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Public investment for sustainable growth – managing subnational risks

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1 THE CONTEXT

The new global emphasis on public infrastructure for connectivity builds on the declarations of the UN Sustainable Development Agenda, and most recently the Belt and Road Initiative that seeks to connect global economies and recreate old trading links and generate new ones. Infrastructure also holds the key to addressing the Middle-Income Trap, along with education and innovation. Yet, there is considerable evidence from the EU, Latin America and China to show that while the advantages of connectivity investment are significant and necessary, in isolation these are far from sufficient in ensuring more inclusive and sustainable outcomes.

Sustainable growth involves private investments that are channeled to the most promising and productive activities. Of course, firms respond to price signals, but with imperfect or incomplete information, tend to reinforce existing profit centers where the jobs tend to be concentrated (London, Barcelona, Milan, Shanghai, Guangzhou-Shenzhen, Santiago de Chile), typically resulting in increasing inequality, congestion and pollution. The resulting conurbations attract migrants, and in large metropolitan areas in Latin America and South Asia, there is a sharp increase in informality that leads to incentives for cheating that result in low productivity (see Levy, 2008). Regional connectivity may not always result in a more equal or level playing field and in the cases mentioned above may have exacerbated imbalances and inequalities. As seen in the UK, which has experienced a strong recovery since the 2008 crisis, the Brexit vote suggests that there may be a political backlash if employment and income generation, or adjustment costs, are not more evenly distributed.

In this paper, we argue that a combination of instruments is likely to be needed at both national and local levels, including tax handles, and full information, particularly involving liabilities within an intertemporal framework, to ensure sustainable and inclusive development. Since most of the policies are implemented at the sub-national level, local financing, institutions and incentives affect the possibility of creating new "growth hubs" or clean and efficient cities that are needed for sustainable growth. We draw on evidence from the EU, China and Chile, which is considered by the IFIs as one of the leading countries as far as investment management is concerned. We also use empirical illustrations based on the theory of reform applied to the Chilean case to illustrate how to improve on the investment allocations that are already praised as arms-length by the Bretton Woods Institutions, to develop a sustainable growth strategy that also addresses the middle-income trap. This has wider applications in Europe, and China, and in the implementation of the Belt and Road Initiative.

2 SOME EU EXAMPLES

The role that public investment may have in encouraging cross-border and regional connectivity has long been a focus of EU policy. Structural funds have been used to finance transport links – including in Motorways and High Speed rail links. This is to facilitate the encouragement of private sector investment and activities to generate employment opportunities.

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One of the main components of a sustainable development strategy is based on clean new cities, or revamped older cities, at some distance from the existing metropolitan hubs. As the EC experience shows, connectivity is necessary but not sufficient in creating hubs.

The UK has some of the best connectivity in Europe, with North-South train and motorway links, as well as international airports. However, as the recent Eurostat report shows, this has not been sufficient to prevent the highest inequality among European cities – by far exceeding that in any other country on the Continent. The connectivity only increased the migratory pressures towards the capital, London. It also explains the Brexit vote in England and Wales, except for London which benefitted from and voted overwhelmingly to stay in the EU.

In the UK, overall growth over the past decade was facilitated by the growth of the financial services industry, particularly in the Greater London area. However, this did not compensate for the failing coal industry in Wales (despite funding from the EC), or the defunct shipbuilding and textiles in the North of England and virtual closure of the automobile industry in the Midlands. The political backlash was felt only with the Brexit vote that took the government by surprise.

Similarly, in Italy, the development of the services sector in Milan has not compensated for the closure of the automobile and textile sector in nearby Turin. Further, the investment in the North-South high speed train and Autostrada links, between Turin to Milan to Rome to Naples has not resulted in rebalancing, e.g., in Turin or in Naples. It just means that it is easier for people to commute from Turin to Milan. Regional inequalities continue to increase, with the lagging South of Italy severely constrained in using the new infrastructure or attracting complementary private-sector investment (see e.g., Ahmad, Bordingnon and Brosio, 2016).

In many cases, local governments have tried to capitalize on perceived rents associated with the infrastructure projects, often to engage in real estate or tourism development. This has been facilitated by poor accounting for PPPs, as well as an ability to hide transactions by contracting from local banks (see e.g., the case of Madeira). The hidden liabilities exacerbated the extent and depth of the crisis. And, as in Spain and Ireland, private liabilities were quickly transformed into public liabilities as the crisis hit, forcing a public charge to rescue the local *cajas* (banks).

It is by no means certain that new connectivity will lead to additional activity and employment in depressed areas, and further imbalances are possible without additional local investments and enhanced service delivery. The lessons from the crisis in Europe are that local accountability matters, both in terms of own-source revenues and effective service delivery for the generation of sustainable hubs. Further, full information on transactions, including PPPs, is needed to avoid rent-seeking behavior and game play across levels of government. Without full information (e.g., local balance sheets consistent with the GFSM2014 standard),

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neither yardstick competition, nor effective implementation of subnational fiscal rules can be assured. In this regard, the absence of EU standards and requirements for information generation pose a significant problem, including for the private sector. Risk management becomes more complicated as private liabilities can be transformed into public debt in a very short period of time.

The EU experience is of relevance for the SDG investment agenda, as well as the Belt and Road initiative.

3 SOME CHINESE PERSPECTIVES

The 1993/4 reforms focused on a centralization of tax instruments in a newly created (central) State Administration of Taxation (SAT), with a sharing of the VAT, and an equalization transfer system. However, a "revenue-returned" component provided the basis for the consolidation and expansion of the "coastal hubs", because of the limited connectivity infrastructure inland. Given the relatively low, albeit relatively equally distributed individual incomes in the aftermath of the Cultural Revolution, an increase in income dispersion was a consequence of the growth process and a driving factor for the migration to the coastal hubs (see Ahmad and Wang, 1991). While this strategy was criticized by some of China's Development Partners as likely to generate spatial inequalities, it was the only feasible mechanism to maintain double digit growth over two decades, and provide more or less full employment opportunities with improving productivity and enhanced complexity of the economy. Over 150 million workers released from agriculture and low value added activities in the interior of the country moved to more productive activities along the coast. And over 700 million people were taken out of poverty in two decades (out of a global total of around 750 million during this period) driven by the strategy of developing the coastal "hubs".

However, widening personal income and regional disparities pose problems for the long-term sustainability of the Chinese development strategy. As pointed out in IMF (2016), the increase in the Chinese level of inequality has been particularly high – rising from around 0.4 in 1992 to around .52 in 2013. This is now at levels in the market-based emerging economies in Latin America, such as Chile, that have relied on the service sector to generate additional employment opportunities. Given the implicit social contract in China, high levels of inequality are likely to be less sustainable than in Chile, although the absence of adequate employment opportunities have begun to pose problems in Chile.

A major consequence of the success of the coastal hub phenomenon in China (as in Chile) is the high level of pollution and congestion in the metropolitan areas, e.g., Beijing, Guangzhou-Shenzhen, Hangzhou-Shanghai corridor. The congestion makes it costlier to do business. And rising pollution levels seriously degrade the quality of life. Beijing's fine particle air pollution level remains well above acceptable health standards despite constant high-level political attention that has led to some improvement in recent years.

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A part of the solution to the problems of success in the coastal growth strategy is to move production inland, closer to population concentrations and sources of raw materials, through the creation of smaller inland urban "hubs" that are less dependent on fossil fuels for transportation needs and where the choice of techniques adequately reflects social costs and benefits. The existing metropolitan areas could then be transformed into clusters of "clean" high-tech and service sectors.

The Chinese "Western region development strategy" over the past decade, however, had limited success, largely because of the higher cost of production and exports. The cost-differential will change with the enhanced public investment in cross-border connectivity with the Belt and Road links to the Middle East, Central Asia, Africa and Europe. Just the opening-up of existing rail and road links have made it possible for the first train from Zhejiang province to arrive in Teheran in 14 days using the Western Khorgos hub, as opposed to the 45 days it takes by the sea route. This is significant in view of the rapidly increasing trade between the two countries, increasing from $4 bn in 2003, to $51bn in 2014, and projected to increase to $600bn in ten years. The deep-sea port of Gwadar, along with road, rail and pipeline links with Xinjiang will similarly open the markets in the Middle East and East and North Africa – eliminating the cost disadvantages faced by the Chinese interior provinces vis à vis the coastal hubs.

The creation of new internal hubs in China has been constrained by the absence of adequate instruments – this includes own-source revenues at the local level, with the failure of the property tax experiments in Shanghai and Chongqing – and full information on local transactions and the buildup of liabilities (see Ahmad and Xiaorong Zhang, 2017). While a system of local bonds has been introduced, without the anchor of own-source local revenues, it is unlikely to provide the right incentives to markets, or resolve the issue of local liabilities in an inter-temporal perspective, or to make for sustainable new hubs.

4 PUBLIC INVESTMENT FOR SUSTAINABLE GROWTH

4.1 METHOD

The use of economy-wide shadow prices[1] allows for the general effects of public interventions to be assessed, shedding light on the sectors more suitable for reforms, taking into account effects on households, producers, and government. Given that a range of shadow prices is feasible, a choice based on government preferences for a clean economy and inclusive growth should be the basis for the specific choice of shadow prices. This is then reflected in the consistent selection of projects at the national and local levels – leading to the choice of sustainable hubs and employment generation.

Following Drèze and Stern (1987) and Ahmad and Stern (1991), the government assesses projects based on preferences among different states of the economy reflecting valuations of environmental costs, as well as distributional characteris-

[1] See Drèze and Stern (1987).

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tics. The decisions are made based on maximizing a welfare function subject to market clearing restrictions and evaluated at shadow prices. The planners' objective function (V) takes the Bergson-Samuelson form, and the social welfare function depends on household consumption levels. Consumption is a function of prices, income, taxes, and demand and supply constraints. Therefore, the aggregated utility of any project is calculated as the welfare-weighted sum of individuals' marginal willingness to pay for the project. The objective function can be more general and include a variety of objectives that reflect the government's perspectives, say, on environmental damage.

$$Max\, V(s,w),\ subject\ to\ E(s,w) = z \tag{1}$$

$V(s,w)$ is the social welfare function, which depends on endogenous variables (s) and exogenous variables (w). The maximization problem can be solved using the Lagrangian:

$$L(s,w) = V(s,w) - v'\,[E(s,w) - z] \tag{2}$$

where v' represents the shadow price or the increase in the value of social welfare function when an extra unit of public output is available (the social opportunity cost). The first order conditions to maximize the function imply that the net effect on welfare due to variations in (s) or (w) includes the costs related to changes in demand evaluated at shadow prices.

$$dV = \frac{\partial V}{\partial w}dw + \frac{\partial V}{\partial s}ds = \left[\frac{\partial V}{\partial w} - v'\frac{\partial E}{\partial w}\right]dw \tag{3}$$

Once the vector of responses is defined, it is possible to assess how private agents would respond (which is reflected in changes in net demand and supply) and the consequent effects on their utility function.

The shadow cost, $v'\dfrac{\partial E}{\partial w}$ of the extra demand can also be represented as the difference between $p'y$ (actual profits) and $q'x$ (household expenditures), which represents government tax revenues (R_v). The shadow cost may be rewritten as

$$dV = \left[\frac{\partial V}{\partial w} + \frac{\partial R_v}{\partial w}\right]dw \tag{4}$$

The total effect on welfare can be seen as the direct change in welfare plus the change in shadow revenue, representing the general equilibrium adjustments associated with the reform. This method can be used in a broad set of applications, and for this case, including tax reforms as shown by Ahmad and Stern (1984). In this case, changes in w would be represented as changes in a vector t or taxes on goods.

$$dV = \left[\frac{\partial V}{\partial t} - v'\frac{\partial x}{\partial t}\right]dt \tag{5}$$

Considering derivatives hold lump-sum incomes constant, and that $q=p-t$, and assuming that producer prices are proportional to shadow prices equation (5) can be rewritten as:

$$dV = \left[\frac{\partial V}{\partial t} - \gamma \frac{\partial}{\partial t}\left(t'x\right)\right] dt \tag{6}$$

$$\frac{\partial V}{\partial t} - \gamma \frac{\partial}{\partial t}\left(t'x\right) > 0 \tag{7}$$

If equation (7) is greater than 0, social welfare is increased by raising the i^{th} tax or increasing its price. Declines in social welfare are offset by the extra revenue raised.

The value of γ can be used to identify directions of reform.

$$\gamma_i = -\frac{\frac{\delta V}{\delta t_i}}{\frac{\delta R}{\delta i_i}} \tag{8}$$

$\frac{\delta V}{\delta t_i} = -\sum_h \beta^h x_i^h$, where β^h represents the social marginal utility of income for households, and x_i is demand for commodity i by household h, and $\frac{\delta R}{\delta i_i} = -\sum v_j \frac{\delta x_i}{\delta t_i}$ can be represented as variations in consumption due to changes in taxes or public supplies at shadow prices.

This method has the advantage of incorporating the degree of inequality aversion in the welfare function by assigning different weights to the additional consumption by groups at different levels of income. A high degree of interpersonal inequality aversion is also expected to favor lagging regions. The effects of a project on the welfare function depend on the social marginal utility of household expenditures and the demand for each commodity by households.

While there are several ways to estimate the welfare weights, this proposal uses the method proposed by Ahmad and Stern (1984). The welfare weights are normalized to the welfare weight for the poorest household (unity) and adjusted by an inequality aversion parameter so that a marginal expenditure by the rich is less valuable than that by the poor.

$$\beta^h = \left(\frac{I^1}{I^h}\right)^e \tag{9}$$

I^h is the per-capita expenditure of the h^{th} household and I^1 is the normalized welfare weight of the poorest household. Therefore, β^h represents the marginal social value of a unit of expenditure to household h relative to household *1*. The parameter e represents the Atkinson inequality aversion parameter, where $e=0$ implies

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that a unit of income to the richest is seen as equivalent to a unit received by the poorest; $e=1$ indicates that, if I^h is twice I^1 then a marginal unit to h is worth half that to household 1, and so forth.

Applying Drèze and Stern (1987) and the related theory of reform enunciated by Ahmad and Stern (1984, 1991) requires:

- market prices to be converted to the shadow prices needed to assess sectoral social profitability. The method extends the Little and Mirrlees (1974) approach; and
- the corresponding changes in taxes/relative prices that need to generate and support welfare-improving structural reforms to be evaluated using estimates of household responses.

The Ahmad and Stern (1984, 1991) and Drèze and Stern (1987) methods permit different scenarios using different inequality aversion parameters. The shadow prices also permit a set of additional objectives linked, for example, to a sustainable development agenda.

The accounting ratios calculated to incorporate inequality aversion parameters given by equation (9) and the cross-industry effects by using economy-wide shadow prices generate alternative patterns of public investment allocations. Accounting ratios linked to the development agenda, and estimated taking into account general effects on the economy, should favor economic convergence and sustainable growth.

In addition, economy-wide accounting ratios provide directions for tax reform, giving policymakers a tool that links government revenues and the effects of consumption and production patterns, and generates incentives for good governance. The tax reforms are needed to "lock" in place the incentives facing key actors in the economy – including firms and households. The tax reforms, such as for local own-source revenues, also require an equalization transfer framework to enable all regions to provide similar levels of service at similar levels of tax effort, to facilitate effective local service delivery in the new growth hubs. An equalization framework was adopted in China following the 1994 reforms, but does not apply in Chile or most Latin American countries.

4.2 ILLUSTRATIONS FOR CHILE

Over the past two decades, Chile has been among the top Latin American performers in terms of macroeconomic management – with a low stock of debt (21% of GDP, which involved a doubling since 2010), low deficits, a SWF, tax/GDP ratio of around 18% – or within the range suggested for the MDGs, and a private-sector oriented policy stance. This is bolstered by the arms-length and uniform approach to public investment, through the National Investment System (SNI), and a transparent procurement process, *Chile Compras* – both praised by the IFIs as being examples of how to manage the public investment process.

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Growth has exceeded that in neighboring countries, including during the crisis period since 2010 (IMF, 2016). It has also led to significant overall reductions in poverty over a twenty-year period. However, the growth has been largely sustained by commodity exports, especially copper and agricultural raw materials, especially to China in the recent decade, offsetting declining productivity growth. The result has been what President Ricardo Lago (2013) called the "middle income trap". As is common in primary commodity exporting countries, there has been limited development of domestic linkages. This is reflected in the very limited economic complexity, lower than it was twenty years earlier, and is symptomatic of the greater reliance on primary commodity exports and a Dutch Disease effect. In relative terms, the negative value of the economic complexity index shows that the full economic potential has not been realized (Hausman et al., 2016). This has left the country exposed to external shocks, and Chile is particularly vulnerable to shifts in demand for its copper exports, especially from China (IMF, 2016). This clearly has an impact on the pattern of employment opportunities, and social cohesion.

Another consequence of the growth and investment strategy is the concentration of activities in the ports, and Metropolitan zone, including Santiago, despite the investment of the North-South Highway. Regional disparities are high, and there is increasing congestion and pollution in the Metropolitan Zone. Migrants from the less well-off regions head to the Metropolitan Zone, because that's where the jobs are, given the limited diversification of the economy to provide sustainable employment generation. This causes crowding in peripheral shantytowns with poor facilities, including for education and other public services. A striking characteristic of Chile is the increasing concentration and population pressure in the Metropolitan areas. This also results in choking growth potential and contributing to the middle-income trap.

The regional imbalances also led to persistent pockets of poverty in the lagging regions. There was an increasing incidence of poverty in 20 of 26 functional urban areas,[2] again with a clear regional pattern. More worryingly, the largest concentration of the poor (40% of the total) is in the Metropolitan area, although it has the highest per capita incomes and employment opportunities. The income inequalities are magnified by the inequalities in access to public services (CASEN, 2015). This is also reflected in the provision of tertiary education, for which there is limited public funding. Consequently, interpersonal inequalities are also increasing, the Gini coefficient in Chile well above the OECD levels.[3] Addressing interpersonal inequalities depends on a more effective operation of the personal income tax. Given its poor performance in Latin America, generating additional third party information from asset holding, particularly property, suggests the importance of a regional/local surcharge or "piggy-back". However, for this not to widen inter-regional inequalities, an equalization framework is needed (Ahmad, Letelier and Ormeño, 2016 and forthcoming).

[2] See OECD (2013).
[3] IMF (2013).

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Regional connectivity, in the form of the North-South Highway in Chile is important and will certainly play a major role in the future. However, it has not reduced regional inequalities, as the preconditions for local "hubs" outside the Metropolitan areas are not met – including the provision of basic services and adequate own-source financing to generate incentives for the local governments to provide adequate supporting infrastructure for private sector activities. This reflect the problems have been observed with the connectivity infrastructure in the EU – e.g., in Spain and Italy – as described above. Without the creation of the new "hubs", or clean new cities, regional inequalities might increase.

The recent development of solar energy in Chile, providing some of the cheapest forms of clean power, also open-up the potential for generating new hubs, if the local preconditions are created. The Chilean examples also have some relevance for the rebalancing in China, and the Belt and Road Initiative focusing on cross-border connectivity in Asia and Africa.

DISEQUALIZING ROLE OF INVESTMENT ALLOCATIONS?

Chile's national system of investment appraisal, SNI, vets all public projects. This performs well against the investment criteria of the IFIs (see assessment for Chile in World Bank, 2007). However, the project selection criteria are largely based on market criteria (see table 1) – including interest rates and accounting rations that do not take adequate account of externalities, or inequalities. There is an attempt to incorporate the cost of carbon emissions, but without full economy-wide implications. It is not surprising that market based criteria would lead to a concentration of activities in the most profitable sectors and in regions that are well endowed with connectivity and public services. The public investment could be complementing private sector activities in the more advanced regions, leading to the migration to the Metropolitan areas and greater inequality in employment opportunities and incomes, as well as in the access to public services as pointed out above.

Table 1

SNI project selection parameters

Goods/inputs	Conversion factor
Social discount rate	6% (8% and 12% in previous years)
Exchange rate	1.01
Emissions (CO_2)	2.213 pesos per ton of equivalent carbon emission
Land	Market value (without any correction)
Domestic goods and inputs	Market value – VAT
Importable materials	(Market value-duties) x currency conversion factor
Fuels	Depends on type of fuel and vehicle
High-skill labor	Market value x factor of conversion for high-skilled labor (0.98)
Medium-skill labor	Market value x factor of conversion for mid-skilled labor (0.68)
Low-skill labor	Market value x factor of conversion for low-skilled labor (0.62)
General expenses and profits	Market value – VAT

See Ahmad and Viscarra (2016).

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The complexity analysis suggests the need for diversification but does not clarify what sectors should be pursued or where, or the role of public policy in achieving this. We focus here on the role of economy-wide shadow prices, drawing on Ahmad and Viscarra (2016) and follow-up work with the SNI supported by the Inter-American Development Bank.

ENHANCING THE SNI

We draw here on work with the SNI to make the investment system more reflective of the sustainable development and climate change agenda that both the current Bachelet Administration and its predecessor have subscribed to (see Ahmad and Viscarra, 2016). Project choices and tax/public pricing decisions are inextricably linked and this is seen most clearly with environmental concerns, and income distribution.

The method permits the examination of economy-wide or inter-industry effects of changes in public supplies or taxes/public prices. It also facilitates the potential effects on households in different circumstances and on firms. While this is at the heart of the theory of reform (and is much simpler to estimate than an optimal tax framework) it can form the basis for an evaluation of gainers and losers needed for a political economy assessment that also includes governments at different levels. While the institutional arrangements vary from country to country, and must be kept in mind, the approach is general enough to be applicable in Chile, Senegal, India or Pakistan, or even China.

In principle, there are a multitude of shadow prices corresponding to various assumptions about traded (importables or exportables) and non-traded goods, the marginal social cost of public funds, and the accounting ratios for different types of labour, capital, and land.

Ahmad and Viscarra (2016) illustrate the method of economy-wide shadow prices for Chile and examine what happens with a number of permutations in the key variables (some of the variance in Accounting Ratios (ARs) is reported in table 2 for a set of scenarios based on assumptions concerning sectors (IM, EX and NT) and factor inputs.

It is clear from the table 2 that the precise assumptions used will matter in relation to the resulting sectoral accounting ratios, and hence the choice and rankings of the projects to the chosen. While there are clear differences across the sets of assumptions, the general pattern emerging from the simulations is that the highest accounting ratios are for the higher linkage (especially in terms of potential employment generation, and higher value added sectors). This is consistent with the Hausman et al. Complexity story for Chile, that suggests the importance of diversification. The economy-wide shadow prices indicate some priorities for public action. This is also reflected in the corresponding social profitability exercise (table 3).

