the growth rate of the population aged 15-64. The sample covers 29-30 OECD countries.

Source: OECD Secretariat calculations using OECD Structural Analysis database; World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; OECD Economic Outlook database; Barro and Lee (2013); World Bank World Development Indicators database.

Table 7. The relationship between finance and GDP growth per capita using five-year averages

Dependent variable: Measure of finance:	GDP growth per capita					
	Value added of finance		Intermediated credit		Stock market capitalisation	
	(1)	(2)	(3)	(4)	(5)	(6)
Measure of finance	-0.113 (0.111)	-0.136 (0.101)	-0.017*** (0.005)	-0.019*** (0.006)	0.029*** (0.009)	0.020** (0.009)
Investment rate	0.140** (0.055)	0.104 (0.066)	0.109*** (0.034)	0.131*** (0.047)	0.078 (0.104)	0.038 (0.103)
School years	0.180 (0.300)	-0.116 (0.238)	0.029 (0.237)	-0.448* (0.226)	-0.132 (0.374)	0.036 (0.391)
Population growth	-0.611* (0.304)	-0.204 (0.276)	-0.118 (0.333)	0.025 (0.281)	-0.679 (0.485)	-0.381 (0.456)
ln(Lagged GDP per capita)	-3.048** (1.380)	-1.916 (1.293)	-1.288 (0.926)	-2.029* (1.067)	-7.059*** (2.083)	-3.774 (3.243)
Year fixed effects	No	Yes	No	Yes	No	Yes
Linear country trends	No	No	No	No	No	No
R-squared	0.505	0.662	0.516	0.652	0.577	0.672
Sample period	1971-2010	1971-2010	1961-2010	1961-2010	1991-2010	1991-2010
Observations	174	174	238	238	120	120

Note: All regressions are OLS and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. Value added of finance is financial and insurance activities divided by GDP, intermediated credit is credit to the non-financial private sector by financial institutions divided by GDP, and stock market capitalisation is the value of all shares listed in a stock market divided by GDP. Investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, and population growth is the growth rate of the population aged 15-64. The sample covers 29-30 OECD countries.

Source: OECD Secretariat calculations using OECD Structural Analysis database; World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; OECD Economic Outlook database; Barro and Lee (2013); World Bank World Development Indicators database.

Table 8. The role of innovation and the quality of finance for the finance and growth relationship

Dependent variable: Measure of finance:	GDP growth per capita						
	Value added of finance		Intermediated credit			Stock market capitalisation	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Measure of finance	-0.257** (0.121)	-0.223 (0.284)	-0.034*** (0.009)	-0.062*** (0.017)	-0.040** (0.016)	0.018*** (0.005)	0.019* (0.009)
Investment rate	0.184*** (0.058)	0.221* (0.111)	0.282*** (0.061)	0.230* (0.119)	0.367*** (0.106)	0.275*** (0.074)	0.284** (0.129)
School years	1.664 (1.021)	1.663 (1.303)	0.233 (0.808)	-0.416 (1.074)	0.760 (1.013)	0.816 (1.162)	1.586 (1.364)
Population growth	-0.255 (0.236)	-1.021** (0.379)	-0.235 (0.213)	-0.863* (0.487)	-0.579 (0.616)	-0.462 (0.393)	-0.484 (0.589)
ln(Patents)	0.240 (0.307)	-	0.112 (0.271)	-	-	-0.147 (0.535)	-
R&D expenditure	-	4.720** (2.186)	-	1.244 (1.686)	-	-	0.997 (1.955)
Non-performing loans	-	-	-	-	-0.147*** (0.040)	-	-
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Linear country trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.591	0.644	0.534	0.662	0.725	0.597	0.649
Sample period	1977-2011	1987-2011	1977-2011	1987-2011	1998-2011	1989-2011	1989-2011
Observations	861	372	956	389	414	701	383

Note: All regressions are OLS and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country-level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. Value added of finance is financial and insurance activities divided by GDP, intermediated credit is credit to the non-financial private sector by financial institutions divided by GDP, and stock market capitalisation is the value of all shares listed in a stock market divided by GDP. Investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, and population growth is the growth rate of the population aged 15-64. ln(Patents) is the natural logarithm of patent applications in the applicant's country of residence, R&D expenditure is business enterprise R&D expenditure divided by GDP, and non-performing loans is the ratio of defaulting loans to total gross loans for banks. The sample covers OECD countries.

Source: OECD Secretariat calculations using OECD Structural Analysis database; World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013); OECD Patent database; OECD Analytical Business Enterprise Research and Development database.

17. Besides the quantity of finance, the quality of finance also has an important association with GDP growth. Nevertheless, approximating the quality of finance by the share of non-performing loans in total loans does not materially affect the estimated relationship between intermediated credit and GDP growth (Column 5). This suggests a negative influence of high levels of intermediated credit on GDP growth beyond the lower average quality which they may entail. The quality of lending is itself positively related with growth.

18. Further insights about the role of the quality of finance can be drawn from an analysis of the structure of finance in this annex and OECD (2014). The twin findings of a negative link between debt finance and GDP growth and of a positive link between equity finance and GDP growth imply that shifting finance from debt to equity, while holding its overall amount constant, would raise GDP growth. Similarly, the result of a particularly tight negative link for credit by banks and to households with growth suggests that a reallocation of lending to other types of credit would promote growth. This is in line with other recent empirical evidence showing that market-based financial systems are more conducive to growth and innovation than bank-based ones (European Systemic Risk Board, 2014; Gambacorta et al., 2014; Hsu et al., 2014).

19. Finally, the results are robust to controlling for the capital share in total income (Table 9). This is to address the concern that the negative link of financial-sector value added and intermediated credit with GDP growth is simply capturing that growth slows down after a lot of capital has been accumulated. The inclusion of the labour share reduces the sample size substantially. Nonetheless, size and significance of the coefficient of interest do not change materially in the baseline regressions when the labour share is not controlled for but the sample restricted to observations for which the labour share is available (Columns 1, 3 and 5). When the labour share is controlled for, the results are very similar. The labour share is itself negatively (statistically significant at the 1% level) related with GDP growth (Columns 2, 4 and 6). This indicates that, contrary to what was conjectured, a higher capital stock actually promotes long-term growth.

**Table 9. The role of the labour share for the finance and growth relationship**

<b>Dependent variable:</b> <b>Measure of finance:</b>	<b>GDP growth per capita</b>					
	<b>Value added of finance</b>		<b>Intermediated credit</b>		<b>Stock market capitalisation</b>	
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>
Measure of finance	-0.284** (0.132)	-0.297** (0.108)	-0.034*** (0.008)	-0.036*** (0.007)	0.020** (0.008)	0.015* (0.008)
Investment rate	0.124*** (0.038)	0.173*** (0.052)	0.162*** (0.043)	0.204*** (0.047)	0.145* (0.072)	0.212*** (0.071)
School years	1.391* (0.762)	0.987 (0.712)	-0.045 (0.455)	-0.321 (0.399)	0.154 (1.216)	-0.368 (1.302)
Population growth	-0.022 (0.223)	0.113 (0.280)	-0.981* (0.533)	-0.803 (0.494)	-0.135 (0.407)	-0.068 (0.427)
Labour share	-	-0.197*** (0.057)	-	-0.187*** (0.048)	-	-0.338*** (0.098)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Linear country trends	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.608	0.626	0.614	0.631	0.677	0.711
Sample period	1970-2010	1970-2010	1961-2010	1961-2010	1989-2010	1989-2010
Observations	700	700	782	782	464	464

*Note:* All regressions are OLS and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country-level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. Value added of finance is financial and insurance activities divided by GDP, intermediated credit is credit to the non-financial private sector by financial institutions divided by GDP, and stock market capitalisation is the value of all shares listed in a stock market divided by GDP. Investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, population growth is the growth rate of the population aged 15-64, and labour share is labour compensation divided by GDP. The sample covers OECD countries.

*Source:* OECD Secretariat calculations using OECD Structural Analysis database; World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; OECD Economic Outlook database; Barro and Lee (2013); World Bank World Development Indicators database; EU-KLEMS database; WORLD-KLEMS database.