TABLE 2

Accounting ratios, sensitivity analysis

		K=0.81			K=0.5			K=0.25		
Groups	**Class**	**L=0.37 M=0.40 H=0.70**	**L=0.62 M=0.68 H=0.98**	**L=0.87 M=0.90 H=1.00**	**L=0.37 M=0.4 H=0.7**	**L=0.62 M=0.68 H=0.98**	**L=0.87 M=0.90 H=1.00**	**L=0.37 M=0.40 H=0.70**	**L=0.62 M=0.68 H=0.98**	**L=0.87 M=0.93 H=1.00**
Flour, pasta, cereals	IM	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986
Vegetables	EX	0.934	0.929	0.929	0.935	0.931	0.93	0.936	0.932	0.932
Fruits	EX	0.541	0.538	0.537	0.542	0.539	0.539	0.543	0.54	0.539
Meats, sausages	IM	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988	0.988
Dairy products, cheese, eggs	NT	0.988	1.134	1.208	0.954	1.074	1.174	0.927	1.047	1.147
Edible oils, fats	IM	0.987	0.987	0.987	0.987	0.987	0.987	0.987	0.987	0.987
Fish, crustaceans, mollusks	EX	0.985	0.982	0.981	0.986	0.983	0.982	0.987	0.984	0.983
Animal feed	NT	0.635	0.755	0.86	0.611	0.73	0.836	0.591	0.711	0.816
Fuels	IM	0.991	0.991	0.991	0.991	0.991	0.991	0.991	0.991	0.991
Other food products	IM	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977	0.977
Liquor	EX	0.961	0.953	0.952	0.965	0.956	0.955	0.967	0.958	0.957
Non-alcoholic beverages	NT	0.550	0.661	0.682	0.513	0.625	0.645	0.484	0.595	0.616
Tobacco	NT	0.464	0.556	0.585	0.437	0.529	0.558	0.415	0.507	0.536
Textiles, clothing, footwear	IM	0.982	0.982	0.982	0.982	0.982	0.982	0.982	0.982	0.982
Material for conservation, repair of dwelling	IM	0.949	0.949	0.949	0.949	0.949	0.949	0.949	0.949	0.949
Stationery, office supplies	EX	0.975	0.969	0.968	0.977	0.971	0.97	0.978	0.973	0.972
Printing, publishing	NT	0.653	0.846	1.014	0.63	0.823	0.991	0.611	0.805	0.973
Pharmaceutical products	NT	0.678	0.856	0.888	0.652	0.829	0.861	0.631	0.808	0.84
Toiletries, cosmetics	NT	0.847	1.064	1.098	0.827	1.044	1.078	0.811	1.028	1.062
Glassware, crystal, tableware, household utensils	NT	0.535	0.639	0.65	0.498	0.602	0.613	0.468	0.572	0.583
Electronic artifacts, large size tools, equipment for the household	NT	0.664	0.83	0.853	0.644	0.81	0.833	0.627	0.794	0.817
Electronic artifacts, small size tools, equipment for the household	NT	0.692	0.853	0.87	0.675	0.837	0.853	0.662	0.824	0.84
Furniture	NT	0.655	0.847	1.012	0.592	0.785	0.95	0.542	0.735	0.899

Groups	Class	K=0.81 L=0.37 M=0.40 H=0.70	K=0.81 L=0.62 M=0.68 H=0.98	K=0.81 L=0.87 M=0.90 H=1.00	K=0.5 L=0.37 M=0.4 H=0.7	K=0.5 L=0.62 M=0.68 H=0.98	K=0.5 L=0.87 M=0.90 H=1.00	K=0.25 L=0.37 M=0.40 H=0.70	K=0.25 L=0.62 M=0.68 H=0.98	K=0.25 L=0.87 M=0.93 H=1.00
Other electronic artifacts, tools, equipment for the household	NT	0.563	0.686	0.793	0.54	0.662	0.77	0.521	0.644	0.751
Electricity	NT	1.051	1.111	1.121	0.784	0.845	0.855	0.569	0.63	0.64
Gas supply	IM	0.995	0.995	0.995	0.995	0.995	0.995	0.995	0.995	0.995
Basic public services	NT	1.043	1.248	1.27	0.896	1.100	1.122	0.776	0.981	1.003
Repair of household goods	NT	0.732	0.936	0.969	0.71	0.913	0.946	0.691	0.894	0.927
Hotels, restaurants	NT	1.036	1.232	1.389	0.999	1.193	1.352	0.968	1.163	1.321
Transportation	NT	0.645	0.79	0.811	0.593	0.738	0.759	0.55	0.696	0.717
Mail, courier services	NT	0.541	0.758	0.938	0.509	0.725	0.905	0.482	0.699	0.879
Telephone services	NT	0.877	1.026	1.059	0.72	0.868	0.902	0.593	0.741	0.775
Financial services	NT	0.41	0.525	0.539	0.386	0.501	0.516	0.367	0.482	0.497
Assurance, reinsurance services	NT	0.706	0.893	0.918	0.651	0.838	0.863	0.607	0.794	0.819
Services to companies	NT	0.570	0.709	0.728	0.518	0.656	0.675	0.475	0.614	0.633
Rents (apartments, houses)	NT	1.026	1.031	1.032	0.702	0.708	0.708	0.441	0.446	0.447
Education	NT	0.820	1.066	1.091	0.793	1.039	1.064	0.772	1.018	1.043
Medical, health services	NT	0.768	0.985	1.011	0.735	0.952	0.978	0.708	0.926	0.952
Entertainment	NT	0.673	0.911	1.121	0.621	0.859	1.069	0.579	0.817	1.027
Other services	NT	0.217	0.282	0.336	0.191	0.256	0.31	0.17	0.235	0.288
Mining	EX	0.981	0.976	0.976	0.982	0.978	0.977	0.983	0.979	0.978
Construction	NT	0.563	0.713	0.845	0.543	0.693	0.824	0.526	0.676	0.807
Commerce	NT	0.553	0.734	0.87	0.518	0.699	0.834	0.489	0.67	0.806
Chemical industry	IM	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989	0.989
Basic industry metals	EX	0.974	0.97	0.969	0.976	0.972	0.971	0.977	0.973	0.972

L = low-skilled labor; M = medium-skilled labor; H = high-skilled labor, K = capital, IM = importable sectors; EX = exportable sectors; NT = non-tradable sectors.

Source: Ahmad and Viscarra (2016). Calculations based on the input-output matrix 2008, Central Bank of Chile.

Interestingly, sensitivity to various levels of a "carbon tax" results does not change the social profitability of sectors, but results in changes within the accounting rations for each set of assumptions.[4] This implies that there will be changes in the

[4] Simulations carried out at the request of SNI and available on request.

choice of techniques within the sectoral prioritization, although the overall recommendation for diversification for more sustainable employment generation remains robust.

Many of the parameters to choose among the wide range of shadow prices will be determined by the governments medium-term macro-fiscal or sustainable growth strategy. This will help to fix the key assumptions to be used in the project selection process, including the choice of the social discount rate. In our view, greater precision is needed especially with respect to tax policy at the national and subnational levels.

Table 3

Chile: social profitability of different sectors

	K=0.81 (A1)			K=0.5 (A2)			K=0.25 (A3)		
Groups	**L=0.37 M=0.43 H=0.73**	**L=0.62 M=0.68 H=0.98**	**L=0.87 M=0.93 H=1**	**L=0.37 M=0.43 H=0.73**	**L=0.62 M=0.68 H=0.98**	**L=0.87 M=0.93 H=1**	**L=0.37 M=0.43 H=0.73**	**L=0.62 M=0.68 H=0.98**	**L=0.87 M=0.93 H=1**
Flour, pasta, cereals	0.404	0.409	0.321	0.435	0.445	0.351	0.459	0.470	0.376
Vegetables	0.395	0.380	0.316	0.430	0.426	0.351	0.458	0.454	0.379
Fruits	-0.030	-0.089	-0.317	0.046	0.006	-0.240	0.108	0.067	-0.178
Meats, sausages	0.255	0.260	0.182	0.280	0.299	0.207	0.301	0.320	0.227
Oils, fats	0.354	0.355	0.311	0.368	0.369	0.325	0.379	0.380	0.336
Fish, crustaceans, mollusks	0.228	0.242	0.154	0.244	0.257	0.170	0.257	0.270	0.183
Fuels	0.847	0.852	0.837	0.864	0.869	0.854	0.877	0.882	0.868
Other food products	0.523	0.535	0.461	0.546	0.557	0.482	0.563	0.574	0.499
Liquor	0.474	0.505	0.416	0.503	0.533	0.445	0.526	0.556	0.468
Textiles, clothing, footwear	0.494	0.497	0.385	0.523	0.527	0.414	0.547	0.550	0.438
Material for conservation, repair of dwelling	0.451	0.460	0.383	0.479	0.488	0.411	0.502	0.510	0.433
Stationery, office supplies	0.478	0.502	0.398	0.514	0.538	0.435	0.544	0.567	0.465
Mining	0.538	0.545	0.512	0.596	0.603	0.569	0.643	0.649	0.616
Chemical industry	0.527	0.539	0.505	0.568	0.580	0.547	0.601	0.613	0.586
Basic industry metals	0.491	0.496	0.455	0.509	0.513	0.472	0.523	0.527	0.493

Source: Ahmad and Viscarra (2016). A number of simulations were carried out with alternative assumptions concerning the tradable and non-tradable sectors.

Ahmad and Viscarra (2016) use the theory of reform (see Ahmad and Stern, 1991) to complete the policy analysis associated with a sustainable investment strategy.

This evaluates the social marginal cost of raising a peso/$ on firms (through the shadow prices) and households (using a household income and expenditure survey), and are evaluated using complete demand systems (estimated by Ahmad and Viscarra, 2016) and estimated for various degrees of inequality aversion (Atkinson index, ε of 0 is what is currently in place with SNI – a peso to the poorest is evaluated as the same as a peso to the richest group in the country; and Atkinson index of $\varepsilon = 5$ puts almost all the weight on the lowest groups of the population. Rankings of the social marginal cost for various levels of ε are shown in table 4.

Details of the directions of reform are explained in Ahmad and Viscarra (2016). For our purposes, we illustrate how the method would work in practice. The basis of the tax system would be a VAT on all transactions that generates production efficiency – business to business transactions are credited, and exports are zero-rated (all tax on earlier stages removed).

Table 4

Chile social marginal cost ranking for different inequality parameters

Groups	**e=0**	**e=0.5**	**e=1**	**e=2**	**e=5**
Rents (houses, apartments)	1	1	1	1	1
Transportation	2	3	15	21	19
Other services	3	17	24	24	24
Education	**4**	**23**	**25**	**25**	**25**
Telephone services	5	16	22	23	23
Hotels, restaurants	6	11	16	18	18
Textiles, clothing, footwear	7	7	12	14	8
Health	8	13	18	16	10
Meats, sausages	9	5	4	6	9
Public basic services	10	2	2	2	2
Financial services	11	14	17	15	14
Flour, pasta, cereals	12	6	5	17	17
Entertainment	13	26	26	26	27
Electricity	14	4	3	5	7
Vegetables	15	9	11	12	15
Non-alcoholic beverages	16	8	7	7	6
Pharmaceutical products	17	21	21	20	20
Dairy products, cheese, eggs	18	10	10	11	13
Other food products	19	19	20	19	22
Gas	20	12	8	10	12
Liquor	21	15	6	3	3
Fruits	22	18	13	8	5
Tobacco	**23**	**25**	**23**	**22**	**21**
Toiletries, cosmetics	**24**	**27**	**27**	**27**	**26**
Fish, crustaceans, mollusks	25	20	9	4	4
Oils, fats	26	22	14	9	16
Fuels	**27**	**24**	**19**	**13**	**11**

*Source: Ahmad and Viscarra (2106). Note 1 is the highest **rank** social cost, **and least attractive to tax** and 27 the lowest rank and most attractive to raise an additional dollar in revenue.*

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The required differentiation, say for tobacco and cosmetics, comes through additional excises, or in the case of fuels, a carbon tax. As seen in the first column of table 4, fuels are attractive from the perspective of the theory reform and are the most attractive sector for additional taxation. The rankings change as the Atkinson index increases, as even the poor consume fuels. However, from a sustainable development perspective, one would still want to tax carbon, and some compensation for the poor needs to be sought. This is a different situation from that pertaining to basic public services that becomes one of the least attractive sectors to tax as inequality aversion increases even slightly – the issue is discussed further in Ahmad (2017). The importance of housing and basic public services that arises from the directions of reform analysis meshes nicely with the issue of who is to provide these, especially for sustainable local "hubs".

Education might appear to be a paradoxical sector to tax. However, given the characteristics of the household income and expenditure surveys (CASEN), the poorer groups do not pay for education, whereas mainly the rich families in Chile pay fees. Subjecting the sector to a VAT, for example, would effectively zero-rate public education, whereas the private sector providing expensive fee paying instruction would be appropriately taxed. Taxation of education, consequently, would be equality enhancing.

URBAN HUBS – "NEW CLEAN CITIES?"

Chile has a huge potential to develop new clean cities or hubs, given the success it has had with renewable energy. Costs for solar energy have dropped precipitously – and in 37 winning auctions (2013-16), Chile had one of the lowest bids in the world at US 2.9 cents/kWh – and this compares with 18.4 cents/kWh in Indonesia, and 6.5 cents/kWh in Brazil and South Africa (Monari, 2017). This presents a huge technological advantage and could be the true "game changer". However, as with the issue of road and rail connectivity, much depends on both the tax agenda and the local service delivery needed to make new "hubs", or clean cities, feasible.

The essence of "convergence" is the faster growth of lagging regions to begin to catch up with the advanced regions in terms of per capita incomes and employment generation capabilities. This is largely driven by the private sector, although the public sector has a major role to play in relation to investments in human and physical capital. To some extent, convergence is already taking place in Chile, as we shall see below, but largely due to slowing growth rates in the Metropolitan areas – due to capacity constraints and congestion, as well as the economic slowdown since 2008 due to the international crisis. This is also a manifestation of the "middle income trap" facing Chile as well as other emerging market economies, such as China, and the challenge of maintaining sustainable growth and employment generation. Indeed, the coefficients for investment appear to change sign, potentially reflecting the continued level of relatively high public spending, offset by lower private spending and reduced effectiveness of investment.

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The role of public investments would be largely to facilitate private investment in sustainable "hubs" that reflect the comparative advantages of the country, and provides sustainable employment generation. A convergence of growth rates with sustainable development, throughout the country, clearly requires a better distribution as well as utilization of "enabling" public investments in physical and human capital. The role of the regional tier is important, and has been the basis for the current discussion in Chile (see Granados and Rodríguez, 2013).

Interior "sustainable" hubs are possible provided they optimize sources of supply (including a skilled labor force), as well as potential demand (domestic consumers as well as exports. Measures such as cash transfers to the poor may not close regional "gaps" or even reduce poverty (as in Chiapas, Mexico – see Ahmad, 2015).

Tax breaks may do little other than to create holes in the tax system that can be abused without generating sustainable private investment. Consequently, it is important to align the incentives for the private sector, as well as workers, to ensure that investments lead to sustained growth of employment opportunities without the need for continued preferences or "holes in the tax system" that lead to cheating.

WHERE TO PUT THE HUBS?

One can think of the current Chilean growth strategy as concentrated in the Metropolitan areas and the ports – for simplicity let's call them *A*. Given existing transport links, *f*, the furthest peripheral areas *P* (at distance *f* from *A*), are also able to utilize the export and demand patters generated by *A*. This leaves the extreme periphery P_N, or the *zonas rezagadas*, as unable to connect either to markets or domestic or external supply chains.

A characteristic of P_N is that the infrastructure gaps are binding. Consequently, giving a tax holiday will lead to a perpetual subsidy, but may not be enough to ensure that the private sector will have an incentive to invest there. Similarly, a cash transfer to the poor in P_N likely means that they will migrate to the metropolitan areas, *A*, in search of work, as there is not much to be had in and around P_N.

New "sustainable growth hubs" would typically focus on regional comparative advantage – and as mentioned above, this has changed significantly with the breakthrough in cheap and clean solar energy. This is also a function of both availability of requisite skills, as well as wider connectivity to domestic and external markets or suppliers, as well as local connectivity to the hinterland – this would be in diversified industries benefitting from cheap energy, agriculture or as in Chile's case, tourism. Consequently, the nature of the hubs will vary according to the relevant endowments.

Investment in human capital and infrastructure will change the endowments, as well as perceptions by the private sector. Some of the "hubs" may be in the remote regions – i.e., beyond the zone *P*, serviced by the main metropolitan/export hubs

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A, and thus opening the disadvantaged zone P_N. In Chile, addressing most of the backward zones may well involve such "hubs" in the interior.

It should be noted that given the topological constraints in Chile, the objectives of sustainable growth might also include "hubs" that are closer to the existing production/export zones *A* than to P_N, but may nonetheless extend the reach of the markets to P_N. An example of such an "intermediate hub" is Querétaro, which has a first-rate university, and this has generated hi-tech industries including aerospace. It is a relatively small town, without the congestion and pollution of Mexico City, and its excellent transport linkages ensure that both workers and products contribute to the growing supply chains.

The placement of investments is in turn a function of project selection methods. There is the case of the famous Chacao Channel Bridge that was initiated under the Ricardo Lagos regime to open Chiloé Island, but later cancelled as the cost-benefit analysis indicated insufficient demand and traffic. However, the demand itself is a function of the bridge, and past trends would not have been appropriate as an indicator of future demands. This brings us back to the issue of choice of techniques, and social cost benefit analysis in determining how resources are to be allocated.

Of course, true convergence is only established if the private sector responds effectively as production costs for producers are reduced with improvement in connectivity. Typically, measures to reduce the cost-differential would be accompanied by taxes and regulations that create incentives to move out of congested and polluted areas.

5 POLICY IMPLICATIONS

The discussion of the investment story in Chile, together with the evidence from the EU and China, suggests the following lessons for other emerging market economies:

1) **Investment in connectivity is a necessary although not sufficient condition for creating a level playing field and generating sustainable and inclusive growth.**
2) **There is a need for coordinated policy actions (see chart 1) that links investment design to tax policy, local urban hubs/clean cities; and effective provision of public services.**
3) **Investment priorities, with economy-wide shadow prices linked to a sustainable growth strategy, are the starting point for the overall policy framework.**
4) **Investment priorities should be supplemented by a national tax policy framework**, and we have already identified both a VAT and a carbon tax as elements that provide financing, reduce distortions and create the right incentives for public action. China has completed the full integration of the VAT on goods and services in 2016 to reduce the costs of doing business – and India is trying to do the same (with a recently passed Constitutional Amendment).

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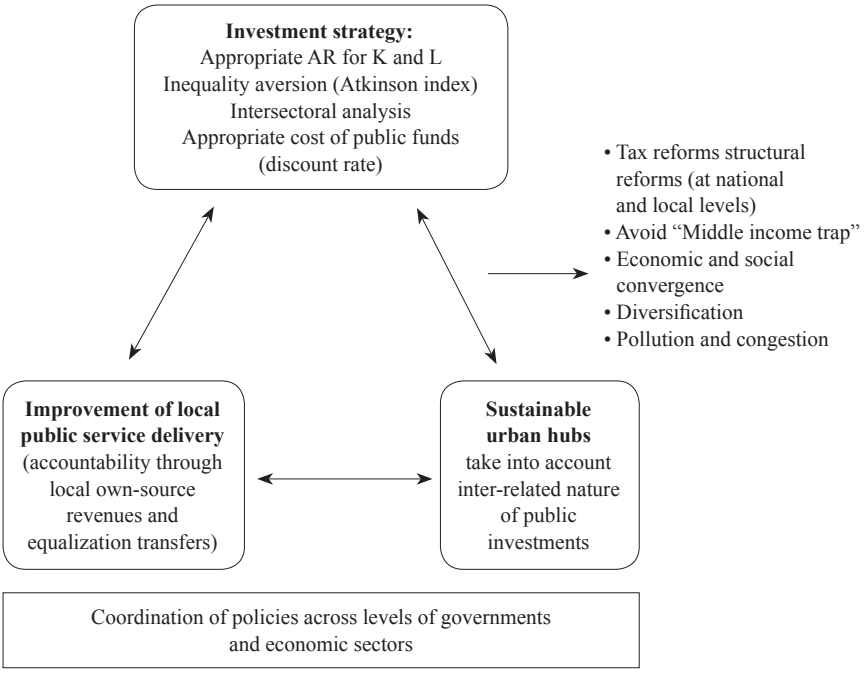
5) **The national tax agenda needs to be supplemented by a local tax system.** As in the case of China or South Asia, a higher carbon tax might be justified in the Metropolitan areas that are subject to congestion and pollution – and this could be achieved with a piggy-back on the national tax (Ahmad and Stern, 2011).

The need for a local tax system, even if relatively small in terms of the overall revenues generated, is quite significant at the local level in influencing incentives facing firms, workers and most importantly, creating hard-budget constraints for local governments. The property tax does not function well at the local level in most emerging market economies, and the generation of alternative mechanisms for emerging market economies is an important ingredient in a sustainable investment agenda (Ahmad, Brosio and Pöschl, 2015; and Ahmad and Brosio, 2017 for an application to Sénégal).

6) **Own-source revenues are needed at the local level also to anchor local access to credit.** Without some local control over rates (e.g., within a band set by the National legislature in unitary countries – see Ahmad, 2017 for a discussion of China), **it would be highly premature to create a local bond market, that would however be very helpful in due course.**

Chart 1

Investment and multilevel taxation linkages



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Institutions, public debt and growth in Europe

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Abstract

This paper provides empirical evidence that supports the view that the quality of institutions is an important determinant of long-term growth in European countries. It shows that an initial high government debt level coupled with institutional quality below the EU average tends to be associated with particularly poor long-term real growth performance. Interestingly, the detrimental effect of high debt levels on long-term growth seems cushioned by the presence of very sound institutions. The paper offers some evidence that sound institutions may be particularly important for long-term growth in countries in which the exchange rate tool is no longer available and less so in countries with flexible exchange rate regimes. The empirical findings on the importance of institutions are robust to various measures of output growth, different measures of institutional indicators, different sample sizes, different country groupings and to the inclusions of additional control variables.

Keywords: quality of institutions and real growth, real convergence in the EU, public governance, structural reforms, public debt, panel estimates

1 INTRODUCTION

During the past twenty years, European countries have witnessed very different growth performances. A significant part of these differences cannot be justified by differences in the initial levels of GDP per capita and the related catching-up potential. The ECB in its Economic Bulletin (ECB, 2015) argued that the quality of domestic institutions and governance has a positive impact on economies' per capita income growth and that a lack of real convergence can be "related to several factors, notably weak institutions, structural rigidities, weak productivity growth and insufficient policies to address asset price booms".

Against this background, this paper investigates whether initial levels of the quality of institutions and public debt can help to explain the different long-term growth performances in Europe and why real convergence in the euro area seems to have been lagging behind. To answer this question, the paper builds on two strands of empirical analysis on the determinants of long term growth of a country: first the impact of the quality of institutions and second the role of high debt in affecting GDP growth. The benchmark model links long-term GDP growth with the initial levels of the quality of institutions, government debt (above a threshold) and an interaction term between these two explanatory variables.

Long-term growth is defined as the 15-year average per capita output growth. While in growth theory this time span may not be sufficient to be qualified as "long-term" growth, in this paper we consider it sufficiently long to derive some robust conclusions for advanced economies. The quality of institutions is based on a composite index including four measurable governance indicators (taken from the World Bank): rule of law, regulatory quality, government effectiveness and control of corruption (in the paper termed "institutional delivery"). These indicators

try to capture how well national administrative and governmental institutions that determine the environment for economic activities are able to deliver a level-playing field for all economic actors, prevent rent extraction and waste of resources, and ensure sound economic incentives for investment, innovation and the provision of public goods. Public debt enters in the benchmark model as a dummy variable that takes the value of one only when public debt is above certain thresholds.

The benchmark model is estimated for EU countries, EU plus non-EU OECD and for two sub-groups of countries: countries with fixed exchange rate regimes and those belonging to the euro area, and countries with flexible exchange rate regimes. Results are also shown for the EU excluding Greece and for the EU excluding the CEEC countries which joined the EU in 2004 and 2007, given the very different levels of institutions and debt in the two groups of countries. The sample period includes annual data from 1995 until 2017. Given that the target variable – potential output growth – includes 15 years of data, the explanatory variables run from 1995 until 2002. The econometric approach consists of pooled mean estimates that account for autocorrelation of errors across time, as the 15-year average per capita output growth series are overlapping. The last 15-year average per capita output growth, e.g. 2002-2017, includes two years of forecasts taken from the European Commission database.

Various robustness exercises have been carried out to enhance the robustness of the results and partly also to control for the risk of reverse causality, for example the use of different proxies for institutional quality, the introduction of additional control variables in the equation. Moreover, the fact that the institutional variable enters the equation as initial condition at time *t*, to explain the subsequent 15-year average per capita GDP growth, may also tend to alleviate the problem of reverse causality. To test for the possibility that both *institutional delivery* and long-term growth are affected by deeper country-specific characteristics, the estimates are also carried out with 2SLS instrumental variables, using legal origin dummies as instruments for institutional delivery. This approach confirms the results of the benchmark model, despite instruments not always being significant. This supports the view that causality seems indeed to run from institutions to long-term growth.

The findings of the paper tend to support the view that the quality of institutions is an important determinant of long-term growth. The results seem particularly important for countries where institutional delivery is below or around the EU average and initial public debt is above a certain threshold (e.g. 60 or 70%). To the extent that causality is indeed running from institutions to subsequent long-term growth, such countries could experience significantly higher per capita GDP growth if their institutions were improved. Interestingly, the presence of very sound institutions appears able to offset the detrimental effect of high debt on long-term growth. While this result needs to be treated carefully as it is driven by rather few observations, it might suggest that the debt thresholds above which debt levels are detrimental for growth are not the same across countries, but could

be endogenous to the quality of public institutions. A possible narrative consistent with these findings could be that sound institutions may help alleviate the debt problem via various channels. For example good institutions may (i) allow for a better (potential growth enhancing) use of government expenditures financed by debt (e.g. the Scandinavian example); (ii) promote stronger growth via sound structural policies; (iii) promote social fairness and allow for more efficient tax administration, thereby reducing the economic and social costs associated with high debt; and/or (iv) ensure that episodes of large increases in debt are followed by sufficiently strong consolidation policies in the subsequent years. Empirical analysis testing for the above channels is beyond the scope of this paper and left for future research.

While the results hold across different group of countries, it appears that the conditions for real convergence are also generally good for the group of euro area and fixed exchange rate countries (for short fixed exchange rate group). At the same time the quality of institutions seems particularly important for this group. While these results are preliminary and require further research, this could reflect that sound institutions – and the associated policies – help to compensate for the lack of the exchange rate tool as adjustment and disciplinary device, supporting the view that improvements in institutions and the associated structural reforms are particularly important for euro area countries to be able to reap the full benefits of monetary union.

The benchmark model is changed in several ways to check the robustness of the results. First the results are assessed against different debt thresholds (corresponding to the EU average, the Maastricht threshold and the EA average); second the model is augmented with the different control variables typically included in the growth literature (such as education attainment, saving rate and government expenditure); third, other measures of institutional quality are used as a proxy for institutional delivery, which allow for extending the sample period considered by 20 years, i.e. advancing the starting date from 1995 to 1975. These changes continue to support the evidence that institutional delivery is a critical determinant of long-term growth in Europe; however the significance of debt thresholds turns out to be less robust to the above changes.