#### 4. Heterogeneities in the finance and growth relationship

20. Allowing for differences in the finance and growth relationship between countries shows that the country-specific coefficients mostly have the same sign as the average estimates (Table 10). The baseline specification with country-specific linear time trends in Column 4 of Table 1 and Column 5 of Tables 2-3 is modified by interacting the measure of finance with a set of country fixed effects. One notable finding is that the association between intermediated credit and GDP growth is significantly negative for 26 of the 42 OECD and G20 countries (Column 2). Chile, India, South Africa and Turkey – four countries characterised by comparatively low levels of economic development over the sample period – are the only ones with a significantly positive link.

21. No evidence is found of a quadratic relationship with GDP growth for the value added of finance and intermediated credit (Table 11). Re-running the regressions in Columns 2 and 3 of Tables 1 and 2 (excluding and including year fixed effects) with the squared value of the measure of finance yields estimates on the quadratic term that are clearly insignificant (Columns 1-4). By contrast, testing for such non-linearities reveals a hump-shaped association between stock market capitalisation and GDP growth. Their correlation becomes negative beyond a certain level of stock market capitalisation (Columns 5 and 6). However, the maximum is at about 210% of GDP which only Luxembourg and Switzerland exceeded several times over the sample period.

**Table 10. The finance and growth relationships for individual OECD and G20 countries**

Measure of finance:	Value added of finance (1)	Intermediated credit (2)	Stock market capitalisation (3)
Argentina	.	--	--
Australia	-	-	--
Austria	--	+	++
Belgium	-	-	+
Brazil	.	+	++
Canada	++	--	++
Chile	+	++	-
China	.	--	++
Czech Republic	-	--	++
Denmark	-	--	+
Estonia	--	--	++
Finland	-	--	++
France	+	-	+
Germany	--	-	+
Greece	--	--	++
Hungary	--	--	+
Iceland	-	+	+
India	.	++	-
Indonesia	.	--	--
Ireland	--	--	-
Israel	.	--	++
Italy	-	--	+
Japan	+	--	++
Korea	--	-	++
Luxembourg	--	--	++
Mexico	--	-	+
Netherlands	--	-	+
New Zealand	--	-	++
Norway	--	--	--
Poland	--	--	+
Portugal	++	--	++
Russian Federation	.	--	++
Saudi Arabia	.	--	++
Slovak Republic	++	--	++
Slovenia	--	--	++
South Africa	.	++	-
Spain	++	--	+
Sweden	--	--	++
Switzerland	+	--	++
Turkey	.	++	--
United Kingdom	--	--	++
United States	-	-	+

*Note:* Entries indicate the sign of the coefficient in a regression of GDP growth per capita on the measure of finance. One sign indicates no significance at the 10% level, two signs (++)/-) significance at the 10% level, and . means no observation is available. Value added of finance is financial and insurance activities divided by GDP, intermediated credit is credit to the non-financial private sector by financial institutions divided by GDP, and stock market capitalisation is the value of all shares listed in a stock market divided by GDP. The specification, control variables and sample are the same as in Column 4 of Table 1 and Column 5 of Tables 2-3. In each case, the measure of finance is interacted with a set of country fixed effects to allow for cross-country heterogeneity in the finance and growth relationship.

*Source:* OECD Secretariat calculations using OECD Structural Analysis database; World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013).