Various robustness exercises are also reported by using different measures of long-term growth and different time-spans. Also, these exercises show that the estimates obtained with the benchmark model are relatively robust to changes in specifications. This is particularly the case for institutional delivery and its interaction with the debt dummy.

There are of course many factors that are not or only partially included in the institutional variables used here, which can enhance longer-term growth. These would include macroeconomic stability, prudent fiscal policies, efficient set-up of university, school and dual education systems, strong incentives for investment in

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human and real capital, a high degree of flexibility and openness in product and labour markets, well capitalised and supervised financial institutions, efficient insolvency frameworks, conditions for an efficient use of capital and labour in the economy, including via economic integration within the EU. The results of this paper are broadly consistent with the view that the Word Bank (or other) indicators measuring the quality of institutions cover key factors and mechanisms, which also determine the probability that governments and societies will in the future support sound policies and reforms in the above areas, enhancing long-term growth. The link between institutional quality and the probability of supporting sound policies and reforms in Europe that enhance long-term growth has however not been tested explicitly in this paper. It is left for further research.

2 LITERATURE OVERVIEW

European countries continue to experience quite different long term GDP growth rates, even when accounting for different catching-up potentials related to the initial levels of per capita GDP. Regarding the euro area countries, in the July 2015 edition of the Economic Bulletin the ECB summarises its assessment of the real convergence and the (lack of) catching-up as follows: "…The global financial crisis that started in 2008 has showed that some countries participating in the Economic and Monetary Union (EMU) had severe weaknesses in their structural and institutional set-up. This has resulted in a large and protracted fall in real per capita income levels in these countries since 2008. While there has been real convergence in the European Union (EU) as a whole since 1999 owing to the catching up of Central and Eastern European (CEE) economies, there has been no process of real convergence among the 12 countries that adopted the euro in 1999 and 2001".

Against this background, this paper specifically investigates the role of two initial conditions in explaining long-term growth differences: the quality of national public and economic institutions and the level of public sector debt. The various specifications used can be considered part of the vast empirical analysis testing the notion of conditional convergence; that is the relationship between growth rates and initial conditions.

The paper provides evidence which is consistent with the view that conditions for real convergence are in principle good for countries that no longer have the nominal exchange rate tool (i.e. the group of euro area and fixed exchange rate countries). At the same time the quality of institutions appears very important for long-run growth in general and seems particularly important for this group of countries and/or for countries with initial debt above a certain threshold.

The crucial role of sound and efficient institutions – sometimes also referred to as good governance – in explaining long-run growth was formalised in a number of contributions in early 2000s, showing that countries with weaker institutions find it harder to sustain growth and are more vulnerable to periods of crisis and stagnation (Acemoglu, Johnson and Robinson, 2001; 2002). Acemoglu et al. (2004) show, by

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using a number of historical episodes, how institutions are able to determine the incentives of, and the constraints on, economic actors and shape long-term economic outcomes. In Acemoglu et al. (2004) economic institutions are identified with the structure of property rights and the access to economic resources. Thus, good economic institutions are those that provide security of property rights and relatively equal access to economic resources to a broad cross-section of society. The historical episodes analysis also shows that strong institutions, democracy, transparency and political stability bring about reduced output volatility.

In this paper, we use a definition of economic institutions similar to that in Acemoglu et al. (2004). It is based on four measurable governance indicators (taken from the World Bank Indicators): rule of law, regulatory quality, government effectiveness and control of corruption. These indicators try to capture how the economic structure is able to deliver a level-playing field for all economic actors, ensure that rent extraction and waste of resources are limited and sound economic incentives are in place for encouraging people to invest, innovate, save, solve problems of collective actions and provide public goods.

As well emphasized by Blanchard and Wolfers (2000), when dealing with institutional variables, the problem of their endogeneity to macroeconomic outcomes arises, also on account of the fact that these variables have been generally measured ex-post. Hall and Jones (1999) also stress the endogenous nature of institutions, arguing that institutions might themselves depend on the level of output per worker in an economy. This implies that any research involving institutional variables requires a significant amount of robustness checks. In this paper, we use 2SLS instrumental variables, using legal origin dummies as instruments for institutional delivery, following La Porta et al. (1999) as well as other robustness checks, i.e. different measures of institutions and the inclusion of other structural control variables. By using legal origins we test the hierarchy of institutions hypothesis (Acemouglu et al., 2004), according to which institutions, while they do affect economic performance, are in turn both directly and indirectly influenced by political institutions. Our approach is similar to that of Eicher and Leukert (2009), who use a set of political institutions variable as instruments for economic institutions. However, our instruments do not suffer from an ex-post measurement bias, as they refer to the legal origins of a country. In a similar vein, Hall and Jones (1999) used location and language differences to instrument institutions and showed that differences in output per worker in a sample comprising 127 countries (OECD and developing) are driven by differences in institutions and government policies, which they refer to as *social infrastructure*. It should be noted that using legal origins as an instrument has been also subject to criticism, as the legal transplantation process appears to have been historically more important than the legal origins for explaining the economic developments of countries (Berkowitz, Pistor and Richard, 2003). As an alternative instrument "human genetic diversity" has been recently used to investigate the impact of corruption on economic growth (Kunieda, Okada and Shibata, 2016). However, this concept

also suffers from several limitations, in particular related to possible large measurement errors (Ashraf and Galor, 2013).

Our approach does not aim to explain differences in the level but in the growth rate of per capita GDP. When limiting the attention to Europe, there has been a relatively large amount of empirical work on the convergence across countries; however not much attention has been devoted to differences in economic institutions as explanatory factor. For example, substantial empirical work has been done to assess the convergence of transition economies of Eastern European countries (Rapacki and Próchniak, 2009), based on a traditional set of macroeconomic and structural variables. Other work has focused on the identification of "convergence clubs", i.e. country groups within the EU which have in common the level of real income per capita (Borsi and Metiu, 2013), derived from a neoclassical growth model augmented with endogenous technological progress. Borsi and Metiu (2013) found that regional linkages seem to play a significant role in determining the formation of convergence clubs and that euro area countries belong to distinct subgroups, thus clustering is not necessarily related to EMU membership. By 2008, the Commission (2008) had already pointed out that the catching-up processes have been somewhat lower in the EMU than outside it, even when accounting for differences in the initial levels of GDP per capita. Most recently, by means of a counterfactual analysis, using synthetic control methodology, Fernandez and Garcia Perea (2015) argued that the adoption of the euro did not produce the expected permanent increase in the GDP per capita growth rate. While their model does not allow an explanation of why this happened, the authors refer to the lack of rise in intra trade and to the lack of policies to boost productivity as potential causes.

However, empirical work on the institutional determinants of longer-term growth performance of euro area countries has been so far relatively limited. This is mainly due to the fact that the euro area history is new, and fifteen years of monetary union may seem rather short for any long-term growth theory to be properly applicable. This also implies that work on growth differentials and governance in the euro area has so far been more of a narrative nature. For example, Fernandez-Villaverde et al. (2013) discuss an impressive set of qualitative and anecdotal evidence in some euro area countries on the interaction of euro area membership and the loosening of financial and borrowing constraints, and related disincentives for governments to reform. Their analysis does not include an attempt to provide empirical estimates on the impact of deep rooted institutional differences across countries.

Much wider, however, is the empirical literature that links GDP growth performance to structural variables in the OECD countries, in which typically each factor of a production function is directly or indirectly related to institutional or structural variables. For example, Bassanini et al. (2001) show how the accumulation of physical and human capital and policy conditions (e.g. R&D activity) affects growth. Similarly, Barnes et al. (2013) reports estimates for all OECD countries where GDP per capita growth and its supply side determinants are affected by a

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wide range of structural policies. These estimates show the large impact of labour and product market regulations, tax systems, education, R&D and FDI policies on real GDP per capita. Our paper is complementary to the above mentioned literature. It focuses on the explanatory power of a parsimonious number of initial conditions on the subsequent long-term GDP per capita growth performance. This is done by looking at eight years of initial conditions, from 1995 to 2002, in terms of starting level of per capita GDP, government debt and quality of economic and public institutions, and for each point in time the subsequent 15-year per capita GDP growth performance. Moreover this paper adds a new dimension to the empirical literature on long-term growth as it investigates the interaction between indebtedness and the quality of institutions.

The link between debt and structural indicators has already been analysed from a different perspective, e.g. by conditioning debt sustainability analysis on a set of structural indicators (Wyplosz, 2007). Papers linking debt with growth have been numerous. Chalk and Tanzi (2002) highlight different channels through which debt can affect growth. In particular, high public debt can put upward pressures on interest rates, which reduces private investment and thus growth; higher debt is *ceteris paribus* associated with higher expected future taxes, which can reduce expected after-tax returns on investment. Most recently empirical papers linking debt with growth found threshold values above which debt can become harmful for GDP growth (Baum, Checherita-Westphal and Rother, 2013). These threshold effects, which are estimated to occur between 70 to 90% of GDP depending on the sample used and the definition of debt, have been found to be significant not only in the case of public debt but also for private debt (Cecchetti, Mohanty and Zampolli, 2011).

Contrary to Wyplosz (2007) this paper does not address the issue of debt sustainability per se, but it shows that in the case of a relatively low quality of domestic institutions a high debt level tends to be associated with lower long-term growth. It also does not search for endogenous threshold values due to the fact that the time dimension is relatively limited (i.e. eight years), which implies little country-specific variability of the debt series. The paper is organised as follows. Section 3 describes the data. Section 4 presents the empirical models and discusses the results. Sections 5 and 6 present a number of variants of the benchmark model and section 7 includes additional robustness check. Section 8 concludes.

3 DATA ANALYSIS

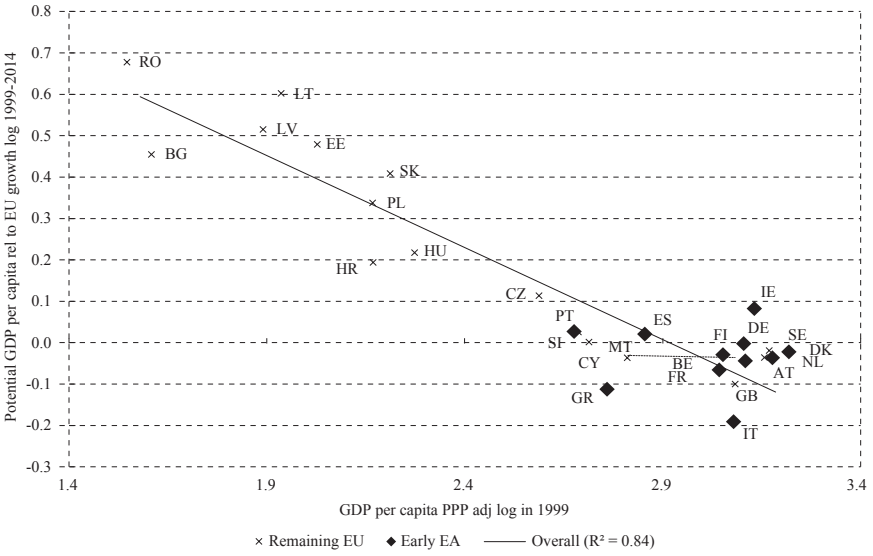
The empirical analysis is based on annual data, covering EU countries.[1] The key variables of interest are: GDP per capita, government debt and an aggregate measure of quality of economic institutions. These initial variables are used to explain the potential GDP per capita growth over the subsequent 15-years. The aggregate measure of economic institutions comes from the Worldwide Governance Indicators (WGI) database published annually by the World Bank (Kaufmann, Kraay and

[1] Luxemburg is excluded from the sample, as GDP per capita is not a meaningful variable, given the very large number of employees commuting cross-borders.

Mastruzzi, 2010)[2]. The full database contains six governance indicators: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption. This paper focuses on the average of the latter four, which captures the quality of economic and administrative institutions, referred to as *institutional delivery* or institutional quality[3], while the first two indicators are related to the political setting. The remaining variables (real GDP, potential GDP, population and government debt) are taken from the European Commission database (November 2015)[4].

Chart 1

Catching-up effects (real GDP per capita in 1999 and potential GDP per capita growth in 1999-2014)



Note: As diamonds early EA countries (i.e. countries that joined the euro area until 2001), as x other EU countries.

Source: ECB computation on EC data.

Chart 1 shows the level of per capita GDP (x-axis) in 1999, plotted against the 15-year average potential GDP per capita growth (y-axis). The chart distinguishes between the early euro area group (i.e. the countries that joined the euro area up to 2001 – early EA) and the rest of the EU. With an R^2 of 0.85, one can conclude that initial GDP conditions are able to explain a great deal of the variability in the subsequent potential GDP per capita growth. This is in line with the expectations that countries with lower income per capita will grow faster than countries with higher income per capita. Stronger GDP growth in the period 1999-2014 in the

[2] Available at < http://info.worldbank.org/governance/wgi/index.aspx>.

[3] See Helliwell et al. (2014).

[4] http://ec.europa.eu/economy_finance/eu/forecasts/2015_autumn_forecast_en.htm for EU-28 data is available from 2001 to 2017. For EU-27 excluding the latest entrant Croatia, data from 1998 onwards is available.

rest of the EU can also be associated with the impact of the EU membership which took place in 2004 (Campos, Coricelli and Moretti, 2014).

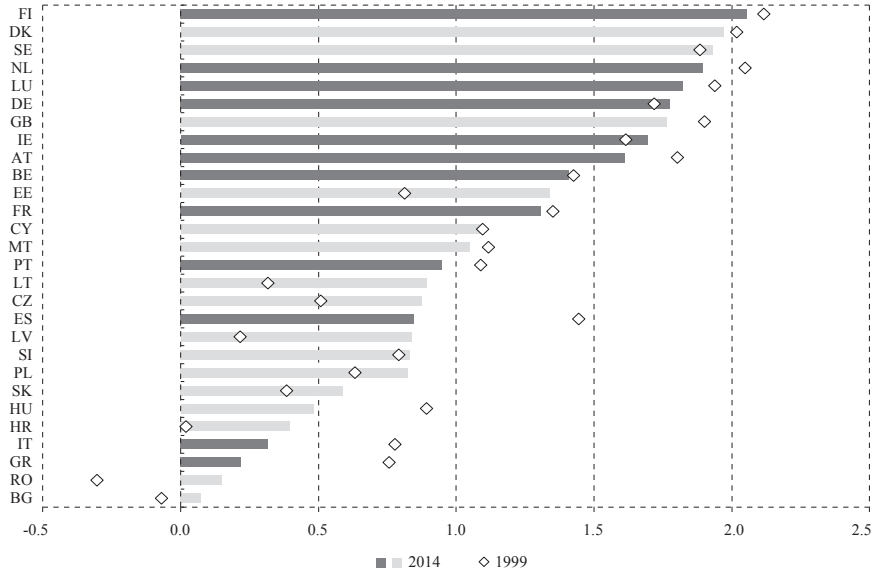
However, the chart shows that certain countries have fallen out from this simple prediction model. For example Greece, Portugal, Slovenia, Cyprus, Italy, Bulgaria, Croatia show particularly high negative residuals while the Baltic countries, Romania, Slovakia and Ireland were growing very fast compared to their initial GDP level.

In this paper the simple catching-up model shown in chart 1 is extended by considering institutional delivery and the level of public debt. Chart 2 shows the level of the institutional delivery indicator across the EU in two periods of time: 1999 and 2014. This indicator refers to the World Bank 215 country sample, where a positive value means good institutional delivery. Its statistical distribution follows a standard normal random variable, i.e. with zero mean, unit standard deviation, and ranges approximately from -2.5 to 2.5. In this paper, we centre this indicator to the EU27 sample average in 1996. Chart 2 shows that there is a large variability across the EU countries in terms of institutional quality, and that, as expected, richer countries enjoy higher institutional delivery. Interestingly however the chart shows a very large variability inside the early EA group (dashed bars) despite much more limited per capita GDP differences across this group of countries. Finally the chart also shows that during the past 15 years many of the early EA group (with the strongest drop in Greece, Italy and Spain) saw a worsening of the institutional delivery indicator. The analysis of the evolution of institutional delivery is presented in annex 1 with a diff-in-diff computation. This picture seems consistent with the findings in Fernandez-Villaverde et al. (2013), which emphasises the disincentives to implement reforms after the stage 3 of EMU.

Chart 3 puts together the residual from the simple catching-up model (chart 1) and the institutional delivery in 1999, taking into account the level of the government debt. This is done by representing the size of countries circles according to their government debt to GDP ratio. Chart 3 shows that the quality of institutions seem to matter most, in the sense that it is associated with subsequent relative GDP growth, for relatively high debt countries, i.e. for countries with government debt at least above 50% of GDP. When focusing on the euro area countries (white dots) a clear positive relationship emerges between the institutional quality and the residual from the simple catching-up model. This chart seems to indicate that institutional quality and government debt (above a certain level) could be two explanatory variables of the long-term GDP performance in the EU, and in particular in the euro area.

CHART 2

Institutional delivery indicator (1999 vs. 2014)

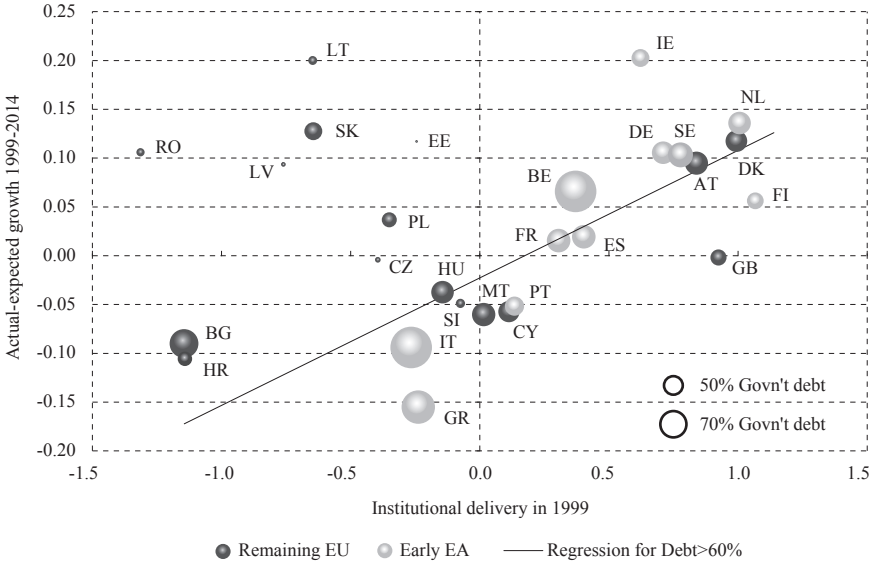


Note: Average of four indicators: government effectiveness, regulatory quality, rule of law and control of corruption. Dashed early EA countries and blank rest of EU.

Source: Authors' computation on WDI data.

CHART 3

Institutions, debt and country-groups



Source: ECB computation on EC and World Bank data.

Before econometric tests are made, the relationship between the variables plotted in chart 3, table 1 provides a summary of the key indicators at play. The table distinguishes between five group of countries: the whole EU, countries with government debt higher than the 60% Maastricht threshold, the countries with government debt lower than the 60% Maastricht threshold, the Early EA, which refers to the countries who joined the euro area between 1999 and 2001; and the transition countries, which refers to the Central and East-European countries which joined the EU in 2004 and 2007. The table shows un-weighted averages across the different groups of the cumulated potential per capita GDP growth in 1999-2014, the level of GDP per capita in 1999, the institutional delivery in 1999, 2007 and 2014 and government debt in 1999[5]. Across the variable reported it is interesting to note that higher debt level in 1999 has been associated with lower per capita potential growth. It also shows that institutional delivery decreased not uniformly across the various group of countries. It has been constantly falling in the high debt countries and in the early EA, constantly improving in the transition countries and falling since 2007 in the low debt countries.

Table 1

Key summary statistics of the indicators used in the regression analysis[6]

	EU	Debt<60$_{1999}$	Debt>60$_{1999}$	Early EA	Transition countries
Pot. GDP per capita PPPadj growth$_{1999\text{-}2014}$	80.24	95.04	55.91	49.02	126.05
GDP per capita in thsd PPPadj EUR$_{1999}$	15.65	14.15	18.72	20.49	8.81
WGI Delivery$_{1999}$	0.034	0.018	0.177	0.445	-0.624
WGI Delivery$_{2007}$	0.091	0.058	0.157	0.359	-0.427
WGI Delivery$_{2014}$	0.062	0.011	0.097	0.271	-0.376
Government Debt % GDP$_{1999}$	52.41	37.67	76.01	69.13	32.38
Observations$_{1999}$	27	16	10	11	11

Source: ECB computation on EC and World Bank data.

4 THE EMPIRICAL MODEL AND ESTIMATION RESULTS

4.1 THE EU SAMPLE AND THE MAASTRICHT DEBT THRESHOLD

The correlations chart shown in the previous section (chart 3) seems to indicate that the quality of institutions may be more important to explain the long-term GDP performance in the early EA group than in the rest of the EU. The analysis has also shown that there is a high correlation between level of debt and early euro area membership. Against the above evidence, this section tests the validity of a parsimonious empirical model capturing the linkages between quality of institutions and level of debt.

[5] There is no European Commission data on the level of Croatian government debt in 1999.
[6] General government debt data are reported in annex 2.

The estimated benchmark model takes the following specification:

$$\Delta y_{c,t} = \alpha + \beta_y y_{c,t} + \beta_D D_{c,t} + \beta_I I_{c,t} + \beta_{DI} D_{c,t} I_{c,t} + \varepsilon_c \quad (1)$$

where:

$\Delta y_{c,t}$ is the 15-year average GDP per capita growth computed starting at time t (i.e. log change of potential purchasing power (PPS) adjusted GDP per capita) with t running from 1995 to 2002 for country c.

$y_{c,t}$ is the log starting level of the PPS adjusted GDP per capita at time t for country c.

$D_{c,t}$ is a dummy, at time t for country c, which takes the value of 1 if government debt is greater than a certain threshold. In our benchmark model we assume that the threshold is 60% of GDP (Maastricht threshold).

$I_{c,t}$ measures the institutional delivery at time t for country c, the index is centred at the EU average level and we apply a 3-year centred moving average. This is done to include as many as possible back data, which prior to 2002 were available on a biannual basis.

$D_{c,t} I_{c,t}$ is the interaction between the latter two indicators.

Given that the last starting data point is 2002 the corresponding GDP growth interval, i.e. 2002-2017, includes two years of forecast, which is taken from the European Commission. For Bulgaria debt data are available from 1997 and for Croatia debt data are available from 2001 onwards.

As a result the panel consists of 208 data points (25*8 + 6 + 2). Given that the panel's GDP growth periods are overlapping, to account for autocorrelation of errors across time we use a pooled OLS regression with standard errors clustered across time. The choice of the pooled OLS regression instead of a country-fixed effect model is due to the use of the country-specific institutional delivery variable, which contains very little variability between 1995 and 2002, plays the role of a country-specific constant.

We estimate the model by using both ordinary least squares and 2SLS instrumental variables. The latter method is used to account for the possibility that deep cultural, legal and political differences underlie different economic institutions (Acemoglu, Johnson and Robinson, 2004; 2005). Thus we decide to use the approach of La Porta et al. (1999), where legal origin dummies are used as instruments for the economic variables.[7] In view of the presence of the interaction term two instrumental equations are estimated in the first step:

[7] In La Porta et al. (1999) countries are grouped according to English (CY, IE, UK), French (MT, BE, ES, FR, GR, IT, NL, PL), German (AT, DE), Soviet (EE, LT, LV, SI, SK, BG, CZ, HR, HU, PL, RO) and Scandinavian (FI, DK, SE) legal origins. As there are doubts about the Soviet legal origin of SI and HR, robustness checks have been carried out by using German origin for these countries (see annex 7). Annex 7 also reports the outcome of 2SLS using human diversity as instrumental variable.

$$I_{c,t} = \gamma_0 + \gamma_1 y_{c,t} + \gamma_1 D_{c,t} + \gamma_2 LO_{c,t} + \gamma_3 D_{c,t} LO_{c,t} + \varepsilon_c \quad (2)$$

$$D_{c,t} I_{c,t} = \delta_0 + \delta_1 y_{c,t} + \delta_1 D_{c,t} + \delta_2 LO_{c,t} + \delta_3 D_{c,t} LO_{c,t} + \varepsilon_c \quad (3)$$

where *LO* stands for legal origin. In the second step the fitted values of $I_{c,t}$ in equation (2) and of $D_{c,t} I_{c,t}$ in equation (3) are plugged into the original equation (1).

Table 2

Estimation output of equation (1)

15-year average per capita potential growth		
Explanatory variables	**OLS**	**2SLS**
Log GDP (PPP)	-0.589***	-0.611***
	(0.0386)	(0.0413)
Institutional delivery	0.0951***	0.116***
	(0.0317)	(0.0394)
(Debt>60)	-0.0394*	-0.0357*
	(0.0197)	(0.0186)
(Debt>60) x Institutional delivery	0.131***	0.123***
	(0.0283)	(0.0289)
Constant	2.127***	2.181***
	(0.0988)	(0.105)
Observations	208	208
R-squared	0.911	0.910

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

The estimation results are shown in table 2.[8] The table shows that the catching up effect, i.e. the impact of the initial level of GDP per capita, is highly significant in both regressions and, as expected, it indicates that higher initial GDP per capita is associated with subsequently lower long-term per capita GDP growth. Moving from one estimation method to another does not impact the significance or the size of the coefficient. The institutional delivery indicator is significant and positive, meaning that stronger quality of institutions is correlated with subsequent higher per capital long-term GDP growth. This result also holds for both estimation methods. Debt dummies are always negatively significant: higher government debt levels reduce long-term GDP per capita growth irrespective of the estimation method. Interestingly, the 60% threshold used for the debt dummy appears significant. The interaction terms are positively highly significant. When looking at the debt dummy and at the interaction term jointly one can conclude that in the presence of high debt, an improvement of institutions is associated with higher growth potential, and a deterioration is instead associated with lower growth potential. This conclusion holds across both estimation methods. The main takeaway of this exercise is that countries with high debt and low institutional delivery would be significantly better off if they were able to increase the quality of their

[8] Annex 3 reports step 1 estimates of the 2SLS.

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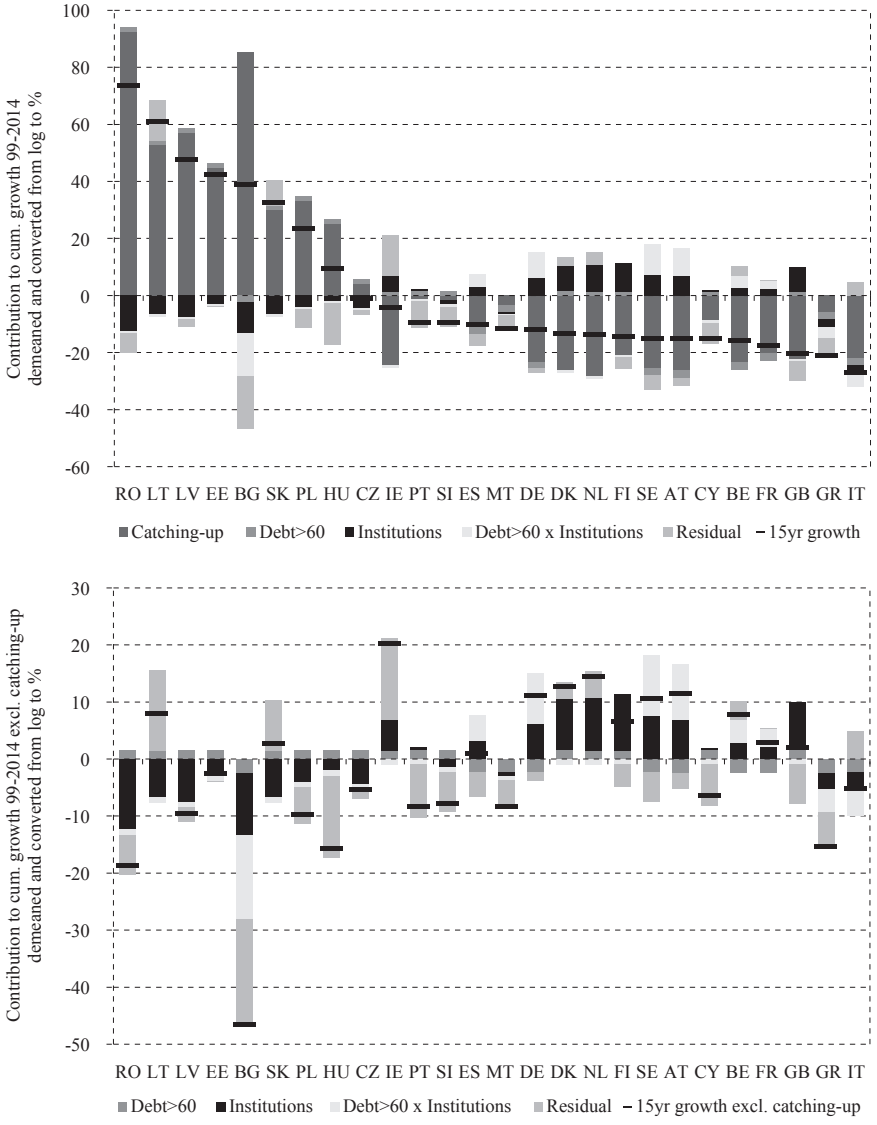
institutions. For high levels of institutional delivery the model suggests that high debt is not a problem. This is the result of the inclusion in the sample of countries that had both high debt and very good institutional delivery between 1995 and 2002 and robust growth afterwards (e.g. Belgium).[9]

CHART 4

Contributions to the cumulative potential GDP per capita growth – estimated equation (1)



Source: Authors' computation on EC and World Bank data.

[9] It is well known that Belgium conducted sound fiscal policies with high primary surpluses after joining the euro area. Possibly, good institutions are conducive to disciplined fiscal policies.

Chart 4 visualizes the regression result of the first column of table 2. The indicators are demeaned and transformed from log to percentages for better readability. The results are shown for the year 1999 (explanatory variables) and for the per capita GDP growth in 1999-2014. The chart shows in the upper panel all the contributions and in the lower panel the contribution of institutional delivery, debt and the interaction term on the per capita GDP growth corrected for the caching up term. While the upper chart clearly indicates that the largest contribution to per capita potential growth is the level of GDP per capita in most EU non-EA countries, also the contribution of the remaining explanatory variables is important. In particular, the contribution of institutions and debt is generally more relevant for the euro area countries than for the rest of the EU.

4.2 CHANGING THE COUNTRY COVERAGE AND THE DEBT THRESHOLD

Our benchmark model (1) is also estimated by using different country groups and different debt thresholds. In this section we only consider the OLS estimates in view of the similarity of results obtained with 2SLS (2SLS estimates are reported in annex 3).

Changing the country coverage allows to test if the three types of initial conditions (GDP per capita, debt and institutions) used in model (1) change their significance for different country groups and different exchange rate regimes. Table 3 shows that when enlarging the group by other OECD countries (based on data availability) the sign and significance of the estimated coefficients remain unaltered. The table also shows the results for 2 sub-groups: the euro area plus fixed exchange rate countries in the EU, and the countries (EU plus other OECD) with flexible exchange rates. It appears very important to test if institutional quality matters more in the presence of fixed exchange rate regimes, given that the absence of the exchange rate tools takes away a degree of flexibility, which would need to be compensated with structural reforms. While the significant drop of observations makes the results less robust, it seems that the model works better for the fixed exchange rate group than for the flexible exchange rate group. In particular, institutional delivery seems more important for the group of countries that have fixed exchange rates or are in the euro area than in countries with flexible exchange rate regimes.

The results seem to indicate that in the fixed exchange rate group (with 21 countries) catching-up conditions are slightly better than in the larger and mixed groups (with 27 or 33 countries), provided that institutions are strong. In the fixed exchange rate group the significance of the debt dummy drops; however the interaction term remains highly significant, indicating that the quality of institutions is particularly important in the presence of high debt. Additional robustness checks for subgroups of countries are shown in annex 4. In particular, when considering CEECs alone, the variables on institutions lose significance, suggesting that institutional quality matters less at the initial stages of catching-up, when the catching-

up potential is still large, while initially other considerations (including the debt level) may be more important.[10]

Table 3

Changing the country coverage (OLS estimates)

	EU (27)	EU + other OECD (33)	Fixed ER (21)	Flexible ER (12)
Log GDP (PPP)	-0.589***	-0.551***	-0.634***	-0.402***
	(0.0386)	(0.0468)	(0.0483)	(0.0735)
Institutional delivery	0.0951***	0.0904**	0.124**	0.00785
	(0.0317)	(0.0391)	(0.0465)	(0.0765)
(Debt>60)	-0.0394*	-0.0716**	-0.0507	-0.0895
	(0.0197)	(0.0297)	(0.0322)	(0.0517)
(Debt>60) x Institutional delivery	0.131***	0.114***	0.133***	0.0873
	(0.0283)	(0.0413)	(0.0425)	(0.069)
Constant	2.127***	2.032***	2.237***	1.657***
	(0.0988)	(0.118)	(0.121)	(0.186)
Observations	208	246	160	86
R-squared	0.911	0.849	0.880	0.834

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

Other OECD: CA, IS, JP, NO, TR, US.

Flexible ER: CZ, GB, HU, PL, RO, SE, CA, IS, JP, NO, TR, US.

Fixed ER (early EA and fixed exchange rate and late EA joining countries): CY, EE, LT, LV, MT, SI, SK, BG, DK, HR.

Changing the debt threshold allows us to test whether the results depend on a specific debt level and if institutions matter differently for low versus high debt. Three cases are considered:

- A dummy that takes the value of 1 when government debt is above 50% of GDP. This value was chosen because a value around 50% of GDP was the un-weighted average of EU countries debt level in 1999 (the average EU27 debt level in the range 1995 to 2002 is 52% of GDP).
- A dummy that takes the value of 1 when Government Debt is above 70% of GDP. This value was chosen because a value close to 70% of GDP was the un-weighted average of Early EA countries debt level in 1999 (the average Early EA debt level in the range 1995 to 2002 is 71% of GDP).
- Government debt to GDP ratio enters directly in the equation, while the interaction term is constructed with actual debt in deviation from the 60% of GDP threshold.

[10] Annex 4 reports the estimates for the EU15 and the CEECs countries (transition countries in table 1) separately, to take into account the differences between the two groups in terms of GDP per capita, initial level of debt and institutions. The same exercise is shown for the whole EU and EU15 excluding Greece, to test if Greece could be driving the results. Table A7a in annex 4 shows the results are robust when considering the EU15 groups and when excluding Greece from the whole EU and EU15 group.

Table 4

Changing debt thresholds (OLS) – baseline sample EU27

	15 year average potential GDP growth (in PPP)			
Debt threshold	**T=60 Baseline**	**T=50**	**T=70**	**No threshold debt centred at 60% for the interaction term**
Log GDP (PPP)	-0.589*** (0.0386)	-0.567*** (0.0413)	-0.600*** (0.0396)	-0.556*** (0.0412)
Institutional delivery	0.0951*** (0.0317)	0.0663* (0.0348)	0.122*** (0.0330)	0.153*** (0.0299)
(Debt>T)	-0.0394* (0.0197)	-0.0670** (0.0243)	-0.0272 (0.0249)	-0.000459 (0.000391)
(Debt>T) x Institutional delivery	0.131*** (0.0283)	0.150*** (0.0291)	0.120*** (0.0348)	0.00291*** (0.000571)
Constant	2.127*** (0.0988)	2.080*** (0.103)	2.154*** (0.102)	2.013*** (0.105)
Observations	208	208	208	208
R-squared	0.911	0.926	0.900	0.917

Robust standard errors in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4 shows that the estimated model is robust to a change in the debt threshold. The institutional delivery term coefficient increases its size with the inclusion of a higher debt dummy. The debt dummy loses significance, however, when the threshold is set at 70% of GDP, while it gains significance when the dummy is set at 50% of GDP. The loss of significance might be related to the fact that between 1995 and 2002 very few countries in the EU sample had debt levels above this threshold. As in the previous specification, this result seems to point to a relatively higher importance of institutional delivery for the expected long-term per capita growth in the case of highly indebted countries. There are several possible channels via which institutions may alleviate the debt problem. Good institutions may (i) allow for a better (potential growth enhancing) use of government expenditures financed by debt (e.g. the Scandinavian example); (ii) promote stronger growth via sound structural policies; and/or (iii) promote social fairness and allow for more efficient tax administration, thereby reducing the economic and social costs associated with high debt.

4.3 SOME COUNTERFACTUAL EXERCISES

For an intuition of what lies behind the estimated models a few numerical counterfactual exercises could be useful. These exercises are carried out on the basis of the coefficient reported in table 4 with the three debt-threshold dummies. We consider five countries in 1999: two high debt countries with below EU average institutional delivery (IT and GR), a low debt country with below EU average institutional delivery (SI) and two countries with initial debt between 50 and 60% with institutional delivery above the EU average (FR and PT), but well below the three best performers (FI, NL and DK).

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In the first exercise (exercise 1 in table 5) we assume that these five countries had been able by 1999 to achieve debt below the debt thresholds included in table 4. According to the results reported in table 4 debt below 50% would have been associated with substantial additional annual real GDP growth over the period 1999-2014. For example in case of initial debt below the threshold of 50% (60%) the associated additional annual real growth per annum would have been 0.8 (0.5) percentage points in Italy, 0.7 (0.5) p.p. in Greece, 0.3 p.p. in Portugal and 0.1 p.p. in France (as Slovenia had below 50% debt in 1999 this exercise is not relevant for this country).

In the second counterfactual exercise, we assume a starting level of debt below the Maastricht threshold of 60% and in addition a convergence to the three best institutional delivery performers in the EU (e.g. FI, NL and DK).[11] This starting position would have been associated according to the models in table 4 with an additional 15 year average annual per capita growth of 1.5 percentage points per year in Italy, 1.4 p.p. in Greece, 0.7 p.p. in Slovenia, 0.6 p.p. in Portugal and 0.5 p.p. in France (table 5).[12]

Table 5

Counterfactual exercises

Exercise 1 – Average annual growth impact of reducing debt to below threshold (in %)

	IT			SI			FR			PT			GR		
Model	D50	D60	D70	D50	D60	D70	D50	D60	D70	D50	D60	D70	D50	D60	D70
Contribution debt	0.46	0.27	0.18	0	0	0	0.46	0.27	0	0.46	0	0	0.46	0.27	0.18
Contribution interaction term	0.27	0.24	0.22	0	0	0	-0.3	-0.3	0	-0.1	0	0	0.24	0.21	0.19
Total	0.75	0.51	0.41	0	0	0	0.14	0	0	0.32	0	0	0.72	0.49	0.38

Exercise 2 – Average annual growth impact of reducing debt to below threshold and moving institutions to EU top 3 (in %)

	IT	SI	FR	PT	GR
Contribution institutional delivery	0.87	0.73	0.47	0.59	0.85
Contribution debt	0.27	0	0.27	0	0.27
Contribution interaction term	0.24	0	-0.3	0	0.21
Total	1.45	0.73	0.47	0.59	1.4

[11] Note that for PT and SI this counterfactual result is only associated with improved institutions, as the initial debt level in 1999 was below 60%, while for the other three countries the results reflect both lower debt levels and improved institutions at the start of 1999, compared to the actual values.

[12] Comparing the first and the second exercise suggests that, e.g. in the case of Greece 0.5 p.p. higher annual real growth is associated with the lower initial debt level, and an additional 0.9 p.p. annual growth is associated with a much improved institutional quality, given debt below 60%. Given that the importance of above average institutions increases with the debt threshold, debt above the higher threshold (70%) coupled with very good institutions can be associated with even higher real growth. To remain on the prudent side, we do not think that this effect should be included in the counterfactual exercises, also as it seems driven by relatively few observations. In any case, the counterfactual result of the impact of better institutions on long-term growth appears rather large even without this effect.

5 EXPANDING THE ORIGINAL MODEL

The empirical growth literature usually contains a much larger set of macroeconomic variables included among the regressors. These variables do not usually cover the institutional set-up as captured by the institutional delivery indicators but other structural characteristics of the economy, such as the level of education, the saving rate, trade openness, the share of government expenditure on top of the initial level of GDP per capita (Barro, 1998; 1991; Barro and Sala-i-Martin, 1995; Easterly and Rebelo, 1993). To check whether model (1) could potentially suffer from an omitted variable problem this section looks at the outcome of an augmented model:

$$\Delta y_{c,t} = \alpha + \beta_y y_{c,t} + \beta_D D_{c,t} + \beta_I I_{c,t} + \beta_{DI} D_{c,t} I_{c,t} + \beta_z Z_{c,t} + \varepsilon_c \qquad (4)$$

where $Z_{c,t}$ is a matrix which includes the following variables: trade openness (imports + exports in percent GDP); government expenditures (adjusted for bank recapitalization in percent of GDP); households savings rate; participation rate (labour force as % of working age population); level of education (percentage of the working age population with at least upper secondary education). These variables are typically included in regression analyses, which try to explain long-term growth differences across countries.

Table 6 reports the estimation results of the expanded model (4). It shows the results of six variants of the benchmark model, by using an incremental approach. Table 6 shows that the institutional delivery and the interaction term remain highly significant throughout variants (1) to (6). By contrast the debt threshold dummy loses significance in four out of the six variants. Among the additional variables, table 6 shows that, while the sign of the additional variables is correct, only the level of education seems to have some limited significance in variant (6), while all other variables are found to be insignificant and are also not able to alter the validity of the original model.

Overall, these exercises show that the parsimonious model seems relatively robust to the inclusions of additional macroeconomic/structural variables. The fact that the latter variables are not found to be significant might have different explanations: first, this model aims at explaining growth performances across similarly developed economies while the additional variables typically explain growth differences across developed and developing countries; second, some of the additional variables might present some degree of collinearity with the institutional delivery, this is particularly the case of education, which is not significant in (5) but only in variant (6); third, the time-span (i.e. 8 years running from 1995 to 2002) implies that there is a relatively limited time-series variability which might also reduce the significance of the additional explanatory variables.

TABLE 6

Expanding the original model for the EU27 countries

	15 year average potential GDP growth (in PPP)						
	Baseline	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Catching-up	-0.589***	-0.588***	-0.588***	-0.559***	-0.586***	-0.551***	-0.550***
	(0.0386)	(0.0395)	(0.0386)	(0.0453)	(0.0365)	(0.0397)	(0.0537)
Institutional delivery	0.0951***	0.0969***	0.102***	0.0736**	0.0885***	0.0763**	0.0718**
	(0.0317)	(0.0317)	(0.0354)	(0.0308)	(0.0301)	(0.0297)	(0.0341)
(Debt>60)	-0.0394*	-0.0346*	-0.0319	-0.0486**	-0.0301	-0.0383	-0.00518
	(0.0197)	(0.0182)	(0.0212)	(0.0215)	(0.023)	(0.0271)	(0.0233)
(Debt>60) x Institutional delivery	0.131***	0.123***	0.138***	0.134***	0.124***	0.128***	0.0799***
	(0.0283)	(0.0266)	(0.0285)	(0.0248)	(0.0286)	(0.0364)	(0.0266)
Trade openness		0.035					0.0355
		(0.0385)					(0.035)
Government expenditure			-0.0985				-0.102
			(0.124)				(0.116)
Savings rate				-0.00161			0.00227
				(0.00176)			(0.00264)
Participation rate					0.00193		0.00374
					(0.00235)		(0.00274)
Education						0.00114	0.00157*
						(0.00079)	(0.00077)
Constant	2.127***	1.969***	2.039***	2.069***	1.980***	2.030***	1.491***
	(0.0988)	(0.214)	(0.157)	(0.106)	(0.189)	(0.102)	(0.29)
Observations	208	208	208	195	208	173	166
R-squared	0.911	0.914	0.914	0.925	0.912	0.897	0.922

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

6 EXPANDING THE SAMPLE PERIOD AND TESTING FOR DIFFERENT PROXY OF INSTITUTIONAL QUALITY

The relatively limited time variation, from 1995 to 2002, and the fact that institutional delivery indicator moves very slowly through time might lead to the conclusion that the time dimension of the results is relatively weak. Given the data limitation on the institutional delivery indicator (only available from 1995 onwards), to test whether the quality of institutions remains an important explanatory variable through time, we use a series of proxies for this variable. In particular, three measures of institutional quality are available since 1975: economic complexity, the Chin-Ito openness, and the Fraser Institute Economic Freedom.

Results are reported in table 7. The first column shows the benchmark model. Model (1) replaces our institutional delivery indicator by Economic Complexity index (ECI), model (2) by the Chinn-Ito Financial Openness Index (KAOPEN), model (3) by the Fraser Institute Economic Freedom (EFF), and model (4) by the Heritage Foundation Economic Freedom (EFH). All these indicators are standardised such that higher values represent better institutions and they are centred on the cross country linear average in 1998.

The ECI is a holistic measure of the production characteristics of countries, which embeds the knowledge accumulated and the country's industrial composition. This information is used to create measures of the relative complexity of a country's exports (Hidalgo and Ricardo, 2009). KAOPEN is a measure of a country's degree of capital account openness (Chinn and Ito, 2006), based on restrictions to cross-border financial transactions. The EFF measures the degree to which the policies and institutions of countries are supportive of economic freedom (Block, 1991). This latter concept is assessed against personal choices, voluntary exchanges, freedom to enter markets and compete, and security of person and privately owned property. The summary index measures the degree of economic freedom in five broad areas: size of government, legal structure and property rights, access to sound money, international trade and regulation of credit, labour and business. The EFH is based on 10 quantitative and qualitative factors measuring: rule of law, limited government, regulatory efficiency and open markets (Miller and Kim, 2016). The first two indicators (ECI and KAOPEN) measure the quality of institutions only indirectly (and in a more narrow sense) via the observed complexity of the economic system or via the extent to which a country is subject to financial transaction costs. Instead the other two indicators are closer proxies of institutional delivery as they attempt to measure the efficiency of economic institutions. The last indicator in table 7 is available only since 1995, i.e. it covers the same time span as institutional delivery.

Table 7

Expanding the sample period for the EU 27 countries

	15 year average potential GDP growth (in PPP)				
Institutions	**Baseline**	**ECI**	**KAOPEN**	**EFF**	**EFH**
		(1)	**(2)**	**(3)**	**(4)**
Catching-up	-0.589***	-0.522***	-0.538***	-0.596***	-0.519***
	(0.0386)	(0.0179)	(0.0161)	(0.0255)	(0.0264)
Institutions	0.0951***	0.0676**	0.0371***	0.0757***	0.00445*
	(0.0317)	(0.0321)	(0.0102)	(0.0218)	(0.00238)
(Debt>60)	-0.0394*	0.0230	0.0303	0.0226	0.00215
	(0.0197)	(0.0326)	(0.0312)	(0.0239)	(0.0248)
(Debt>60) x Institutions	0.131***	0.0535	-0.00929	0.0522**	0.0108***
	(0.0283)	(0.0389)	(0.0191)	(0.0206)	(0.00277)
Constant	2.127***	1.941***	2.000***	2.139***	1.941***
	(0.0988)	(0.0448)	(0.0467)	(0.0664)	(0.0694)
Observations	208	454	458	470	200
First observation	1995	1975	1975	1975	1995
R-squared	0.911	0.873	0.865	0.882	0.883

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

Table 7 shows that when extending the sample period by 20 years, i.e. advancing the starting date from 1995 to 1975 (models (1) to (3)) the role of institutions remains equally important to explain long-term per capita growth. When compar-

ing all specifications (i.e. also including model (4)), the significance of the institutional variable is maintained. In models (1) to (3) one can also observe that the significance of the debt threshold dummy and the interaction term is notably reduced. Only in model (3) does the interaction term continue to be significant. Thus, from a longer term perspective, it seems that the quality of institutions matters more than the level of indebtedness and that the 60% threshold dummy itself does not play a role in explaining per capita long term growth since the 1970s. However, for EFF and EFH, which are a closer proxy of institutional delivery, the interaction term between debt and institutions remains significant. Given the longer time series used in model (1) to (3) it is interesting to test how an augmented version of the models would work. Tables A8 (1-4) in annex 5 report the results of the augmented versions of models (1-4) in table 7. The inclusion of additional variables follows the same principle used in table 6. Tables A8 (1-4) show that coefficient on institutions continue to be very significant, moreover the interaction term between debt and institutions remains significant together with three additional explanatory variables: trade openness, participation rate and education in most of the specifications. Finally table A12 in annex 7 shows the results for institutional quality as estimated by Kunčić (2014), where the institutional indicator is derived from factor analysis based on 30 available indicators. Even though the magnitude of the coefficients differs due to different scales, the overall message remains broadly unchanged also for this alternative measure of institutional quality.

Overall, the extension of the sample period continues to support the importance of institutions for supporting higher long-term per capita growth. However, the evidence on the importance of debt becomes weaker and the model's specification seems to miss some explanatory variables when we go back to the 1970s.

7 ADDITIONAL ROBUSTNESS EXERCISES

In this section we report three additional robustness exercises to test the validity of our benchmark model. First, we use a variant of the model where the focus is on the interaction between the debt dummy threshold and institutional delivery from the countries which have below average institutional delivery; second, we test the robustness of the results by changing the measures of long-term per capita GDP growth and finally we change the time span of the target variable, per capita GDP growth, from annual to twenty-year average growth to see if the information content of the model changes for short, medium and long term growth.

7.1 DIFFERENT MEASURES OF PER CAPITA GDP GROWTH AND GDP LEVELS

Another robustness check consists of assessing the sensitivity of the model (1) to changing the measure of per capita long-term GDP growth. Throughout the paper the baseline measure of per capita long term GDP growth has been the European Commission (EC) estimates of the PPP-adjusted potential GDP per capita. The choice was dictated by the need to consider a trend variable and to correct it for the purchasing power (PPP-adjustment) of the different EU countries. However, given the unobservable status of potential output estimates and the uncertainty

related to PPP-adjustment estimates some robustness checks on these two parameters are warranted.

The robustness check is carried out by using four alternative measures of long-term per capita GDP growth (table 8).

Actual real GDP PPP-adjusted: in this case the EC PPP-adjusted potential GDP per capita estimates are replaced by actual PPP-adjusted GDP per capita figures (table 8 (1)).