Table 11. Testing for a quadratic relationship between finance and GDP growth

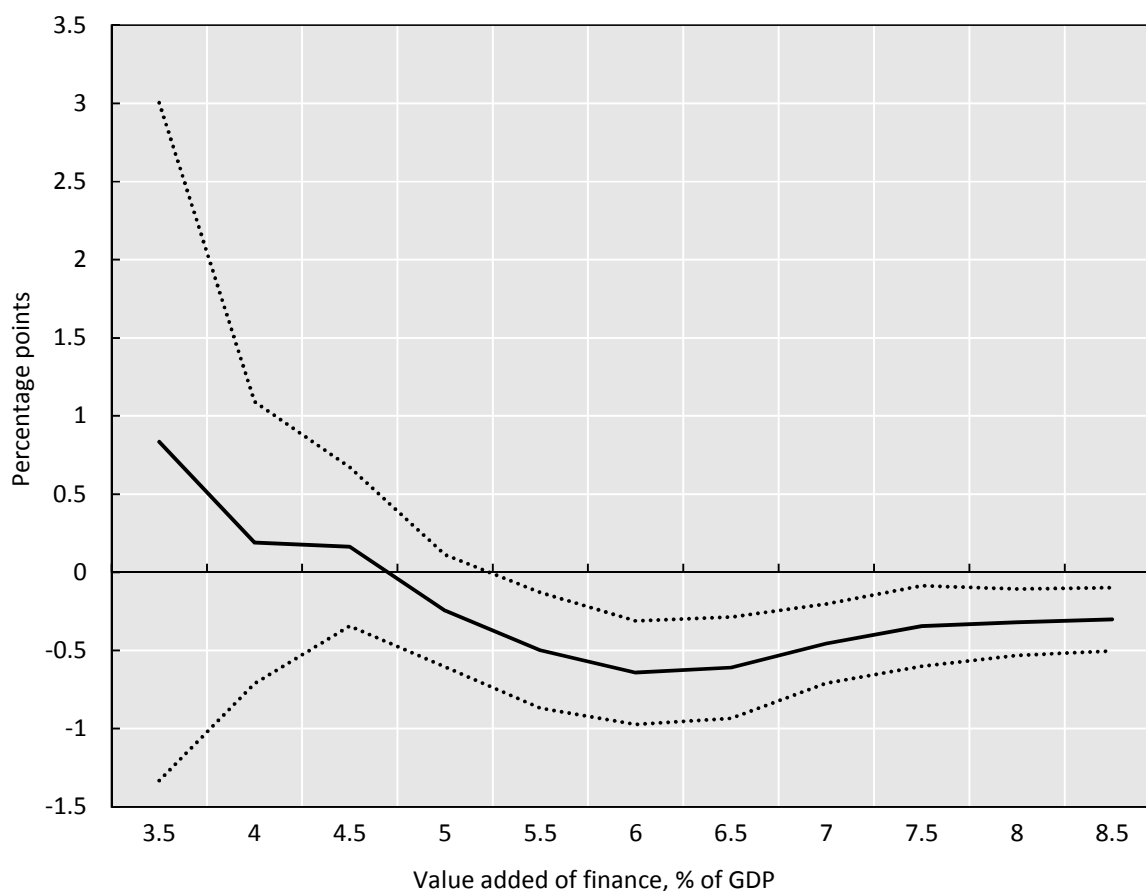
Dependent variable: Measure of finance:	GDP growth per capita					
	Value added of finance		Intermediated credit		Stock market capitalisation	
	(1)	(2)	(3)	(4)	(5)	(6)
Measure of finance	-0.161 (0.174)	-0.232* (0.127)	-0.004 (0.016)	-0.020 (0.013)	0.077*** (0.012)	0.043*** (0.011)
(Measure of finance) <sup>2</sup>	0.004 (0.004)	0.002 (0.003)	-0.00005 (0.00006)	0.000004 (0.00004)	-0.0002*** (0.00004)	-0.0001** (0.00004)
Investment rate	0.208*** (0.049)	0.198*** (0.051)	0.194*** (0.039)	0.211*** (0.039)	0.222*** (0.059)	0.204*** (0.063)
School years	0.532 (0.339)	-0.188 (0.256)	0.377 (0.286)	-0.480* (0.243)	0.011 (0.392)	-0.356 (0.371)
Population growth	-0.742*** (0.217)	-0.496** (0.184)	-0.486 (0.318)	-0.357 (0.261)	-0.918*** (0.297)	-0.598* (0.298)
ln(Lagged GDP per capita)	-4.385*** (1.246)	-3.620*** (1.244)	-2.835** (1.077)	-4.121*** (1.186)	-9.190*** (1.490)	-7.805*** (2.022)
Year fixed effects	No	Yes	No	Yes	No	Yes
Linear country trends	No	No	No	No	No	No
R-squared	0.251	0.555	0.243	0.483	0.370	0.580
Sample period	1970-2011	1970-2011	1961-2011	1961-2011	1989-2011	1989-2011
Observations	948	948	1260	1260	702	702

Note: All regressions are OLS and contain country fixed effects. Standard errors, which are shown in brackets, are clustered at the country level. \*\*\* indicates significance at the 1% level, \*\* at the 5% level and \* at the 10% level. Value added of finance is financial and insurance activities divided by GDP, intermediated credit is credit to the non-financial private sector by financial institutions divided by GDP, and stock market capitalisation is the value of all shares listed in a stock market divided by GDP. Investment rate is gross fixed capital formation divided by GDP, school years is average years of schooling in the population aged 25 and over, and population growth is the growth rate of the population aged 15-64. The sample covers 29-30 OECD countries.