Actual real GDP: in this case the EC PPP-adjusted potential GDP per capita estimates are replaced by real GDP per capita estimates (table 8 (2)).

IMF Potential GDP: in this case the EC PPP-adjusted potential GDP per capita estimates are replaced by IMF potential GDP per capita estimates. It should be noted that the IMF doesn't provide the full history for the countries that more recently joined the EU and euro area (table 8 (3)).

Potential GDP relative to the EU average: in this case instead of taking the EC PPP-adjusted potential GDP per capita estimates, we use for the target variable and for the explanatory variable the PPP adjusted GDP per capita relative to the European Union average (table 8 (4)).

Table 8

Different measures of GDP growth and GDP levels

	15 year average per capita GDP growth				
	Baseline	**Actual PPP Log (1)**	**Actual Real Log (2)**	**IMF Pot Real Log (3)**	**EC Pot PPP RelEU (4)**
PPP Log	-0.589***	-0.597***			
	(0.0386)	(0.0441)			
Real Log			-0.403***	-0.373***	
			(0.0499)	(0.0398)	
PPP RelEU					-0.469***
					(0.0509)
Institutions	0.0951***	0.0909**	0.146**	0.148***	6.432**
	(0.0317)	(0.0359)	(0.0533)	(0.0455)	(2.455)
(Debt>60)	-0.0394*	-0.0540*	-0.0401	-0.0401	-3.208
	(0.0197)	(0.0271)	(0.0298)	(0.0269)	(2.002)
(Debt>60) x Institutions	0.131***	0.150***	0.161***	0.144***	11.63***
	(0.0283)	(0.0384)	(0.0400)	(0.0327)	(3.237)
Constant	2.127***	2.134***	1.374***	1.296***	46.05***
	(0.0988)	(0.113)	(0.131)	(0.101)	(4.024)
Observations	208	208	208	184	208
R-squared	0.911	0.896	0.799	0.766	0.776

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

The results in table 8 show that the regression model (1) is robust to measurement changes of the 15-year average GDP growth. Generally, the catching-up coefficient becomes smaller when using other measures of per capita GDP growth while the institutional delivery coefficient becomes larger. The significance of the debt threshold dummy is somewhat reduced, but the significance of the interaction term remains intact. From these exercises one can conclude that the measurement uncertainty related to "potential" and "PPP-adjustment" does not distort the results.

7.2 VARYING TIME SPANS AND STARTING LEVELS

The final robustness check consists of evaluating to what extent the regression results depend on the starting level and on the time span used. This exercise is needed to test if the robustness of the results depends on the chosen sample period, both in terms of starting level used for the regressors and in terms of time span used for GDP growth variable. The robustness check is done by estimating 380 cross-sectional equations (19 base years and 20 years of possible time spans) for equation (1) above. In other words, starting at the base year 1996, twenty cross-sectional regressions have been carried out on that base year to explain an average GDP growth that goes from one to 20 years. The results are shown in form of a matrix where the y axis represents the time span and the x axis the starting or base year.

Equation (5) modifies model (1) by changing the base year and the time span:

$$(y_{c,t=Base+Span} - y_{c,t=Base}) = \alpha + \beta_y y_{c,t=Base} + \beta_D (D>60)_{c,t=Base} + \beta_I I_{c,t=Base} + \beta_{DI} (D>60)_{c,t=Base} I_{c,t=Base} + \varepsilon_c \quad (5)$$

Table 9 reports the values of the R^2 in equation (5). It is possible to observe that the explanatory power of the regression is larger the longer is the time span considered for the average per capita GDP growth. In particular the R^2 is relatively higher for average GDP growth rates that include more than 9 years of observations. The matrices with t-statistics of the explanatory variables are reported in annex 6. They show that the significance of the model is maintained for different base years and time spans, but the performance is better for a longer time-span. Overall this exercise suggests that the model is more suitable to explain long-term growth performances and not the business-cycle frequencies. It also suggests that the model would continue to perform well even when taking a longer time span than the one used in the paper.

Given the above results a few variants of the target variable are considered in table 10. We test how the model performs for three measures of the long-term per capita GDP growth. First, we reduce the overlapping period and assume that we have only three different data points for the 15-year average GDP per capita growth (1996, 1999 and 2002); second, we consider the 23-year average per capita GDP growth and, third, we consider two non-overlapping 10-year average per capita GDP growth periods. These variants imply a significant drop of the availa-

ble observations and basically the model is reduced to a cross-sectional analysis. This, notwithstanding institutional delivery and its interaction with the debt threshold dummy, remains largely significant.

Table 9

R^2 of equation (5)

Span \ Base	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
1	30	26	43	15	56	49	56	52	62	61	77	58	45	31	41	47	24	31	48	**1**
2	26	32	28	39	57	64	64	70	68	76	75	73	49	43	56	45	31	46	49	**2**
3	39	33	38	49	68	68	74	73	77	76	81	69	52	51	52	47	42	50	50	**3**
4	39	43	50	62	72	75	76	78	79	82	77	69	57	53	51	52	46	52		**4**
5	46	55	62	70	79	77	81	81	85	80	77	71	57	54	55	54	48			**5**
6	57	63	69	77	81	82	83	86	83	80	78	71	58	58	56	55				**6**
7	64	68	76	79	85	85	88	85	83	82	78	71	59	60	57					**7**
8	69	74	78	83	88	90	88	85	84	82	78	70	60	61						**8**
9	73	78	82	87	92	90	87	85	84	82	77	69	60							**9**
10	77	83	87	92	93	89	88	86	85	82	76	68								**10**
11	82	88	92	92	92	90	88	86	84	81	75									**11**
12	88	92	92	92	92	90	88	86	84	80										**12**
13	92	93	92	92	93	90	87	85	83											**13**
14	93	93	92	92	92	89	87	84												**14**
15	94	94	93	92	92	88	86													**15**
16	94	94	92	91	91	87														**16**
17	94	93	91	90	90															**17**
18	94	93	90	90																**18**
19	93	92	90																	**19**
20	93	91																		**20**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	

Table 10

Varying growth spans

	Average potential per capita GDP growth (in PPP)			
Outcome	**Baseline**	**15yr starting 1996/1999/2002**	**23yr starting 1995**	**10yr non-overlapping**
Catching-up	-0.589***	-0.572***	-0.705***	-0.471***
	(0.0386)	(0.0430)	(0.0637)	(0.0378)
Institutions	0.0951***	0.0892**	0.0965*	0.127***
	(0.0317)	(0.0359)	(0.04838)	(0.0304)
(Debt>60)	-0.0394*	-0.0549**	-0.0153	-0.00512
	(0.0197)	(0.0239)	(0.0380)	(0.0226)
(Debt>60) x Institutions	0.131***	0.151***	0.202***	0.0809*
	(0.0283)	(0.0354)	(0.0483)	(0.0430)
Constant	2.127***	2.080***	2.505***	1.674***
	(0.0988)	(0.108)	(0.152)	(0.101)
Observations	208	78	25	52
R-squared	0.911	0.904	0.936	0.843

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

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Finally, table 11 reports three cross-sectional results. The first is the one already presented in table 10, where the 23 year average per capita potential growth (from 1995 until 2017) is regressed against the level of GDP per capita, the quality of institutions, the debt threshold and the interaction term. The second and the third replace the institutional delivery with the Fraser Institute Economic Freedom Index (EFI) described in section 6, which is available for a limited group of EU countries since the mid-1970s. In the second column, the results with the EFI are shown for the 23 year average potential per capita growth. This is done to show that the cross-sectional results are not significantly affected by the choice of the institutional indicator. In the third column, the results with the EFI are shown for the 35-year average per capita potential growth. While the very limited number of observations does not allow a robust conclusion to be derived, the results continue to be consistent with the view that the quality of institutions is an important determinant of long-term growth.

Table 11

Cross-sectional results

	Average potential per capita GDP growth (in PPP)		
Outcome	**23yr starting 1995 (Institutional delivery)**	**23yr starting 1995 (EFI)**	**35yr starting in 1983 (EFI)**
Catching-up	-0.705***	-0.664***	-0.738***
	(0.0637)	(0.0514)	(0.2122)
Institutions	0.0965*	0.0318	0.165***
	(0.0484)	(0.0233)	(0.0473)
(Debt>60)	-0.0153	-0.0155	0.0438
	(0.0380)	(0.0402)	(0.0896)
(Debt>60) x Institutions	0.202***	0.197***	-0.0847
	(0.0483)	(0.037)	(0.0862)
Constant	2.505***	2.423***	2.662***
	(0.152)	(0.135)	(0.4835)
Observations	25	25	13
R-squared	0.936	0.943	0.768

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

8 CONCLUSIONS

This paper tried to explain the different long-term per capita GDP growth performances in Europe by using a parsimonious empirical model, testing if and how the initial quality of institutions and government debt are important determinants of long term growth in Europe. The benchmark model explains long-term growth by the initial levels of government debt, quality of institutions (institutional delivery) and an interaction term between the two variables, on top of the initial level of GDP per capita (to account for the catching-up potential). The sample period used for the initial level of variables runs from 1995 to 2002, while long term per capita growth is the 15-year average potential per capita GDP growth estimated by the Commission.

The benchmark model is estimated for the whole of Europe, the OECD and for two groups of countries: countries with fixed exchange rate regimes and belonging to the monetary union, and countries with flexible exchange rate regimes. The findings of the paper support the view that the quality of institutions is an important determinant of long-term growth. The results seem particularly important for countries where institutional delivery is below or around the EU average and initial public debt is above the threshold of, for example, 60 or 70%. Such countries could experience significantly higher per capita GDP growth if their institutions were improved. Interestingly, initial debt levels above 60% or 70% appear not to be negative for long-term growth in the presence of very sound institutions. While this result needs to be treated carefully as it is driven by rather few observations, it might suggest that thresholds above which debt levels are detrimental for growth are not the same across countries, but could to be endogenous to the quality of public institutions.

While the results hold across different groups of countries, it appears that the conditions for real convergence are generally also good for the group of euro area and fixed exchange rate countries. At the same time the quality of institutions might be particularly important for this group. This could reflect that sound institutions – and the associated policies – are helpful to compensate for the lack of the exchange rate tool as adjustment and disciplinary device, supporting the view that improvements in institutions and structural reforms are particularly important for euro area countries to be able to reap the full benefits of monetary union. However, this result is preliminary and requires further research.

The benchmark model is changed in several ways to check the validity of the results. First the results are assessed against different debt thresholds (corresponding to the EU average, the Maastricht threshold and the EA average); second the model is augmented with different control variables, which are typically included in the growth literature (education attainment, saving rate, government expenditure, etc.); third other measures of institutional quality are used as a proxy for institutional delivery, which allow the sample period considered to be extended by 20 years, i.e. moving the starting date from 1995 to 1975. These changes continue to support the evidence that institutional delivery is a critical determinant of long-term growth in Europe; however the significance of debt thresholds turns out to be less robust to the above changes.

Finally other robustness exercises are reported by using different measures of long-term growth and different time-spans. Also these exercises show that the estimates obtained with the benchmark model are relatively robust to changes in specifications. The only variable where we observe a drop in significance is the debt dummy. This suggests that debt per se is not a problem but can become a problem in the presence of weak institutions.

There are of course many factors which are not or only partially included in the institutional variables used here, which can enhance longer-term growth. These might include macroeconomic stability, sound fiscal policies, efficient education systems and incentives for investment in human and real capital, a high degree of flexibility and openness in product and labour markets, well capitalised and supervised financial institutions, efficient insolvency frameworks, conditions for an efficient use of capital and labour, including via higher economic integration within the EU and a more active use of national policy tools to prevent asset price and credit boom-bust cycles. The results of this paper are broadly consistent with the view that the World Bank (or other) indicators measuring the quality of institutions cover key factors and mechanisms, which also determine the probability that governments and societies in the future support policies and reforms in the above areas, enhancing long-term growth. The link between institutional quality and the probability of the above mentioned sound policies and reforms that enhance long-term growth has however not been tested explicitly. It is left for further research.

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ANNEX 1

ANALYSIS OF THE EVOLUTION OF THE INSTITUTIONAL DELIVERY INDICATORS OVER TIME

This annex looks at the evolution of the institutional delivery indicators over time. The analysis is done by using the difference in difference approach, where the 28 EU countries have been divided in five groups defined as follows:

- Early EA-high: the early euro area joiners with the WGI in 1996 > 1.33
- Early EA-low: the early euro area joiners with the WGI in 1996 < 1.33
- New EA: the countries that joined the EA after 2001
- NOEA-high: the countries not part of the EA with WGI in 1996 > 1.33
- NOEA-low: the countries not part of the EA with WGI in 1996 < 1.33

The breakpoint of 1.33 was decided upon using a difference in difference calculation, where this cut off reached the highest R^2.

		WGI delivery (not transformed)			
		1996	***>1.33***	**2008**	**2014**
GR	Early EA	0.70		0.60	0.22
IT	Early EA	0.75		0.48	0.32
FR	Early EA	1.26		1.43	1.31
PT	Early EA	1.30		1.04	0.95
ES	Early EA	1.30		1.11	0.85
BE	Early EA	1.41	x	1.36	1.41
IE	Early EA	1.64	x	1.72	1.69
DE	Early EA	1.70	x	1.62	1.78
AT	Early EA	1.79	x	1.81	1.61
LU	*Early EA*	*1.87*	*x*	*1.77*	*1.82*
FI	Early EA	1.89	x	1.99	2.06
NL	Early EA	1.92	x	1.84	1.90
LV	New EA	0.10		0.63	0.84
SK	New EA	0.40		0.72	0.59
LT	New EA	0.45		0.61	0.89
EE	New EA	0.59		1.15	1.34
MT	New EA	0.88		1.28	1.05
SI	New EA	1.07		0.98	0.83
CY	New EA	1.28		1.33	1.09
BG	Non EA	-0.41		0.05	0.08
HR	Non EA	-0.38		0.27	0.40
RO	Non EA	-0.17		0.02	0.15
PL	Non EA	0.66		0.54	0.82
CZ	Non EA	0.78		0.83	0.87
HU	Non EA	0.78		0.80	0.48
SE	Non EA	1.84	x	1.93	1.93
GB	Non EA	1.90	x	1.68	1.77
DK	Non EA	1.96	x	2.14	1.97

The charts below show the country group mean development of WGI-delivery over time (red line) and the linear fits split into three intervals: 1996-2001, 2002-2008 and 2009-2014. The first row shows absolute values, the second row allows for group fixed effects in 1996 and the last row allows for country fixed effects in 1996.

Institutions
Early EA high
Early EA low
New EA
Non EA high
Non EA low
Country fe
Group fe
0
.5
1
1.5
2
-.4
-.2
0
.2
.4
-.5
0
.5
1996
2001
2008
2014

ANNEX 2

GENERAL GOVERNMENT DEBT

The table below shows the General Government Debt in percent of GDP. Countries are ordered by debt level in 1999. Values larger than 60% formatted in bold.

	1996	1997	1998	1999	2000	2001	2008	2014
BE	**128.0**	**123.2**	**118.2**	**114.4**	**108.8**	**107.6**	**92.4**	**106.7**
IT	**116.3**	**113.7**	**110.8**	**109.6**	**105.1**	**104.7**	**102.3**	**132.3**
GR	**101.2**	**99.3**	**97.2**	**98.6**	**104.7**	**106.8**	**109.4**	**178.6**
BG		**97.3**	**69.3**	**76.1**	**71.2**	**64.7**	13.0	27.0
AT	**68.0**	**63.2**	**63.6**	**66.4**	**65.9**	**66.5**	**68.5**	**84.2**
MT	38.7	46.6	51.2	**62.1**	**60.9**	**65.5**	**62.7**	**66.9**
SE	**70.3**	**68.2**	**66.7**	**61.5**	50.6	51.7	36.8	44.9
ES	**65.6**	**64.4**	**62.5**	**60.9**	58.0	54.2	39.4	**99.3**
FR	59.7	**61.1**	**61.0**	**60.2**	58.7	58.2	**68.1**	**95.6**
DE	57.6	58.8	59.4	**60.0**	58.9	57.7	**65.0**	**74.9**
HU	**71.6**	**62.1**	**60.0**	59.9	55.1	51.7	**71.6**	**76.2**
NL	**71.2**	**65.6**	**62.5**	58.2	51.4	48.7	54.5	**68.2**
DK	**69.9**	**65.8**	**61.8**	58.2	52.4	48.5	33.4	44.6
CY	49.2	53.2	54.8	55.1	55.1	56.9	45.1	**108.2**
PT	59.5	55.2	51.8	51.0	50.3	53.4	**71.7**	**130.2**
SK	30.5	33.0	33.9	47.1	49.6	48.3	28.2	53.5
IE	**69.9**	**61.6**	51.5	46.7	36.1	33.2	42.4	**107.5**
FI	55.3	52.2	46.9	44.1	42.5	41.0	32.7	59.3
GB	47.8	46.6	44.0	41.7	38.9	36.0	51.7	**88.2**
PL	42.4	42.3	38.4	39.0	36.5	37.3	46.6	50.4
SI	21.6	22.1	22.8	23.7	25.9	26.1	21.6	**80.8**
LT	13.9	15.4	16.5	22.7	23.5	22.9	14.6	40.7
RO	10.6	14.9	16.7	21.6	22.4	25.7	13.2	39.8
CZ	11.6	12.1	13.9	15.2	17.0	22.8	28.7	42.7
LV	13.3	10.7	9.0	12.1	12.1	13.9	18.7	40.8
EE	7.5	7.0	6.0	6.5	5.1	4.8	4.5	10.4
LU	7.6	7.5	7.2	6.4	7.6	6.6	14.4	23.0
HR						36.1	38.9	**85.1**
EA19	**72.7**	**72.2**	**71.7**	**70.6**	**68.0**	**67.0**	**68.5**	**94.5**
EU28						**59.8**	**61.0**	**88.6**

ANNEX 3

2SLS ESTIMATES

This instrumental variable approach requires that the instruments (legal origin) are relevant, i.e. they are correlated with the explanatory variable (institutions) and exogenous, i.e. they are not correlated with the error term in our regression of interest. In our baseline regression institutions appear both independently and in interaction with the debt>60 dummy. It can be argued that if legal origin is a valid instrument for institutions, then legal origins in interaction with the exogenous debt dummy is also a valid instrument for institutions interacting with the debt dummy. The relevance of the instruments used can be tested by checking if the F-statistic of the first stage is larger than 10. As shown in table A2 below this criterion is met with ease if we don't enforce cluster-robust standard errors however the criterion is not met for the more robust approach.

TABLE A2

First stage of 2SLS regression shown in table 2

Explanatory variables	**Institutions**	**(Debt>60) x Institutions**	**Institutions**	**(Debt>60) x Institutions**
(Origin=English)	Omitted	Omitted	Omitted	Omitted
(Debt>60) x (Origin=English)	Omitted	Omitted	Omitted	Omitted
(Origin=French)	-0.127	0.0200	-0.127	0.0200
	(0.0809)	(0.0626)	(0.165)	(0.0248)
(Origin=Soviet)	-0.414***	0.115*	-0.414**	0.115
	(0.0895)	(0.0693)	(0.190)	(0.0781)
(Origin=German)	0.0689	-0.00983	0.0689	-0.00983
	(0.115)	(0.0893)	(0.143)	(0.0153)
(Origin=Scandinavian)	0.332***	-0.0151	0.332*	-0.0151
	(0.0900)	(0.0697)	(0.163)	(0.0199)
(Debt>60)	0.0384	0.521***	0.0384	0.521***
	(0.144)	(0.112)	(0.194)	(0.157)
(Debt>60) x (Origin=French)	-0.289*	-0.392***	-0.289	-0.392*
	(0.160)	(0.124)	(0.238)	(0.224)
(Debt>60) x (Origin=Soviet)	-0.0295	-1.214***	-0.0295	-1.214***
	(0.171)	(0.133)	(0.296)	(0.360)
(Debt>60) x (Origin=German)	-0.00134	0.253*	-0.00134	0.253
	(0.196)	(0.152)	(0.194)	(0.158)
(Debt>60) x (Origin=Scandinavian)	-0.0884	0.374***	-0.0884	0.374**
	(0.181)	(0.141)	(0.212)	(0.165)
Catching-up	0.782***	0.133**	0.782***	0.133
	(0.0694)	(0.0537)	(0.155)	(0.0867)
Constant	-1.782***	-0.401**	-1.782***	-0.401
	(0.216)	(0.168)	(0.487)	(0.261)
Observations	208	208	208	208
R-squared	0.843	0.691	0.843	0.691
Clustered standard errors	NO	NO	YES	YES
F-stat of excluded instruments	14.41	37.86	5.354	9.282

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

TABLE A3

Changing the country coverage (2SLS)

	EU (27)	EU + other OECD (33)	Fixed ER (21)	Flexible ER (12)
Log GDP (PPP)	-0.611***	-0.624***	-0.567***	-0.568***
	(0.0413)	(0.0654)	(0.0560)	(0.0810)
Institutions	0.116***	0.159**	0.0626	0.163*
	(0.0394)	(0.0784)	(0.0508)	(0.0866)
(Debt>60)	-0.0357*	-0.0612**	-0.0611*	-0.0693*
	(0.0186)	(0.0252)	(0.0321)	(0.0383)
(Debt>60) x Institutions	0.123***	0.106**	0.131***	0.0371
	(0.0289)	(0.0499)	(0.0386)	(0.0706)
Constant	2.181***	2.219***	2.067***	2.087***
	(0.105)	(0.173)	(0.137)	(0.238)
Observations	208	246	160	86
R-squared	0.910	0.842	0.874	0.803

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

Other OECD: CA, IS, JP, NO, TR, US.

Flexible ER: CZ, GB, HU, PL, RO, SE, CA, IS, JP, NO, TR, US.

Fixed ER (early EA and fixed exchange rate and late EA joining countries): CY, EE, LT, LV, MT, SI, SK, BG, DK, HR.

TABLE A4

Changing debt thresholds (2SLS) – baseline sample EU27

	15 year average potential GDP growth (in PPP)			
Debt threshold	**T=60 Baseline**	**T=50**	**T=70**	**No threshold debt centred at 60% for the interaction term**
Log GDP (PPP)	-0.611***	-0.590***	-0.633***	-0.556***
	(0.0413)	(0.0494)	(0.0422)	(0.0499)
Institutions	0.116***	0.0932*	0.151***	0.157***
	(0.0394)	(0.0503)	(0.0386)	(0.0366)
(Debt>T)	-0.0357*	-0.0641***	-0.0175	-0.000419
	(0.0186)	(0.0235)	(0.0252)	(0.000475)
(Debt>T) x Institutions	0.123***	0.133***	0.120***	0.00316***
	(0.0289)	(0.0363)	(0.0393)	(0.00111)
Constant	2.181***	2.140***	2.238***	2.012***
	(0.105)	(0.123)	(0.108)	(0.129)
Observations	208	208	208	208
R-squared	0.910	0.925	0.899	0.917

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

TABLE A5

Expanding the original model (2SLS) – baseline sample EU27

	15 year average potential GDP growth (in PPP)						
Catching-up	-0.611***	-0.617***	-0.602***	-0.561***	-0.591***	-0.570***	-0.594***
	(0.0413)	(0.0434)	(0.0438)	(0.0568)	(0.0505)	(0.0544)	(0.0640)
Institutions	0.116***	0.123***	0.117**	0.0775*	0.0954*	0.0970**	0.116*
	(0.0394)	(0.0408)	(0.0531)	(0.0430)	(0.0540)	(0.0440)	(0.0636)
(Debt>60)	-0.0357*	-0.0315*	-0.0285	-0.0462**	-0.0277	-0.0265	-0.000569
	(0.0186)	(0.0182)	(0.0212)	(0.0198)	(0.0208)	(0.0239)	(0.0232)
(Debt>60) x Institutions	0.123***	0.122***	0.129***	0.120***	0.115***	0.0988***	0.0817***
	(0.0289)	(0.0298)	(0.0265)	(0.0245)	(0.0287)	(0.0331)	(0.0290)
Trade openness		0.0342					0.0304
		(0.0370)					(0.0330)
Government expenditure			-0.101				-0.135
			(0.135)				(0.140)
Savings rate				-0.00151			0.00216
				(0.00174)			(0.00242)
Participation rate					0.00198		0.00253
					(0.00291)		(0.00318)
Education						0.00127	0.00162**
						(0.000785)	(0.000710)
Constant	2.181***	2.046***	2.072***	2.071***	1.991***	2.077***	1.687***
	(0.105)	(0.182)	(0.115)	(0.132)	(0.311)	(0.141)	(0.228)
Observations	208	208	208	195	208	173	166
R-squared	0.910	0.913	0.913	0.925	0.912	0.896	0.919

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

TABLE A6

Expanding the sample period with different institutional indicators (2SLS)

	15 year average potential GDP growth (in PPP)				
Institutions	**WGI Baseline**	**Economic Complexity**	**Chinn-Ito Openness**	**Economic Freedom Fraser**	**Economic Freedom Heritage**
Catching-up	-0.611***	-0.559***	-0.690***	-0.773***	-0.516***
	(0.0413)	(0.0306)	(0.0776)	(0.0870)	(0.0794)
Institutions	0.116***	0.134***	0.144***	0.202**	0.00375
	(0.0394)	(0.0464)	(0.0487)	(0.0848)	(0.00889)
(Debt>60)	-0.0357*	0.0235	0.0358	0.0189	0.000462
	(0.0186)	(0.0428)	(0.0292)	(0.0298)	(0.0459)
(Debt>60) x Institutions	0.123***	0.0875	-0.0569	0.115**	0.0122***
	(0.0289)	(0.0697)	(0.0682)	(0.0501)	(0.00308)
Constant	2.181***	2.019***	2.399***	2.582***	1.934***
	(0.105)	(0.0696)	(0.200)	(0.227)	(0.194)
Observations	208	454	458	470	200
First observation	1995	1975	1975	1975	1995
R-squared	0.910	0.855	0.716	0.803	0.883

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

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ANNEX 4

CHANGING THE COUNTRY GROUPING

TABLE A7 (a)

Changing the country grouping

	15 year average potential GDP growth (in PPP)				
Variables	**EU27 (baseline)**	**EU27 (excl. GR)**	**EU (15)**	**EU (15) (excl. GR)**	**CEECs (10)**
Catching-up	-0.589***	-0.573***	-0.407***	-0.398***	-0.634***
	(0.0386)	(0.0350)	(0.0422)	(0.0426)	(0.0712)
Institutions	0.0951***	0.0833***	0.0671**	0.0629**	0.0722
	(0.0317)	(0.0288)	(0.0271)	(0.0262)	(0.0777)
(Debt>60)	-0.0394*	-0.0294*	-0.0519**	-0.0342	-0.120**
	(0.0197)	(0.0164)	(0.0228)	(0.0194)	(0.0436)
(Debt>60) x Institutions	0.131***	0.120***	0.142***	0.117***	0.0626
	(0.0283)	(0.0231)	(0.0359)	(0.0335)	(0.0504)
Constant	2.127***	2.085***	1.605***	1.579***	2.210***
	(0.0988)	(0.0897)	(0.124)	(0.126)	(0.192)
Observations	208	200	120	112	80
R-squared	0.911	0.914	0.659	0.675	0.862

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

TABLE A7 (b)

Changing the country grouping (2SLS)

	15 year average potential GDP growth (in PPP)			
Variables	**EU27 (baseline)**	**EU27 (excl. GR)**	**EU (15)**	**EU (15) (excl. GR)**
Catching-up	-0.611***	-0.596***	-0.415***	-0.413***
	(0.0413)	(0.0399)	(0.0513)	(0.0541)
Institutions	0.116***	0.104***	0.0787**	0.0787**
	(0.0394)	(0.0374)	(0.0394)	(0.0401)
(Debt>60)	-0.0357*	-0.0284	-0.0419*	-0.0172
	(0.0186)	(0.0173)	(0.0220)	(0.0218)
(Debt>60) x Institutions	0.123***	0.122***	0.122***	0.0868**
	(0.0289)	(0.0293)	(0.0362)	(0.0366)
Constant	2.181***	2.145***	1.621***	1.615***
	(0.105)	(0.100)	(0.148)	(0.156)
Observations	208	200	120	112
R-squared	0.910	0.913	0.657	0.672

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

ANNEX 5

EXPANDING THE ORIGINAL MODEL WITH ADDITIONAL VARIABLE AND WITH DIFFERENT PROXY OF INSTITUTIONAL QUALITY

TABLE A8 (1)

Institutions refers to Economic Complexity

	15 year average potential GDP growth (in PPP)						
Catching-up	-0.522***	-0.539***	-0.484***	-0.484***	-0.507***	-0.468***	-0.488***
	(0.0179)	(0.0172)	(0.0281)	(0.0228)	(0.0310)	(0.0345)	(0.0304)
Institutions	0.0676**	0.0923***	0.0254	0.00484	0.0113	0.00737	0.0262
	(0.0321)	(0.0227)	(0.0373)	(0.0282)	(0.0308)	(0.0292)	(0.0323)
(Debt>60)	0.0230	0.0133	-0.00750	-0.0412	-0.0225	-0.0130	0.00696
	(0.0326)	(0.0283)	(0.0364)	(0.0241)	(0.0275)	(0.0196)	(0.0204)
(Debt>60) x Institutions	0.0535	0.0136	0.103***	0.129***	0.107**	0.0955***	0.0610**
	(0.0389)	(0.0432)	(0.0355)	(0.0284)	(0.0394)	(0.0246)	(0.0279)
Trade openness		0.123***					0.0658**
		(0.0334)					(0.0284)
Government expenditure			-0.135				-0.128
			(0.131)				(0.113)
Savings rate				-0.00126			0.00234
				(0.00179)			(0.00257)
Participation rate					0.00294*		0.00639***
					(0.00147)		(0.00198)
Education						0.00126	0.00124
						(0.000925)	(0.000847)
Constant	1.941***	1.469***	1.749***	1.882***	1.715***	1.821***	0.995***
	(0.0448)	(0.130)	(0.125)	(0.0556)	(0.0906)	(0.0927)	(0.194)
Observations	454	454	270	311	307	200	183
R-squared	0.873	0.901	0.866	0.900	0.896	0.840	0.925

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

TABLE A8 (2)

Institutions refers to Chinn-Ito Index

	15 year average potential GDP growth (in PPP)						
Catching-up	-0.538***	-0.546***	-0.503***	-0.515***	-0.532***	-0.488***	-0.530***
	(0.0161)	(0.0175)	(0.0245)	(0.0248)	(0.0220)	(0.0262)	(0.0444)
Institutions	0.0371***	0.0353***	0.0254**	0.0241***	0.0154	0.0241**	0.0276***
	(0.0102)	(0.00996)	(0.00915)	(0.00861)	(0.00946)	(0.00959)	(0.00956)
(Debt>60)	0.0303	0.0205	-0.00282	-0.0181	0.00283	0.00279	-0.000956
	(0.0312)	(0.0254)	(0.0345)	(0.0246)	(0.0213)	(0.0244)	(0.0197)
(Debt>60) x Institutions	-0.00929	-0.00528	0.00941	0.0216	0.0293**	0.00408	0.0147
	(0.0191)	(0.0170)	(0.0148)	(0.0166)	(0.0129)	(0.0154)	(0.0145)
Trade openness		0.0680**					0.0639**
		(0.0322)					(0.0286)
Government expenditure			-0.0435				-0.0256
			(0.0879)				(0.0901)
Savings rate				0.000670			0.00402
				(0.00168)			(0.00296)
Participation rate					0.00313**		0.00663**
					(0.00145)		(0.00259)
Education						0.00161**	0.00175*
						(0.000698)	(0.000903)
Constant	2.000***	1.735***	1.869***	1.935***	1.764***	1.864***	1.155***
	(0.0467)	(0.140)	(0.114)	(0.0565)	(0.0997)	(0.0715)	(0.229)
Observations	458	458	280	307	316	207	187
R-squared	0.865	0.875	0.842	0.885	0.889	0.826	0.920

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

TABLE A8 (3)

Institutions refers to Economic Freedom from the Fraser Institute

	15 year average potential GDP growth (in PPP)						
Catching-up	-0.596***	-0.589***	-0.576***	-0.565***	-0.573***	-0.549***	-0.560***
	(0.0255)	(0.0230)	(0.0273)	(0.0324)	(0.0241)	(0.0349)	(0.0623)
Institutions	0.0757***	0.0681***	0.0555***	0.0468***	0.0378*	0.0581**	0.0497*
	(0.0218)	(0.0176)	(0.0195)	(0.0162)	(0.0191)	(0.0268)	(0.0244)
(Debt>60)	0.0226	0.0172	-0.0188	-0.0189	-0.00253	-0.0307	-0.00529
	(0.0239)	(0.0218)	(0.0180)	(0.0186)	(0.0169)	(0.0182)	(0.0219)
(Debt>60) x Institutions	0.0522**	0.0465*	0.104***	0.0707**	0.0808***	0.104***	0.0475*
	(0.0206)	(0.0241)	(0.0178)	(0.0271)	(0.0234)	(0.0277)	(0.0273)
Trade openness		0.0410					0.0444
		(0.0317)					(0.0330)
Government expenditure			-0.0290				0.00126
			(0.0777)				(0.102)
Savings rate				0.00103			0.00392
				(0.00169)			(0.00281)
Participation rate					0.00306**		0.00652**
					(0.00146)		(0.00265)
Education						0.00128*	0.00154
						(0.000692)	(0.000968)
Constant	2.139***	1.951***	2.062***	2.057***	1.868***	2.017***	1.343***
	(0.0664)	(0.136)	(0.0898)	(0.0722)	(0.113)	(0.0941)	(0.285)
Observations	470	470	286	319	323	207	187
R-squared	0.882	0.886	0.881	0.903	0.904	0.867	0.916

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

TABLE A8 (4)

Institutions refers to Economic Freedom from the Heritage Foundation

	15 year average potential GDP growth (in PPP)						
Catching-up	-0.519***	-0.513***	-0.537***	-0.496***	-0.527***	-0.489***	-0.520***
	(0.0264)	(0.0276)	(0.0306)	(0.0296)	(0.0224)	(0.0250)	(0.0513)
Institutions	0.00445*	0.00401*	0.00542**	0.00276	0.00409	0.00410	0.00344
	(0.00238)	(0.00226)	(0.00212)	(0.00212)	(0.00247)	(0.00275)	(0.00229)
(Debt>60)	0.00215	0.00259	-0.00067	-0.0135	0.0220	0.00771	0.0219
	(0.0248)	(0.0234)	(0.0260)	(0.0281)	(0.0211)	(0.0230)	(0.0209)
(Debt>60) x Institutions	0.0108***	0.0104***	0.0102***	0.0102***	0.01000***	0.0106***	0.00303
	(0.00277)	(0.00245)	(0.00320)	(0.00290)	(0.00245)	(0.00376)	(0.00315)
Trade openness		0.0313					0.0493
		(0.0370)					(0.0376)
Government expenditure			0.0915				0.0353
			(0.131)				(0.137)
Savings rate				-0.00132			0.00322
				(0.00215)			(0.00295)
Participation rate					0.00469**		0.00719***
					(0.00201)		(0.00249)
Education						0.00171***	0.00145
						(0.000603)	(0.000910)
Constant	1.941***	1.786***	2.062***	1.900***	1.625***	1.860***	1.205***
	(0.0694)	(0.185)	(0.167)	(0.0706)	(0.160)	(0.0698)	(0.286)
Observations	200	200	200	187	200	170	163
R-squared	0.883	0.886	0.885	0.896	0.893	0.875	0.909

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

ANNEX 6

T-STATISTICS OF MODEL (5)

TABLE A9 (1)

t-statistic of the catching-up term in equation (5)

Span \ Base	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
1	-2.9	-2.1	-2.7	-1.1	0.0	-3.4	-1.7	-1.9	-3.1	-2.2	-3.1	-3.3	-2.9	-2.3	-1.3	-1.4	-1.7	0.1	-1.0	1
2	-2.6	-2.9	-2.5	-0.7	-2.0	-4.0	-2.3	-2.8	-3.3	-3.0	-3.9	-5.0	-3.2	-2.5	-1.4	-2.1	-1.1	-0.6	-0.9	2
3	-3.5	-3.1	-2.4	-2.0	-2.8	-4.3	-2.8	-2.9	-3.6	-4.0	-5.2	-4.8	-3.1	-2.5	-2.2	-1.6	-1.5	-0.8	-0.9	3
4	-3.5	-3.2	-3.3	-2.7	-3.5	-4.8	-3.1	-3.3	-4.4	-5.2	-5.1	-4.5	-3.1	-3.1	-2.3	-1.9	-1.6	-0.9		4
5	-3.8	-4.1	-3.6	-3.4	-3.9	-5.0	-3.4	-4.4	-5.5	-5.1	-4.8	-4.3	-3.4	-3.2	-2.6	-2.0	-1.7			5
6	-4.6	-4.3	-4.3	-3.9	-4.2	-5.4	-4.5	-5.5	-5.3	-4.9	-4.8	-4.5	-3.5	-3.5	-2.8	-2.0				6
7	-5.0	-4.8	-4.7	-4.1	-4.7	-6.2	-5.5	-5.5	-4.9	-4.9	-5.0	-4.5	-3.6	-3.7	-2.9					7
8	-5.3	-5.1	-4.8	-4.7	-5.6	-7.8	-5.6	-5.1	-4.8	-5.2	-5.1	-4.5	-3.7	-3.8						8
9	-5.4	-5.4	-5.2	-5.5	-7.2	-8.0	-5.1	-4.9	-4.9	-5.3	-5.1	-4.4	-3.7							9
10	-5.7	-6.0	-6.1	-7.0	-7.6	-7.9	-5.0	-4.9	-5.0	-5.2	-5.0	-4.3								10
11	-6.0	-6.9	-7.5	-7.2	-7.4	-8.1	-5.0	-4.9	-4.8	-5.0	-4.8									11
12	-6.9	-8.4	-7.8	-7.2	-7.6	-8.4	-4.9	-4.6	-4.6	-4.9										12
13	-8.5	-9.0	-7.7	-7.4	-7.9	-8.2	-4.7	-4.4	-4.5											13
14	-9.0	-9.0	-7.9	-7.6	-7.7	-8.0	-4.5	-4.2												14
15	-9.1	-9.2	-8.2	-7.5	-7.4	-7.6	-4.3													15
16	-9.3	-9.5	-7.8	-7.2	-7.0	-7.3														16
17	-9.7	-9.1	-7.5	-6.9	-6.7															17
18	-9.1	-8.7	-7.2	-6.6																18
19	-8.7	-8.3	-6.9																	19
20	-8.2	-7.9																		20
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	

TABLE A9 (2)

t-statistic of the institutions term in equation (5)

Span \ Base	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
1	2.7	1.8	1.9	1.3	-1.7	1.8	0.1	0.7	0.9	0.1	0.0	1.1	1.1	1.1	0.1	-0.2	1.0	-0.8	-0.7	1
2	2.3	2.2	1.9	-0.1	0.1	1.5	0.6	0.6	0.8	0.1	0.8	1.9	1.4	1.0	-0.3	0.7	0.3	-0.7	-0.7	2
3	2.8	2.2	1.2	0.8	0.3	1.7	0.5	0.6	0.6	0.9	1.4	2.0	1.2	0.7	0.6	0.2	0.2	-0.7	-0.7	3
4	2.7	1.8	1.7	0.8	0.8	1.7	0.6	0.6	1.2	1.4	1.7	1.6	0.9	1.2	0.7	0.2	0.2	-0.6		4
5	2.5	2.1	1.6	1.2	0.8	1.6	0.5	1.4	1.5	1.6	1.5	1.4	1.3	1.3	0.9	0.2	0.1			5
6	2.8	2.0	2.0	1.2	0.7	1.5	1.2	1.7	1.5	1.4	1.3	1.6	1.4	1.4	1.0	0.2				6
7	2.7	2.2	1.9	1.1	0.7	1.7	1.5	1.8	1.2	1.2	1.6	1.6	1.5	1.5	1.1					7
8	2.7	2.1	1.6	1.0	0.9	2.1	1.7	1.4	1.0	1.4	1.7	1.6	1.6	1.6						8
9	2.5	1.9	1.3	1.1	1.1	2.3	1.3	1.2	1.2	1.5	1.8	1.7	1.6							9
10	2.1	1.6	1.2	1.3	1.3	2.3	1.2	1.2	1.2	1.5	1.8	1.6								10
11	1.7	1.4	1.3	1.3	1.4	2.3	1.2	1.2	1.1	1.5	1.8									11
12	1.4	1.5	1.1	1.3	1.5	2.4	1.1	1.1	1.1	1.5										12
13	1.5	1.3	1.1	1.4	1.5	2.4	1.0	1.0	1.0											13
14	1.2	1.3	1.2	1.4	1.5	2.4	1.0	0.9												14
15	1.0	1.3	1.3	1.4	1.5	2.4	0.9													15
16	1.0	1.5	1.3	1.4	1.5	2.3														16
17	1.2	1.4	1.3	1.4	1.5															17
18	1.1	1.4	1.3	1.4																18
19	1.0	1.4	1.2																	19
20	0.9	1.3																		20
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	

TABLE A9 (3)

t-statistic of the debt dummy term in equation (5)

Base / Span	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
1	1.2	1.6	-1.5	-0.2	-2.1	-0.2	-0.8	-1.1	0.5	-1.7	-3.2	-0.5	1.4	0.3	-1.5	-1.7	-0.5	-1.6	-2.1	1
2	1.2	1.0	-0.2	-1.4	-1.1	0.0	-1.1	-1.1	-0.1	-2.5	-1.7	0.4	0.9	-0.5	-2.2	-1.2	-1.2	-2.0	-2.2	2
3	1.3	1.4	0.0	-1.0	-0.8	-0.5	-1.2	-0.9	-0.9	-1.2	-0.8	0.4	0.0	-1.0	-1.1	-1.6	-1.4	-2.2	-2.2	3
4	1.4	1.6	0.3	-0.9	-1.0	-0.9	-1.0	-1.1	-0.1	-0.7	-0.5	-0.4	-0.6	-0.5	-0.9	-1.6	-1.5	-2.2		4
5	1.9	1.8	-0.1	-1.1	-1.3	-0.8	-1.2	0.0	0.0	-0.5	-0.9	-1.0	-0.5	-0.3	-0.6	-1.7	-1.6			5
6	2.2	1.5	-0.5	-1.3	-1.2	-1.1	-0.2	0.2	0.0	-1.2	-1.3	-0.9	-0.4	-0.2	-0.5	-1.7				6
7	2.0	1.1	-0.9	-1.1	-1.5	-0.9	-0.1	0.3	-0.7	-1.7	-1.2	-0.8	-0.5	-0.1	-0.4					7
8	1.6	0.7	-0.7	-1.1	-1.2	-0.7	0.0	-0.4	-1.2	-1.7	-1.1	-0.9	-0.6	-0.1						8
9	1.1	0.8	-0.7	-1.0	-1.2	-0.5	-0.6	-0.7	-1.2	-1.7	-1.1	-1.0	-0.6							9
10	1.0	0.8	-0.4	-1.1	-1.2	-0.8	-1.0	-1.0	-1.4	-1.8	-1.1	-1.0								10
11	0.6	0.6	-0.5	-1.2	-1.2	-0.9	-1.2	-1.2	-1.6	-1.9	-1.1									11
12	0.5	0.6	-0.8	-1.2	-1.3	-1.3	-1.5	-1.4	-1.8	-1.9										12
13	0.5	0.5	-0.8	-1.3	-1.6	-1.2	-1.7	-1.5	-1.9											13
14	0.1	0.4	-1.0	-1.6	-1.6	-1.2	-1.8	-1.7												14
15	-0.1	0.2	-1.3	-1.5	-1.6	-1.2	-1.9													15
16	-0.4	-0.1	-1.2	-1.5	-1.5	-1.2														16
17	-0.5	-0.1	-1.3	-1.4	-1.5															17
18	-0.7	-0.1	-1.3	-1.4																18
19	-0.8	-0.2	-1.4																	19
20	-0.9	-0.2																		20
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	

TABLE A9 (4)

t-statistic of the interaction term in equation (5)

Base / Span	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
1	-1.3	-1.4	0.4	-1.2	-0.7	0.4	0.4	0.0	0.5	0.3	0.7	-0.4	0.2	1.0	1.9	1.9	0.8	2.6	3.0	1
2	-1.0	-0.7	0.1	-1.0	0.0	0.4	0.1	0.7	0.2	0.6	0.0	-0.3	1.1	1.5	2.7	1.4	2.1	3.3	3.0	2
3	-1.0	-0.3	-0.4	-0.6	0.1	0.1	0.4	0.4	0.3	0.0	0.0	0.5	1.5	2.0	2.0	2.4	2.6	3.4	3.1	3
4	-0.7	-0.4	-0.2	-0.2	-0.1	0.0	0.3	0.4	-0.3	0.0	0.6	1.1	1.9	1.7	2.3	2.7	2.8	3.4		4
5	-1.1	0.0	-0.5	-0.2	-0.1	0.0	0.3	-0.3	-0.1	0.5	1.0	1.5	1.6	2.0	2.4	2.9	2.9			5
6	-1.0	0.0	-0.4	-0.2	0.0	-0.1	-0.1	-0.2	0.4	1.1	1.4	1.3	1.9	2.1	2.4	3.0				6
7	-0.8	0.1	-0.5	0.0	-0.1	0.1	0.0	0.3	1.1	1.5	1.2	1.7	1.8	2.1	2.4					7
8	-0.5	0.1	0.0	0.3	0.2	0.4	0.4	0.9	1.4	1.4	1.5	1.6	1.7	2.2						8
9	-0.3	0.5	0.5	0.6	0.5	1.1	0.9	1.2	1.4	1.8	1.5	1.6	1.7							9
10	0.2	1.0	1.1	0.8	1.4	1.4	1.2	1.4	1.9	1.8	1.4	1.6								10
11	0.9	1.5	1.3	1.5	1.6	1.6	1.3	1.8	2.0	1.8	1.4									11
12	1.4	1.8	2.1	1.9	1.8	1.9	1.7	1.9	2.0	1.8										12
13	1.6	2.8	2.4	2.2	2.2	2.0	1.8	2.0	2.0											13
14	2.5	3.1	2.6	2.6	2.2	1.9	1.8	2.0												14
15	3.0	3.4	2.9	2.7	2.2	1.8	1.8													15
16	3.4	3.7	2.7	2.5	2.1	1.8														16
17	3.4	3.5	2.6	2.5	2.0															17
18	3.4	3.4	2.4	2.4																18
19	3.4	3.3	2.3																	19
20	3.4	3.2																		20
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	

ANNEX 7

ADDITIONAL ROBUSTNESS CHECKS ON THE INSTRUMENTS USED

Changing legal origin for Croatia and Slovenia

Below we report a change in the instrumental variable method, by replacing the legal origins of Croatia and Slovenia with the German ones, as there are doubts about the classification of La Porta et al. (1999). The table shows that changing the legal origin of these two countries does not change the results of the baseline model.

TABLE A10

Modified legal origin

	15-year average per capita potential growth		
Explanatory variables	**OLS**	**2SLS (LO)**	**2SLS (LO mod)**
Log GDP (PPP)	-0.589***	-0.611***	-0.579***
	(0.0386)	(0.0413)	(0.0424)
Institutional delivery	0.0951***	0.116***	0.0839**
	(0.0317)	(0.0394)	(0.0408)
(Debt>60)	-0.0394*	-0.0357*	-0.0420**
	(0.0197)	(0.0186)	(0.0195)
(Debt>60) x Institutional delivery	0.131***	0.123***	0.139***
	(0.0283)	(0.0289)	(0.0298)
Constant	2.127***	2.181***	2.100***
	(0.0988)	(0.105)	(0.107)
Observations	208	208	208
R-squared	0.911	0.910	0.911

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

Using human diversity (Ashraf and Galor, 2013)

Below we report the change in the instrumental variable method, using genetic diversity as instrument. Compared to the original OLS and 2SLS legal origin regression the regression with genetic diversity has the same signs for the coefficients however less significant. The interaction term however is still significant at the 5% level.

TABLE A11

Human diversity instrumenting institutions

	15-year average per capita potential growth		
Explanatory variables	**OLS**	**2SLS (LO)**	**2SLS (gen. div.)**
Log GDP (PPP)	-0.589***	-0.611***	-0.674***
	(0.0386)	(0.0413)	(0.121)
Institutional delivery	0.0951***	0.116***	0.163
	(0.0317)	(0.0394)	(0.124)
(Debt>60)	-0.0394*	-0.0357*	-0.0357
	(0.0197)	(0.0186)	(0.0276)
(Debt>60) x Institutional delivery	0.131***	0.123***	0.161**
	(0.0283)	(0.0289)	(0.0635)
Constant	2.127***	2.181***	2.341***
	(0.0988)	(0.105)	(0.316)
Observations	208	208	208
R-squared	0.911	0.910	0.899

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

Using the institutional quality dataset by Kunčić (2014)

Complementary to the results presented in table 7, where we experiment with different proxies of institutional quality as opposed to the baseline specification using the World Bank indicators, below we show regression results with institutional quality estimated by Kunčić (2014). Scores are demeaned in the first year and we are taking the average across the three dimensions legal, political and economic institutional quality, recorded in the dataset. Even though the magnitude of the coefficients differs due to different scales, the overall message remains broadly unchanged. For the OLS estimate significance levels are unchanged except for a slight drop for the debt dummy. In our 2SLS model specification institutions and the interaction term are significant at the 5 percent level. The marginal drop in explanatory power can be traced back to the longer time horizon of available data, starting in 1990, while the instrument is time constant.