Source: OECD Secretariat calculations using OECD Structural Analysis database; World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013).

22. To further investigate the role of the level of finance for the finance and growth relationship, multiple regressions (in the specification without country-specific linear time trends) are run consecutively including observations with higher levels of value added (Figure 1). Along the horizontal axis the number of observations and also the average level for the value added of finance increase. As the value added of finance increases, the point estimate converges to the average estimate identified in Column 3 of Table 1. The link between the value added of finance and GDP growth is positive for low levels of value added, but not in a statistically significant fashion (as indicated by the endpoints of the 90% confidence interval). The point estimate becomes negative and significant at 5-6% of GDP. The variations of the point estimate at rather high levels of financial-sector value added are affected by extreme observations from international financial centres.

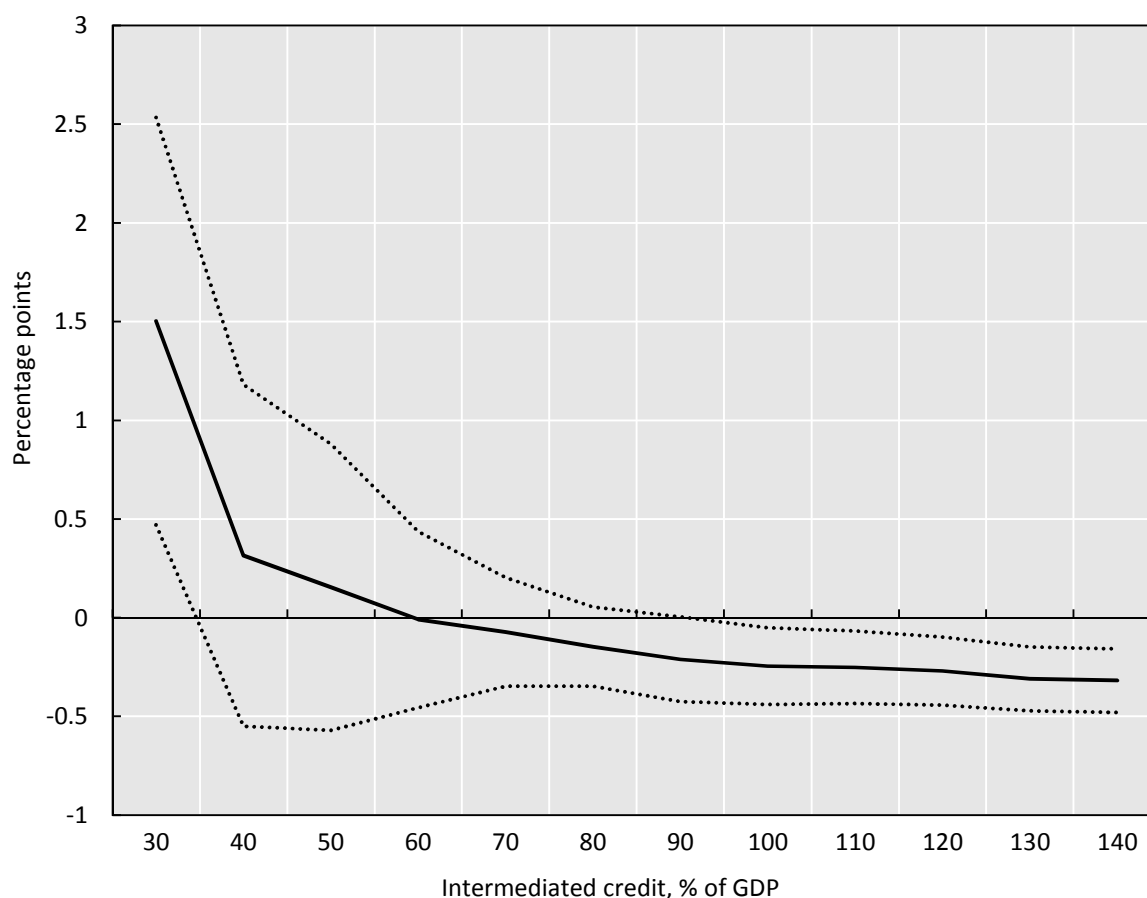
**Figure 1. The increasingly more negative association between value added of finance and GDP growth**



Note: Value added of finance is financial and insurance activities. Estimates are obtained by consecutively including observations with higher levels of value added of finance in Column 3 of Table 1. The dotted lines represent the 90% confidence band. The sample covers 32 OECD countries.