Table A12

Institutional quality as estimated by Kunčić

	15-year average per capita potential growth			
Explanatory variables	**OLS**	**2SLS**	**OLS Kunčić**	**2SLS Kunčić**
Log GDP (PPP)	-0.589***	-0.611***	-0.559***	-0.693***
	(0.0386)	(0.0413)	(0.0354)	(0.0930)
Institutions	0.0951***	0.116***	0.457***	1.120**
	(0.0317)	(0.0394)	(0.163)	(0.481)
(Debt>60)	-0.0394*	-0.0357*	-0.0145	-0.0155
	(0.0197)	(0.0186)	(0.0245)	(0.0267)
(Debt>60) x Institutional delivery	0.131***	0.123***	0.616***	1.037**
	(0.0283)	(0.0289)	(0.184)	(0.428)
Constant	2.127***	2.181***	2.045***	2.381***
	(0.0988)	(0.105)	(0.0955)	(0.236)
Observations	208	208	277	277
R-squared	0.911	0.910	0.849	0.798

Robust standard errors in parentheses.

**** p<0.01, ** p<0.05, * p<0.1*

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Effective international information exchange as a key element of modern tax systems: promises and pitfalls of the OECD's common reporting standard

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Abstract

Today's global economic environment is characterized by the high mobility of capital and labour across national borders. Against the backdrop of a legal framework governing taxation of cross-border income, this may lead to double taxation on the one hand, as well as provide opportunities for tax evasion and tax avoidance on the other. It is well-established that a prerequisite for effective taxation of foreign-sourced income earned by "domestic taxpayers" (i.e. tax residents) is the system of administrative co-operation across national boundaries, mainly in the form of exchange of tax-relevant information between tax authorities. Since the lack of information-exchange mechanisms is linked with tax havens and the proliferation of "harmful tax practices", the OECD put the issue high on the global political agenda as early as 1998. Further developments strengthened the importance of the exchange of information, leading to the so-called "big bang" of 2009, i.e. to a significant increase in the number of concluded tax information exchange agreements, caused by the growing concern about international tax evasion and avoidance in the post-crisis period.

Nowadays the so-called automatic exchange of information (AEOI) between tax authorities has emerged as a new global standard. This is mostly due to the development of specific national and international models, aimed at enhancing intergovernmental cooperation in fighting offshore tax evasion. In this regard special attention should be drawn to the 2014 release of the OECD's Common Reporting Standard (CRS), which is based on the idea that banks and other financial institutions should play a crucial role in providing information on taxpayer's income and assets to tax authorities around the globe.

The aim of this paper is to explore some of the most important implications of the adoption of the CRS as a global AEOI model. While there are marked advantages of the new standard – mainly related to its potential in curbing large-scale offshore tax evasion – some important concerns arise as to its implementation on a global level. Particular attention will be paid to the issue of coordination of the CRS with the other information exchange models (e.g. FATCA) and to the problem of protecting taxpayers' rights and information.

Keywords: exchange of information, tax transparency, Common Reporting Standard, FATCA, international tax law

1 INTRODUCTION

It is quite commonplace for any new scholarly contribution on the subject of international taxation to open by remarking on the way in which the legal framework for taxing cross-border economic activities has evolved in the aftermath of the latest global economic crisis (the "Great Recession"). In essence, this ongoing evolution is founded on the idea that wealthy individuals and large multinational companies (MNCs) were somehow allowed legally to avoid payment of their "fair share" in the financing of public services. Against the backdrop of this normative

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judgement – notwithstanding its vague content (Stevens, 2014:702) – a coordinated approach for the reform of a pertinent legal framework has emerged, primarily under the auspices of the G20 and the OECD, the epitome of which is the initiative against base erosion and profit shifting (BEPS) (OECD, 2013).

The new era of "tax transparency", characterized by the unprecedented levels of taxpayer information shared between governments around the globe (Owens, 2014; Turina, 2016), cannot be viewed separately from this broad context. However, one crucial point should be added: while the BEPS project and similar initiatives are aimed at curbing tax planning schemes which are by definition legal (i.e. tax avoidance), the emergence of new forms of inter-governmental cooperation in the area of information exchange is mainly aimed at preventing the phenomenon of international tax evasion, i.e. taxpayer behaviour that breaks the law, mainly in the form of income underreporting. It is therefore unsurprising that the strengthening of the framework for information exchange was recognized as a political priority as early as 1998, within the debate on the negative effects of "harmful tax practices" and tax havens (OECD, 1998). The issue gained new prominence in 2008, when several tax evasion scandals broke out; the largest Swiss banks had connived in wealthy clients escaping taxation via offshore accounts. Amid much fanfare, G20 leaders jointly declared in 2009 that, with regard to taxation, the era of bank secrecy was over (G20, 2009). The panacea was found in the so-called automatic exchange of information (AEOI), which essentially entails "systematic and periodic transmission of 'bulk' taxpayer information by the source country to the residence country regarding various categories of income (e.g. dividends, interest, royalties, salaries, pensions, etc.)" (OECD, 2012:7).

The catalyst for worldwide expansion of AEOI was a piece of legislation adopted in the United States (US) in 2010, commonly called the Foreign Account Tax Compliance Act (FATCA) (Grinberg, 2012:352; Zucman, 2015). The subsequent quest for "multilateralization" of the mechanics of FATCA – with the key role played by banks and other financial institutions – reached a pinnacle in 2014, when the OECD published the so-called Global Standard for AEOI, the key component of which is the Common Reporting Standard (CRS) (OECD, 2014b). Put simply, the CRS shadows the structure of FATCA, with the aim of giving governments a proper instrument for retrieving information on the assets their tax residents hold with foreign financial institutions, thus putting an end to evasive tax practices.

The aim of this paper is to explore some of the most important implications of the adoption of CRS as a universal model for AEOI. While there are marked advantages of the new standard – mainly related to its potential in curbing large-scale offshore tax evasion – some important concerns arise as to its implementation on a worldwide level. Accordingly, this paper comprises five main sections. Following the introductory part, section two traces the development of a legal framework for AEOI on an international level, thus depicting the historical context of the

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OECD's adoption of the CRS. Particular attention is drawn to FATCA, since it acted as the catalyst for future developments under the auspices of the OECD. Section three analyses the most important features of the CRS and puts special emphasis on its legal and operational basis. Section four examines some of the possible pitfalls of the CRS, which need to be taken into account in the evaluation of its appropriateness as a global anti-tax evasion instrument. Concluding remarks are provided in section five.

2 A SHORT HISTORY OF CROSS-BORDER EXCHANGE OF INFORMATION IN TAX MATTERS: THE ROAD TO THE CRS

The slogan "no taxation without representation" not only played a central role in the American Revolution, but is also one of the cornerstones of other modern Western democracies, in the light of historical movements against arbitrary taxation (Vanistendael, 1996:15-19). Similarly, from the viewpoint of tax authorities and their objective of efficiently enforcing tax laws and collecting taxes due, recent times confirm the validity of the saying "no taxation without information" (Pomeranz, 2015). This especially applies to taxation of income, since a self-assessment system prevails in most jurisdictions (Gordon, 1996:103). In other words, tax authorities ordinarily collect income tax on the basis of information received from the taxpayers themselves, backed up by the authority to request relevant information from third parties (e.g. banks) and conduct more detailed inquiries into taxpayers' activities and assets.

While this system works reasonably well in relation to taxpayers involved in purely "domestic" economic activities, the problem arises with regard to resident taxpayers who earn at least one part of their income abroad. Since the state wishing to tax foreign-sourced income of its tax residents lacks, under current norms of public international law, the same enforcement powers in relation to foreign financial institutions and other foreign persons holding relevant information (Picciotto, 1992:257-262), it will most likely need to rely on some form of assistance provided by foreign tax authorities in order to enforce tax collection effectively. Unsurprisingly, the data on the extent of international tax evasion and on the ensuing loss of tax revenue is staggering. As per official estimates, every year USD 100 billion in tax revenues is lost due to offshore tax abuse (Blank and Mason, 2014:2). Tax evasion schemes are quite straightforward and will not be examined in detail here. Put simply, financial institutions located in tax havens facilitate evasion by assisting clients to open accounts in the name of offshore entities, by advising clients on offshore structures to hide ownership or assets and covering up asset transfers between accounts. The importance of a formidable framework for inter-governmental exchange of tax-relevant information was recognized very early, long before the high mobility of capital and labour across national borders became a quintessential feature of the global economic environment. Accordingly, this section will proceed with a short insight into the history of information exchange models.

2.1 A HISTORICAL OVERVIEW OF INFORMATION EXCHANGE

The present-day network of bilateral tax treaties, which have a key role in allocating taxing rights over cross-border income, is largely based on the intellectual work carried out under the auspices of the League of Nations in 1920s, resulting in the creation of the first "model tax treaties". Even at that time, when the economy was largely based on "bricks and mortar" and opportunities for cross-border trade and investments were severely limited, governments around the globe paid serious attention to the issue of international tax evasion (Picciotto, 1992:250-251). More remarkably, the history of the exchange of information for tax purposes goes back to the double taxation treaties signed between Belgium and France in 1843 and between Belgium and the Netherlands in 1845 (Oberson, 2015:4).

In 1963, the Draft Double Taxation Convention on Income and Capital (hereinafter: the OECD Model Convention) was adopted, containing provisions on the exchange of information (Ring, 2016:9). Namely, Art. 26 of the OECD Model Convention 1963 provided a legal basis for three forms of information exchange: 1) exchange upon request; 2) spontaneous information exchange; and 3) automatic exchange of information (AEOI). The three forms may be combined and some other techniques are also possible, such as simultaneous examinations or tax examinations abroad. Tax treaty practice has shown that the most frequently used method is information exchange upon request where one state requests information foreseeably relevant for a specific case from another state. On the other hand, spontaneous exchange of information entails provision of foreseeably relevant information from one state to another without prior request, when it is supposed that the information provided will be of interest to the other state. Finally, AEOI entails routine transmission of information on a regular basis without specific request from another state.

Tax treaty provisions replicating Art. 26 of the OECD Model are essential for correct allocation of taxing rights between treaty partners, primarily from the perspective of the state of taxpayer's residence (Dourado, 2015:1858-1859). Amendments to Art. 26 in subsequent versions of the OECD Model, most recently in 2014, contributed to the strengthening of information exchange effectiveness in a bilateral context (Ring, 2016:13). Most importantly, in line with the global developments (see below, section 3), since 2009 the focus has shifted on linking Art. 26 to AEOI, rather than to the previously-favoured exchange upon request (Dourado, 2015:1853-1854).

The first efforts for AEOI outside the framework of double tax treaties can be traced to the very beginning of the 20th century. Zucman (2015) discusses the first national anti-fraud mechanism of 1901 based on AEOI between banks and the tax authorities, intended to fight fraud regarding inheritance. In 1908 the first international treaty on AEOI was signed between France and the UK. For the purpose of this paper special attention needs to be drawn to the 1988 Multilateral Convention on Administrative Assistance in Tax Matters (hereinafter: the Multilateral

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Convention), drafted jointly by the Council of Europe and the OECD, providing the possibility for AEOI on a multilateral basis. As stated by Ring (2016:14), its status "(…) has allowed it to serve as a vital platform for important international developments in exchange of information, as demonstrated by its role in promoting expansion of automatic exchange of information."

One should also take note of the role played by the EU in developing anti-tax evasion instruments. The so-called Savings Directive, adopted by the Council of the EU in 2003, set out AEOI provisions in respect of specific items of income (i.e. interest on savings accounts). Even more importantly, the scope of AEOI between tax authorities of EU member states has been significantly expanded by the 2014 amendments to the Directive on Administrative Cooperation (DAC), mainly under the influence of OECD's work on the CRS (Somare and Wöhrer, 2015:814).

2.2 FATCA CHANGES THE GAME: FROM UNILATERAL ACTION TO MULTILATERAL SOLUTION

The US imposes income tax on the basis of both citizenship and residence. The citizenship-based tax regime allows US tax authorities to tax worldwide income of every US citizen, irrespective of his residence. Certain concessions embodied in the US federal tax law are given to US citizens in order to avoid the negative effects of double taxation. One is the foreign tax credit which allows US citizens to take a tax credit for tax liabilities paid to foreign tax authorities, and the other is the foreign earned income exclusion, granting preferential tax treatment for foreign-source income (Holm, 2014:459). While it is beyond the scope of this paper to analyse the rationale of such a tax regime, it is important to note the problems with its enforcement, mainly related to the above mentioned issue of information deficit on the side of tax authorities. When it comes to taxation of income earned abroad not only by US citizens and corporations, but also by individuals who are deemed tax residents in the US, income tax essentially turns into a "tax on honesty", particularly in cases where no foreign withholding tax applies.

2.2.1 The mechanics of FATCA and its criticism

Against this backdrop, US legislators amended the federal tax code in March 2010 by imposing obligation on foreign banks and other financial institutions (FFIs) to directly and periodically report to the US Internal Revenue Service (IRS) information on the financial accounts of US citizens and corporations. These obligations imposed mainly upon FFIs and US paying agents were embodied in Sections 1471 through 1474 of the Internal Revenue Code (IRC) and the new regime became widely known as Foreign Account Tax Compliance Act (FATCA). If a FFI does not comply with this basic requirement, a 30% withholding tax is imposed on a variety of payments it derives from US sources (Gupta, 2013:226). The purpose of withholding is twofold, as explained by Dourado (2015:1869): "(…) to induce foreign financial institutions that were investing in or through participating financial institutions but not in the US to participate in FATCA and to make the participating foreign financial institutions consider stop doing business with non-participating institutions (since such business would imply withholding tax)."

The UBS banking scandal of 2008, where a banker employed with the Swiss bank helped wealthy US citizens to evade US taxes by covertly keeping the money in Swiss bank accounts, accelerated the adoption of FATCA (Oberson, 2015:151) and the legislation went into effect in July 2014. From a policy perspective, the main aim of FATCA is not to raise additional tax revenues but rather to deter and discourage future tax evasion (Dizdarevic, 2011:2984-2985). Put simply, in the light of the requirements imposed upon banks and other financial institutions, US taxpayers would lose the incentive to engage in offshore activities in attempts to hide their wealth out of the IRS's sight.

From a public international law perspective, the basic problem of FATCA is that it is blatantly extraterritorial in application (Mukadi, 2012:1231; Essers, 2014:59). It essentially represents an exertion of US law into the jurisdictional realm of foreign countries, without their consent. Accordingly, the US has been criticized as taking on a one-sided initiative against tax evasion, instead of opting for the co-operative route with the participation of other countries (Holm, 2014:449). In addition, important questions have been raised with regard to the conflicts between FATCA and domestic laws on data protection (Tello, 2014:92).

Debates have also raged over the ability to enforce FATCA effectively, as well as over its potential negative effects on the US economy (Blank and Mason, 2014:4-5). Critics have pointed to its high compliance and administrative costs (Blank and Mason, 2014:5). On the one hand, the IRS would have to increase human resources, improve information technology, infrastructure, analyse new data and link it with client profiles in original databases in order to enable complete and reliable data (Gupta, 2013:38). On the other hand, particularly high compliance costs, related to engagement of additional human resources and the upgrade of due diligence processes, would arise for financial institutions operating in multiple jurisdictions. It was apparent that FFIs would have to adjust their processes and enhance computer systems, educate potential investors on disclosure requirements, maintain centralized customer databases and regularly update relevant information.

Moreover, FATCA has been perceived as discouraging investment in US assets, thus impeding the growth of the US economy. With the intention of saving money intended for due diligence processes and updating their operating systems in accordance with the FATCA provisions, FFIs may avoid investments in US assets (stocks, bonds), which may lead to reduction of stock indices in the US and other financial markets. Furthermore, investment already made in the US may be liquidated. It should also be noted that the number of US citizens renouncing their US citizenship has reached the highest rates ever since the introduction of FATCA[1].

[1] Annual number of requests in 2011 was 1,781. Further 2,999 requests were made in 2013, which represents a 221% increase in comparison to 2012 (932 requests). The year 2014 brought even higher number of citizenship renouncement (3,415) and in 2015 there were approximately 4,300 expatriations (Forbes, 2016). However, expatriations may also be attributed to causes other than FATCA, such as specific features of determining tax liabilities of the US citizens.

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Finally, some FFIs responded to the commitments imposed by FATCA by refusing to serve US account holders in order to avoid problems with the IRS (Holm, 2014:466).

2.2.2 Enhancement of FATCA on the inter-governmental level

The above described criticism of FATCA urged stakeholders, particularly multinational financial institutions (MFIs) and foreign governments, to embark upon a quest to create a system incorporating its basic principles, but leaving out the most burdensome rules, such as the withholding regime (Grinberg, 2013:332). This process of the "globalization" of a unilateral US instrument can be mostly attributed to the complementary interest shared by the US and other countries in curbing international tax evasion, confirming the predictions that the adoption of FATCA will result in a "domino effect" (Mukadi, 2012:1233). The decisive moment in this respect was the release of a G5 Joint Statement (US, France, Germany, Italy, Spain and the UK) in 2012, announcing that FATCA compliance will be provided by a framework for inter-governmental AEOI on pertinent financial accounts (Grinberg, 2013:332; Essers, 2014:60).

Accordingly, the legal basis for the implementation of FATCA was found in special intergovernmental agreements (IGAs) that resolve the problem of incompatibility of national laws with FATCA. Put simply, the solution was found in the "routing mechanism", which entails that FFIs do not report relevant information directly to the IRS, but rather to their local tax authorities, who will further engage in the exchange of information with their US counterparts (Oberson, 2015:157). Two types (so-called Model 1 and Model 2) of IGAs have been prepared by the US Treasury and have been accordingly used in negotiations with other countries (Gupta, 2013:223-224). Each of the models has a sub-version, targeted at countries which have concluded neither a double tax treaty nor a special Tax Information Exchange Agreement (TIEA) with the US. Model 1 IGA is the only one incorporating the concept of reciprocal information exchange. Therefore, it has been selected as a template for the creation of the OECD's Global Standard (see below, section 3).[2]

3 OECD'S COMMON REPORTING STANDARD AS A SYMBOL OF THE NEW ERA OF INFORMATION EXCHANGE

In 2013 the G20 countries committed to the OECD's proposal for a model of AEOI to be implemented on a global basis (the OECD's Global Standard). The OECD made it clear at the outset that its intention was to set a minimum standard for AEOI, without the intention of restricting the existing models (OECD, 2014:10). The highlight of this initiative came in 2014, when the OECD released the document titled "The Standard for Automatic Exchange of Financial Account Information" (Oberson, 2015:184).

[2] Conversely, Model 2 IGA was perceived as unsuitable for global cooperation due to its limited scope and provisions according to which financial institutions provide information on US customers to US tax authorities. Hence, the usage of the Model 2 IGA has been limited to countries with strong privacy and banking secrecy laws (Somare and Wöhrer, 2014:396-397).

3.1 COMPONENTS OF THE OECD'S GLOBAL STANDARD AND ITS IMPLEMENTATION

The OECD's Global Standard actually consists of two main components: 1) the Model Competent Authority Agreement (Model CAA), which is essentially a template for a legal instrument enabling AEOI between participating countries; and 2) the Common Reporting Standard (CRS), which lays down reporting and due diligence requirements in respect of specific categories of financial accounts, in a fashion similar to FATCA (see above, section 2.2.1). Accordingly, it should be noted that the Model CAA is primarily addressed to participating tax authorities who want to regulate their mutual AEOI relationships, whereas the CRS is primarily aimed at banks and other financial institutions upon which the reporting and due diligence obligations are imposed (McGill, 2016:2).

Akin to the role played by IGAs for FATCA enforcement (see above, section 2.2.2), the CAA links the legal basis for inter-country exchange of information (i.e. Multilateral Convention) with the CRS (Oberson, 2015:197). While the CAA is drafted as a reciprocal agreement, it may also provide for a non-reciprocal exchange, considering that some countries may not be interested in receiving information (Radcliffe, 2014:162). In a classic reciprocal scenario, each party must annually exchange the obtained information with other competent authority on an automatic basis. The information is to be exchanged within nine months from the end of the calendar year to which it relates (Oberson, 2015:199). As per section 4 of the Model CAA, if the "requesting state" receives incomplete or incorrect information, it has to notify the "requested state" to take appropriate measures to address the errors or non-compliance. Unlike FATCA, the Model CAA does not envisage withholding obligations, placing some doubts over enforcement of the Global Standard (Oberson, 2015:200-201). However, it should be noted that the OECD's Global Forum on Transparency and Exchange of Information for Tax Purposes (below, the Global Forum) has been entrusted with the task of monitoring and reviewing the Global Standard in the form of peer-reviews (Radcliffe, 2014:162).

In order to give effect to the Global Standard, each participating country has to fulfil certain legal requirements. First, for the conclusion of CAA there has to be a legal basis for inter-governmental information exchange, such as Art. 26 of a bilateral tax treaty that replicates the OECD Model (see above, section 2.1). The most suitable legal basis for the operation of CAA is probably provided by the Multilateral Convention (see above, section 2.1), that has a global reach, allows for all forms of administrative cooperation and contains rules on confidentiality and the proper use of information (OECD, 2014b:13). In order for information to be exchanged automatically under the Multilateral Convention, a separate agreement between the competent authorities is required. Accordingly, the CAA fulfils the function of activating and operationalizing AEOI between the parties (OECD, 2014b:13; Dourado, 2015:1854; Oberson, 2015:188). Second, the CRS is legally binding upon "reporting financial institutions" only if it is implemented into domestic law of each participating state (Dourado, 2015:1856).

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Hitherto around 100 countries around the world have publicly committed to the implementation of the Global Standard. Notably, the US is not among participating jurisdictions and this does not seem likely to change in the foreseeable future. As the US representatives officially explained to the OECD, their country will insist on administering AEOI as envisaged in FATCA and in IGAs signed with other countries (Parillo, 2015:727). It is not entirely clear whether this entails the US being treated as a "non-participating jurisdiction" for CRS purposes, since the OECD has repeatedly acknowledged that the adoption of its Global Standard has been made possible by FATCA. In any case, interaction between FATCA and the CRS breeds some uncertainty and adds complexity in determining financial institutions' legal responsibilities (see below, section 4.1.).

3.2 COMMON REPORTING STANDARD: A CLOSER LOOK

The CRS, a key element of the OECD's Global Standard, sets out reporting and due diligence requirements with regard to specific types of accounts ("reportable accounts"). These obligations fall on the shoulders of "reporting financial institutions", which encompass a wide range of financial institutions and investment entities (e.g. brokers, collective investment vehicles, certain insurance companies) (Oberson, 2015:189). Reporting financial institutions are obliged to collect information and report the collected information to their local competent authorities who will then exchange the information with other jurisdictions (Knobel and Meinzer, 2014:16). With the aim of preventing taxpayers from circumventing the model by shifting assets to institutions or investment products not covered by the model, the scope is set widely not only in relation to the definition of reporting financial institutions, but also in two further dimensions (OECD, 2014b:12). First, relevant information to be reported is defined very broadly, covering different types of investment income (e.g. interest, dividends) as well as addressing situations in which a taxpayer attempts to hide capital. Second, "reportable accounts" encompass not only accounts held by individual taxpayers, but also accounts held by interposed legal entities or arrangements (e.g. shell companies, trusts, etc.). In essence, this means that financial institutions are required to "look through" the often complex ownership structures to find beneficial owners (Oberson, 2015:189).

These core CRS requirements have to be translated into the domestic law of participating jurisdictions. In doing so, each state not only has substantial leeway in choosing implementation techniques (e.g. primary legislation, administrative guidance, etc.), but also in deciding on the level of detail that will be contained in its domestic rules on reporting, due diligence and other CRS requirements (OECD, 2015a:10-11). Moreover, participating jurisdictions are free to cherry-pick among a number of optional CRS provisions/definitions, depending on the specifics of their domestic legal framework (OECD, 2015a:11-17). Even more importantly, individual countries may embark upon an even more ambitious approach, imposing additional due diligence requirements on financial institutions, with the aim of enhancing the effectiveness of the regime (OECD, 2014b:284-300). Thus, it is

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evident that the legal nature of the CRS breeds local idiosyncrasies, which raises serious concerns for reporting financial institutions (see below, section 4.1).

Finally, it should be noted that the CRS (see section IX) requires each participating jurisdiction to ensure, within its domestic legal framework, effective compliance with its basic requirements. For this purpose, a number of rules and administrative procedures must be translated into domestic law, e.g. an anti-avoidance rule or penalty regime for non-compliant financial institutions (OECD, 2014b:207-211). Different local approaches will arise also in this regard, since every country will first compare its existing legal framework with CRS requirements and then adapt it as may be necessary (OECD, 2015a:23; Radcliffe, 2014:166).

4 ASSESSMENT OF THE CRS: DO POTENTIAL BENEFITS OUTWEIGH THE COSTS?

This section addresses the most vexing problems associated with the introduction of CRS and its implementation around the globe, which may compromise the attainment of legitimate policy goals that underlie the OECD's approach in the area of tax transparency and administrative co-operation.

4.1 COMPLEXITY AND INCOHERENCE OF THE REGULATORY FRAMEWORK

As may be inferred from the analysis presented in previous sections, the OECD's Global Standard is extremely ambitious when juxtaposed to the institutional arrangements for AEOI that dominated in the preceding period and are also widely used today (see section 2.1). First, it largely embraces core elements of FATCA, which are indeed revolutionary (see section 2.2). Second, it is fully based on the premise of multilateralism, establishing a system of universal principles and rules to be implemented across national borders (see section 3.1).