Source: OECD Secretariat calculations using OECD Structural Analysis database; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013).

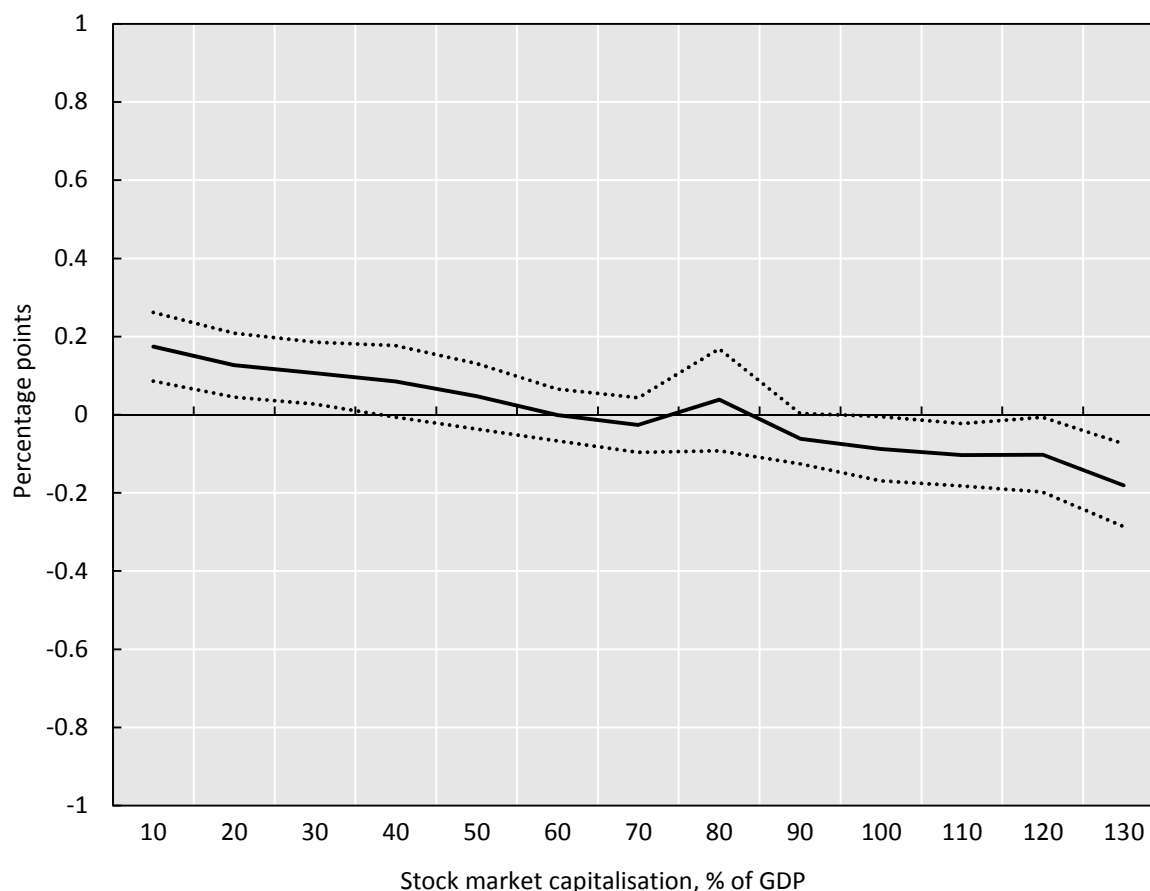
23. The same exercise is conducted for intermediated credit (Figure 2). At low levels of credit, the link with GDP growth is statistically significant, positive and large. The coefficient then becomes statistically insignificant, and beyond 100% of GDP intermediated credit exhibits a significantly negative association with GDP growth at the margin. The point estimate continues to decline with rising credit intermediation. The findings are broadly consistent with other recent research (Arcand et al., 2012; Cecchetti and Kharroubi, 2012; Beck et al., 2014; Law and Singh, 2014). In larger samples of advanced, middle-income and developing countries, these studies identify a threshold for intermediated credit of 90-100% of GDP above which its relationship with GDP growth is negative.

**Figure 2. The increasingly more negative association between intermediated credit and GDP growth**

*Note:* Intermediated credit is credit to the non-financial private sector by financial institutions. Estimates are obtained by consecutively including observations with higher levels of intermediated credit in Column 3 of Table 2. The dotted lines represent the 90% confidence band. The sample covers 33 OECD countries.

*Source:* OECD Secretariat calculations using World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013).

24. Similarly, very high stock market capitalisation exhibits a negative link with GDP growth at the margin (Figure 3), even though their relationship over the full sample is positive. The consecutive inclusion of observations with lower levels of stock market capitalisation continuously increases the coefficient. The estimate turns statistically insignificant (at the 10% level) at 100% of GDP. This is lower than the peak identified in the regression with the squared value of stock market capitalisation in Column 6 of Table 11. Restricting the sample to observations with high levels of stock market capitalisation enables a much more precise characterisation of the finance and growth relationship in this region of financial development.

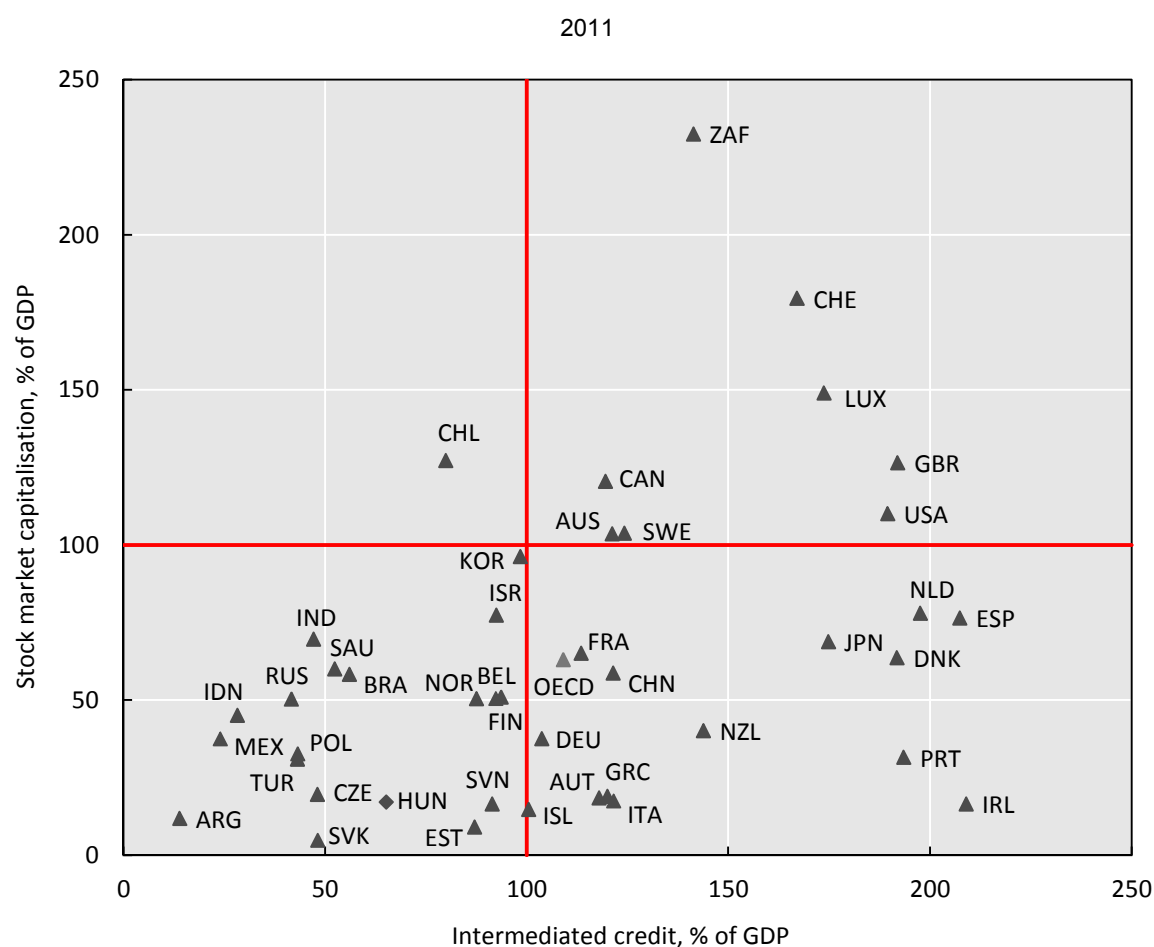
**Figure 3. The increasingly less positive association between stock market capitalisation and GDP growth**

*Note:* Stock market capitalisation is the value of all shares listed in a stock market. Estimates are obtained by consecutively including observations with lower levels of stock market capitalisation in Column 3 of Table 3. The dotted lines represent the 90% confidence band. The sample covers all OECD countries.

*Source:* OECD Secretariat calculations using World Bank Global Financial Development database; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013).

25. In 2011, intermediated credit and at the same time stock market capitalisation exceeded their respective thresholds in one fifth of OECD countries (Figure 4). A majority of countries had intermediated credit in excess of 100% of GDP, the level where its relationship with GDP growth becomes statistically significant and negative. Intermediated credit was below 100% of GDP only in Mexico, Turkey, Poland, the Czech Republic, the Slovak Republic, Hungary, Chile, Estonia, Slovenia, Belgium, Israel, Finland and Korea. Six of the eight non-OECD G20 countries had intermediated credit of less than 100% of GDP; the exceptions were China and South Africa. By contrast, stock market capitalisation was greater than 100% of GDP (the level where its link with GDP growth becomes statistically significant and negative) only in Australia, Sweden, the United States, Canada, the United Kingdom, Chile, Luxembourg, Switzerland and, among the non-OECD G20 countries, in South Africa. These differences between the two measures of finance indicate why the coefficient for the full-sample association at the margin is negative with intermediated credit and positive with stock market capitalisation. Overall, eight OECD and G20 countries are classified to have had growth-reducing levels of both intermediated credit and stock market capitalisation in 2011: Australia, Canada, Luxembourg, South Africa, Sweden, Switzerland, the United Kingdom and the United States.

**Figure 4. OECD and G20 countries relative to the thresholds for intermediated credit and stock market capitalisation**



*Note:* Intermediated credit is credit to the non-financial private sector by financial institutions, and stock market capitalisation is the value of all shares listed in a stock market. The vertical line indicates the threshold above which intermediated credit has a negative relationship, statistically significant at the 10% level, with GDP growth in Figure 2. The horizontal line indicates the threshold above which stock market capitalisation has a negative relationship, statistically significant at the 10% level, with GDP growth in Figure 3. OECD is the simple average of OECD countries. For New Zealand, the data point is for 2010.

*Source:* OECD Secretariat calculations using World Bank Global Financial Development database; Bank for International Settlements credit series; Statistics Canada; World Bank World Development Indicators database; OECD Economic Outlook database; Barro and Lee (2013).

## APPENDIX A1. DATA SOURCES

26. The main data sources used in this annex are: OECD Structural Analysis database for the value added of finance; World Bank Global Financial Development database for intermediated credit and stock market capitalisation; World Bank World Development Indicators database for GDP growth per capita, the investment rate in non-OECD G20 countries and population growth; OECD Economic Outlook database for the investment rate in OECD countries and growth of potential GDP per capita; and Barro and Lee (2013) for average years of schooling. Intermediated credit from the World Bank Global Financial Development database exhibits apparent breaks for Canada and Denmark. The data for Denmark are replaced by the credit series from the Bank for International Settlements (BIS). The difference in their definition is that the data from the World Bank refer to deposit money banks and other financial institutions (Čihák et al., 2012) and the data from the BIS to deposit money banks only (Dembiermont et al., 2013). The data for Canada are replaced by credit data from Statistics Canada. The BIS series was not used for Canada because it does not include credit provided by other financial institutions which makes up a substantial proportion of overall intermediated credit in Canada. The choice of the data source does not affect the regression results in a material way, as can be seen when the estimates in the present annex are compared with those in OECD (2014) which does not make these replacements.



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