Accordingly, considerable caution is advised for all stakeholders when assessing the benefits of this new regime. More precisely, one should not underestimate potential costs to be incurred by stakeholders due to the rising complexity of the regulatory framework(s). This is indeed a familiar concern from a policy standpoint: it is well-established in the tax literature that policymakers' pursuit for solutions which are deemed "first-best" in the light of normative precepts like equity and/or efficiency usually come at the expense of simplicity of the tax system (Kaplow, 1999; Krever, 2003; Rosen, 2008:368-369), which conversely is a value in itself (Stiglitz, 2000:497; Hyman, 2011:425). For the purpose of the ensuing analysis we adhere to the view that compliance costs serve as key evidence of the level of tax complexity (Krever and Mellor, 2015:1).

In light of the mechanics of information exchange envisaged in the Global Standard (see above, section 3) it is perfectly clear that the additional cost linked with the complexity of the new regime is not an issue for the taxpayers, since their role in the international information exchange is merely "passive". Conversely, significant cost is expected to be borne both by tax authorities and by banks and

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other financial intermediaries (Grinberg, 2013:366-367; McGill, 2016:sec. 1). In this respect particular attention should be drawn to the costs arising due to existence of multiple instruments regulating AEOI, as well as inconsistencies between them (Oberson, 2015:247).

4.1.1 Financial institutions' perspective: increased compliance costs

Taking a bird-eye view on the matter, it is visible that a multinational financial institution (MFI) will in all likelihood have to comply with at least three AEOI models: 1) the FATCA model, which regulates their relationship with US tax authorities; 2) a system based on EU DAC; 3) a multilateral framework modelled in accordance with OECD's Global Standard. The biggest issue at hand is how these overlapping models fit together, not only when it comes to resolving potential conflicts in application (Altenburger, 2015), but even more importantly as regards to disparities between the specified rules and standards for collection, storage and transmission of data (Vainstendael, 2014:1152; McGill, 2016: sec. 5.1). The former aspect has been particularly underscored by the financial institutions themselves, within the public debate on global implementation of FATCA (Grinberg, 2013:348-349) and in subsequent discussions on the implications of the introduction of the CRS.

On the face of it, the OECD's CRS replicates the system set up by international agreements adopted for FATCA purposes (Model 1 IGAs): under both systems financial intermediaries are obliged to perform due diligence during collection of data about specific account holders, implement processes for efficient data storage and finally report relevant information to respective tax authorities. However, there are some marked differences as regards specifics of these obligations, making it clear that the CRS is much more than a global "extension" of FATCA (KPMG, 2014:2).[3] Some of the most important discrepancies directly cause increased compliance costs for financial institutions.

First, the scope of due diligence and reporting procedures under the CRS is significantly broader than that under FATCA. Not only does the CRS require that these procedures are implemented in relation to tax residents of more than 100 participating countries, but it does not employ FATCA-like exemptions for low-value accounts (KPMG, 2014:25). Second, on a more technical level, forms that are used under the FATCA-based framework are of no use for CRS purposes (McGill, 2016:sec. 5.1). Instead, the CRS relies upon a specific self-certification mechanism in order to identify reportable accounts. Third, there is some inconsistency between the CRS and FATCA as regards the classification of financial and non-financial entities (OECD, 2015a:20). Notably, the CRS classifies investment entities (e.g. trusts, investment funds) resident in a non-participating country as "passive non-financial entities", meaning that reporting financial institutions are required to document and report on their beneficial owners (see above, section 3.2). Conversely, under FATCA and Model 1 IGA such investment entities man-

[3] A detailed comparison between FATCA and the CRS is laid out in OECD, 2015a:87-101.

aged by a MFI are classified as financial institutions and there are no look-through requirements (Parillo, 2015:728). Against the background of the ambiguous status of the US as a (non-)participating country for CRS purposes (see above, section 3.1), it is apparent that a number of MFIs will face a conundrum in entity classification and determination of ensuing responsibilities (KPMG, 2014:28). Fourth, unlike under FATCA, the CRS does not require financial intermediaries to withhold tax on certain US payments made to non-compliant persons and entities. While the fact that this important "punitive" feature of FATCA is missing under the CRS may come as a relief for MFIs, they still need to be extremely wary of the prospect that countries take diverse approaches to enforcement of CRS requirements (see above, section 3.2).

An inevitable outcome of this lack of AEOI standardization on a global scale is the increase in compliance costs for banks and other financial intermediaries. The burden will be higher, both in absolute and in relative terms, for the biggest MFIs operating in the majority of countries around the world, as they would have to meet terms with a number of local regulatory variances, thus multiplying the total compliance cost (Grinberg, 2013:350; KPMG, 2014:2). Arguably, such concerns may be mitigated to a certain extent by technological advancements (McGill, 2016:sec. 7), since IT systems supporting due diligence and reporting processes can be amended to capture all features envisaged under both CRS and domestic legislation. In this respect it should be noted that the importance of common or compatible technical solutions for reporting and exchanging information in line with the CRS has been recognized by the OECD (2014b:14). While such an approach may reduce overall compliance costs in the future, it entails significant investments in technology-based solutions for financial institutions in the short run (KPMG, 2014:3).

4.1.2 Tax authorities' perspective: administering the new arrangements for AEOI

On the other side of the same coin, the complexity of the new global AEOI architecture – with the CRS at the heart of it – may pose quite a burden on tax authorities, which are required to collect a massive load of relevant information from local financial intermediaries, as well as to exchange this information, largely in a reciprocal manner, with their foreign counterparts. As is the case with any comprehensive usage of information transmitted from third party intermediaries to the tax authorities, the success of these new arrangements will largely depend on the quality of systems in place for electronic reporting and matching of data with tax authorities' own records (OECD, 2015b:307). Doubts have been expressed in the literature as to the capacity of tax authorities, particularly those of developing countries, fully to capitalize on the AEOI developments due to institutional and/or technical constraints, putting an additional strain on their already limited resources (Grinberg, 2013:347-348; Mosquera Valderrama, 2015:sec. 5.3.1.3.; McGill, 2016:sec. 7). As noted in the OECD's report on the role of capacity building in a tax administration, various instruments for provision of technical assistance and capacity building should be established to ensure that developing countries effec-

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tively implement the new Global Standard for AEOI (OECD, 2016:23-24). In this respect, promising steps have already been taken under the auspices of the OECD's Global Forum and other international organizations (Grinberg, 2013:359; OECD, 2016:23-32).

To sum up, the potential of the CRS to act as a powerful anti-tax evasion tool, thus having positive revenue effects for participating governments, may be seriously hindered by existing administrative constraints and by the outlay of resources respective revenue bodies have to make in order to assure effective implementation of a global AEOI framework. Accordingly, assertions that developed countries would benefit the most from the CRS seem quite convincing (Mosquera Valderrama, 2015:sec. 5.3.1.3.).

4.2 PROTECTION OF TAXPAYERS' RIGHTS

Taxpayers, apart from being obliged to pay taxes, are information holders and as such they have to report, determine, compute and pay taxes. Their duties increase domestically and internationally with the global development of information exchange and in those procedures their interests are protected by various rights contained in domestic or international instruments. Taxpayer rights include the right to a fair process in the exchange of information proceedings, basic privacy protection and procedural rights. Oberson (2015:209) notes that "the more global the exchange of information, the greater risk of breaches of confidentiality, privacy and secrecy provisions or even abuse in the use of data obtained."

Oberson (2015:211) analyses the scope of taxpayers' rights and summarizes a minimum standard consisting of the right to be informed and heard, the right of appeal, the right to pay an exact amount of tax, the right to certainty, the right to privacy and the right to confidentiality and secrecy. Another limitation is that information does not have to be supplied to another jurisdiction if its disclosure is contrary to the *ordre public* (public policy) of the supplying state, which is the term relating to, e.g. proceedings which would result in imposition and execution of death penalty, torture or other violations of human rights as well as tax investigations motivated by political, racial or religious prosecution (OECD, 2014a).

The role of exchange of information is to prevent double taxation, which is in the interest of taxpayers, as well as to combat tax evasion and tax avoidance, which is in the interest of the states. The protection of taxpayers' interests is crucial because the exchange of information relates to personal data and potentially confidential information. Therefore, the governments have to take into account the interests of taxpayers when fulfilling obligation to exchange information (Oberson, 2015:212). Taxpayers as well as tax administrations have a legal right that the exchanged information remain confidential. Financial information is sensitive and it should be handled appropriately. International exchange will be trustworthy only if the information is used and disclosed in accordance with the legal instruments allowing the exchange (OECD, 2014a).

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Oberson (2015:213) points out that in exchanging information with contracting states, certain rules should be followed. A requesting state should make an effort to collect information under the domestic law before turning to a foreign state (principle of subsidiarity). Furthermore, the competent authorities of the contracting states are obliged to exchange information which is foreseeably relevant for implementation of international law instruments, in which "foreseeably relevant" provides for the widest possible extent of exchange of information, but rules out "fishing expeditions". Finally, competent authorities must keep information received through exchange of information as confidential, taking into account domestic laws on secrecy in tax matters as well as protection provided by international law.

Baker and Pistone (2015:59) warn that the growth of AEOI in recent years will cause large amounts of financial data about taxpayers to flow between tax authorities. The importance of security of the data will therefore be more significant than in the case of exchange of information upon request. In applying this method of exchange of information, it might be impractical to inform each taxpayer of the exchange so it will be sufficient that the taxpayers are informed by financial institutions that the information provided to them may be subject to the automatic exchange (Baker and Pistone, 2015:64).

As examined above (section 3), implementation of the CRS is based on a specific instrument of international law which allows AEOI, such as a Multilateral Convention or a bilateral tax treaty. Therefore, confidentiality and data protection within the CRS framework is based on this instrument (Oberson, 2015:219). Both bilateral tax treaties and the Multilateral Convention contain provisions on the confidentiality of information exchanged and limit the persons who have access to the information as well as purposes for which the information may be used (OECD, 2014b:13).

Under Section 5(1) of the Model CAA all information exchanged is subject to the confidentiality rules and other safeguards provided for in the above mentioned international instrument, including the provisions limiting the use of the information exchanged and, to the extent needed to ensure the necessary level of protection of personal data, in accordance with the safeguards which may be specified by the supplying Competent Authority as required under its domestic law. Therefore, the importance of the confidentiality and data safeguards has been recognized within the new global model of AEOI. It has to be noted that jurisdictions provide for different rules on protection of personal data of taxpayers – the data subject's right to information, access correction and the oversight mechanism. The state supplying information may specify in the agreement the safeguards which have to be respected in accordance with its national law. The receiving state's obligation is to provide practical implementation and respecting of the safeguards, which have to be in compliance with its own national law as well as domestic law of the state supplying information (OECD, 2014a).

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Moreno González (2016:147) notes that the efforts in international and supranational taxation aimed at improving the exchange of information among tax administrations have not been accompanied by corresponding improvement of the protection of taxpayers' rights and the personal data obtained through that process.

5 CONCLUSION

A serious crisis, it has been said, should never go to waste, which may be applied to the issues explored in this paper. Indeed, a major shift in the framework for international exchange of information occurred in the aftermath of the latest global economic crisis. It has to be acknowledged that until fairly recently the veil of bank secrecy protected taxpayers from having their assets and income revealed to the revenue bodies of the states of their residence. Insufficient mechanisms for the exchange of information with other countries, or the utter absence of them, was thus recognised as a crucial element in characterizing a tax system as "harmful" or even giving a country the label of tax haven. Ground-breaking work in the post-crisis period has been undertaken mainly by the OECD, with the strong support by G20 countries and EU member states, bringing about a new paradigm in this area. A considerable degree of caution is, however, advised in the analysis of the effects of this global initiative for tax transparency, since some recent estimates find that around USD 7.6 trillion or 8% of global households' total financial wealth is still hidden in tax havens (Zucman, 2015:35).

The crucial impetus towards a global system of automatic exchange of information (AEOI) was the adoption of FATCA in the US. Its basic features were adopted and, *mutatis mutandis*, incorporated in the OECD's Global Standard for AEOI, released in 2014. This paper has devoted particular attention to the Common Reporting Standard (CRS), as a key component of the Global Standard. The CRS comprises a two-tier system of annual reporting of data about account holders and due diligence procedures necessary to identify reportable accounts.

The matter of CRS implementation still remains open as the first exchanges are planned for 2017. Against this backdrop, we highlighted some concerns regarding the functioning of the new system. Pertinent compliance costs will definitely be substantial and this burden will be borne both by tax administrations and financial institutions. Attention was drawn to the problem of incoherence between the CRS and other AEOI systems currently in force, such as FATCA. Accordingly, it was argued that the CRS is much more than a global "extension" of FATCA. From the perspective of reporting financial institutions, the biggest concern is that it is unlikely that any two countries will implement the CRS in the same manner in their domestic law, bringing about additional costs in order to comply with all the local variances. Likewise, tax authorities will have to invest additional resources in order to effectively implement the new system and reap its potential benefits. In this regard developed countries – having sophisticated tax administrations – are in a far better starting position than developing countries.

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Another vexing concern relates to the protection of taxpayers' rights within the AEOI procedures. We emphasized that the information exchange under OECD's Global Standard must abide by the safeguards relating to the data to be exchanged, the procedures used as well as the access to the data exchanged and the use to which it can be put. Often sensitive data should be handled confidentially while respecting data protection standards set out by the international tax law instruments as well as domestic laws of both countries involved in the exchange. However, it seems that we are still very much in uncharted waters with regard to the status of taxpayers' rights within global AEOI architecture and the issue has been given serious attention only fairly recently, in both academic and policy circles.[4]

In conclusion, the "brave new world" of tax transparency symbolized by the CRS is, and will remain in the foreseeable future, yet another battlefield between conflicting tax policy norms (e.g. tax equity, simplicity, protection of human rights, etc.). In our view, its ultimate success or failure will be dictated by the aptness of multilateral responses to the most pressing problems at hand.

Disclosure statement

No potential conflict of interest was reported by the authors.

[4] For an overview see, e.g. Baker and Pistone (2015:59-65); André Rocha (2016:502-503).

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An international integration history of the Zagreb Stock Exchange

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Abstract

We investigate stock market co-movements among the Croatian and several other markets (in the US, UK, Germany, Austria, Poland, Czech Republic and Hungary) in the period from 3 September 1997 to 19 August 2016 with dynamic correlation coefficient models. This allows us to analyse long-term trends of the international financial integration of the Zagreb Stock Exchange in the last two decades as well as the separate impacts of major events that influenced financial markets during that period. Our results imply a relatively low level of international financial integration of the Croatian stock market, but some convergence in co-movement with the analysed markets over time is present. The strongest market co-movement is related to the subprime mortgage crisis, and EU accession seems to have made Croatian international integration less segmented.

Keywords: stock market co-movement, Croatian international financial integration, dynamic correlation coefficient models

1 INTRODUCTION

The emerging European stock markets have brief histories compared to more mature markets. Most emerging European countries actively follow economic policies that lead towards more internationally integrated financial markets, yet full integration of these countries' financial markets is far from complete. Since their initial trading sessions in the first half of the 1990s, the emerging European stock markets have had varied performances in terms of international integration. Horvat and Petrovski (2013) find that Central European stock markets are highly integrated into the global financial system, whereas those of South-Eastern Europe exhibit a much lower degree of integration. Due to the special characteristics of the Croatian transition process relative to other emerging EU countries (i.e. war destruction in the initial transition phase, delayed EU accession), its financial integration needs to be investigated individually.

In this paper, we examine the co-movement of the Croatian stock market with various European and global financial markets. We are interested in the long-term perspective of financial integration but investigate the impact of several major financial events in last two decades on the integration process as well. There has been some research on stock market integration and closely related topics for emerging European countries (Cappiello et al., 2006; Egert and Kocenda, 2007; Horvat and Petrovski, 2013; Ivanov, 2014), but a detailed examination of the Croatian stock market is lacking. Therefore, we collect daily data on the closing prices of stock market indices from the Zagreb Stock Exchange and several European (UK – FTSE100, broad EU – STOXX600, German – DAX, Austrian – ATX, Polish – WIG20, Czech – PX and Hungarian – BUX) and global (US – S&P500) markets for the period of 3 September 1997 to 19 August 2016. We identified several important events from the literature on the stock market integration of emerging European countries: the Russian crisis (see Jochum et al., 1999; Gelos and Sahay, 2000), the dot-com crisis and the 9/11 shocks, the subprime mortgage

crisis (see Gijka and Horvath, 2012), and EU accession (see Cappiello et al., 2006b). Next to these events, we analyse the full sample period as well.

The first significant financial shocks for emerging European markets were the Asian and Russian crisis but since it is hard to separate effects of these two events due to their chronological closeness, we investigate the Russian crisis only. The dot-com crisis was the following event that had a pronounced impact on the global financial system but we include the 9/11 shock in our analysis as well since it represents an important non-financial event that affected financial markets globally in that period. The next important event was the subprime mortgage crisis. It started in United States and propagated to the rest of the world through the financial system, in which emerging European countries were particularly affected. This makes it especially interesting as an event that affected the Croatian financial market as well. Finally, as well as a wider set of economic, social and political effects, EU accession implies the intensification of financial integration between Croatian and European markets. Therefore, it is important to analyse how EU accession affected co-movements among Croatian and other markets.

The analysis of Croatian international stock market integration is of interest to investors looking for diversification opportunities in emerging European countries. Investors who seek financing on the local capital market will be better informed about assessing risk related to the channels of financial shock propagation. The emerging European countries experienced a larger drop in economic activity in the recent financial crisis than other regions (Berglof et al., 2009), so the implications of this study have relevance for domestic macroeconomic and monetary policy. Melitz and Zumer (1999) and Baele et al. (2004) claim that integrated European capital markets may decrease risk and allow for better diversification, while Kassim (2010) states that the extent of integration is highly relevant in the context of countries aiming for macroeconomic harmonization. Therefore, the financial stability of emerging European markets is important for the stability of the whole region and also has implications for the economic stability of the EU.

We contribute to the existing literature in several ways. Firstly, we use data on the longest time span available and are therefore able to investigate the full history of Croatian stock market co-movements. This allows us to go into detail about different events during that period and put them in a comparative perspective. This is especially interesting with respect to Croatia's EU accession, which was later than that of other new member states and should be analysed as a separate event. Secondly, our methodological approach makes use of both the dynamic conditional correlation model (DCC) of Engle and Sheppard (2001) and the asymmetric dynamic conditional correlation model (ADCC) of Cappiello et al. (2006a). It is reasonable to assume that correlations between Croatian and other stock markets are time-varying, these models accordingly being able to account for changing dynamics of the correlation structure and suitable for analysing different financial crises and events. Furthermore, by using both, symmetric and asymmetric volatility

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models we are able to check the impact of positive and negative news (shocks) on volatility. Thirdly, we analyse the co-movements between Croatian and different European and global markets, which allows us to inspect whether different financial incidents and other analysed events drive the correlation structure of these markets. Since similarities in the correlation of returns between different markets imply their closer integration we are also able to make some general conclusions about the structure of financial integration and transmission of global and regional financial shocks.

Our results suggest that the overall level of Croatian international financial integration is relatively low, average correlation in the full period amounting to around 0.25, compared to developed markets. However, there are some tendencies of cross-market correlations to converge over time, which reduces Croatian international market segmentation. The analysis also shows that the subprime crisis had the strongest effect on international market integration, whereas Croatia's EU accession caused correlation coefficients to converge and somewhat reduced international market segmentation.

The article is organized as follows: section 2 gives an overview of related literature, while section 3 describes the data set and describes the empirical model. Section 4 presents the results and discusses implications. Concluding remarks are given in section 5.

2 RELATED LITERATURE

One of the main interests of the literature about short and long term relationships between stock markets in emerging European countries has been in implications of results for portfolio diversification opportunities. The findings of the literature have been somewhat mixed but mostly point to regional stock market interdependence and imply that there are only limited diversification opportunities for investors in emerging European countries. The results show that there is a long-run relationship among emerging EU stock markets, but much less evidence has been found on the relationship between them and world markets. This is supported in MacDonald (2001) and Voronkova (2004), which do not find any significant benefits of portfolio diversification when investing in emerging EU stock markets due to their high degree of integration. Their results confirm that co-movement among emerging European markets is much stronger than the relationship between these markets and other world markets. Egert and Kocenda (2007) find some evidence in favour of stock market co-movement among the Czech Republic, Hungary, Poland, and developed European stock markets, but they conclude that portfolio diversification in these markets can still have some advantages.

Several papers analysed how various financial incidents and important events affected the integration of emerging European countries. The results show that different events affect these markets differently and more generally, that there is significant amount of heterogeneity within the sample. Syriopoulos (2004) investi-

gates the impact of the European Monetary Union on international stock market integration among emerging EU countries and the developed markets of Germany and the United States. The author finds a co-integrating relationship between every analysed country pair and therefore confirms the long-term relationship among those markets. Cappiello et al. (2006b) find that the 2004 EU enlargement increased the international stock market integrations of the new EU members with each other and with EU countries in the period before EU accession. They find that the three largest new EU member states (the Czech Republic, Hungary, and Poland) are much more integrated with each other and with the EU than the smaller countries (Cyprus, Estonia, Latvia, and Slovenia), which do not co-move with each other.

Wang and Moore (2008) use a dynamic conditional correlation model to study the interdependence of the Czech, Hungarian, Polish and other EU markets. The authors find that the EU accession and the subprime crisis increased the degree of integration of new EU members and other European markets. Kenourgios et al. (2009) extends the dynamic conditional correlation model with structural breaks to analyse how several financial incidents affected stock market co-movements between developed EU countries, emerging EU countries, and Balkan countries. They find that the dot-com crisis, Euro introduction, and EU enlargement, as well, increased interdependence in these markets.

The literature has been focused on differently defined groups of emerging European countries, which makes it hard to draw clear conclusions about the financial integration of the whole group. Overall, results show that these countries are differently integrated into European and global financial markets. Furthermore, new member states are characterized by a higher degree of financial integration whereas South-Eastern European countries have a somewhat lower degree of financial integration into global and European financial systems. Syriopulos and Roumps (2009) analyse the integration of Balkan countries' stock markets with the German and US markets. The results show that developed markets affect Balkan markets in the long term and that correlations among them are dynamic and asymmetric. Egert and Kocenda (2011) analyse the Czech, Hungarian, and Polish stock markets' correlation with developed EU countries by using intraday trading data. They find very weak correlations among all the analysed countries, from which they conclude that financial shocks in developed markets have a delayed effect on the emerging EU stock markets. Furthermore, the EU accession effect is found to increase the integration of the analysed markets into world financial markets. Gjika and Horvath (2012) study stock market co-movements among the Czech Republic, Hungary, and Poland. Their results show that the correlation among the analysed stock markets rose steadily from 2001 onwards. EU accession and the subprime crisis positively affected their integration process. The authors find that correlations between stock market returns are characterized by asymmetric conditional variances and correlations.

In a recent study of the financial integration of South and East European countries with western European markets, Horvat and Petrovski (2013) find that the stock

market integration of Central Europe vis-à-vis Western Europe is much higher than the integration of South-Eastern Europe vis-à-vis Western Europe. Their results show that Croatia has a positive integration trend and higher degree of financial integration than other South-Eastern European countries due to growing economic integration with the EU. Ivanov (2014) examines the return and volatility spill-overs and stock market co-movements among Western, Central and Southeast European stock markets. The results confirm a high and stable conditional correlation between Central and Western European markets. The conditional correlation between the Croatian market and developed markets is found to be modest but increasing.

Overall, the literature on the stock market integration of emerging European countries is characterized by several heterogeneities, and results have been somewhat mixed. The methodological approach differs among papers which makes it hard to compare the results directly. The literature has focused on different samples of countries, so that drawing implications about the financial integration of the whole region is not straightforward. However, the results confirm a significant mutual financial interdependence among emerging European countries but a somewhat lower degree of their integration into global financial system. The financial integration is generally higher for new member states and central European countries than for Balkan and South European countries. Finally, the results imply that different events and financial incidents have different impacts on this region but usually lead to more integration.

3 DATA AND MODEL SELECTION

We collected data on closing prices for CROBEX and several other stock markets market indices: S&P500, STOXX600, FTSE100, DAX, ATX, WIG20, PX, and BUX. The data are daily and span the period from 3 September 1997 to 19 August 2016 for all indices. The prices are in HRK for the CROBEX index, US$ for S&P500, PLN for WIG20 and EUR for all other indices. The data were collected from Reuters DataStream service. We calculated the return series as:

$$R_{i,t} = ln(I_{i,t}) - ln(I_{i,t-1})$$

where $I_{i,t}$ is the index price of the i-th country at time t, $I_{i,t-1}$ is the index price of the same country in the previous period, and $R_{i,t}$ is the corresponding rate of return of the index.

Figure 1 shows the return series of all the analysed stock market indices. It can be seen that all series exhibit clustering volatility. Periods of high volatility returns are common to all indices, especially during the recent financial economic crisis, when historically high extreme return values were observed. It can also be seen that the return series of the CROBEX index follows a relatively smooth pattern with few volatility clusters except during the recent economic crisis period.

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FIGURE 1

Return plots of the series

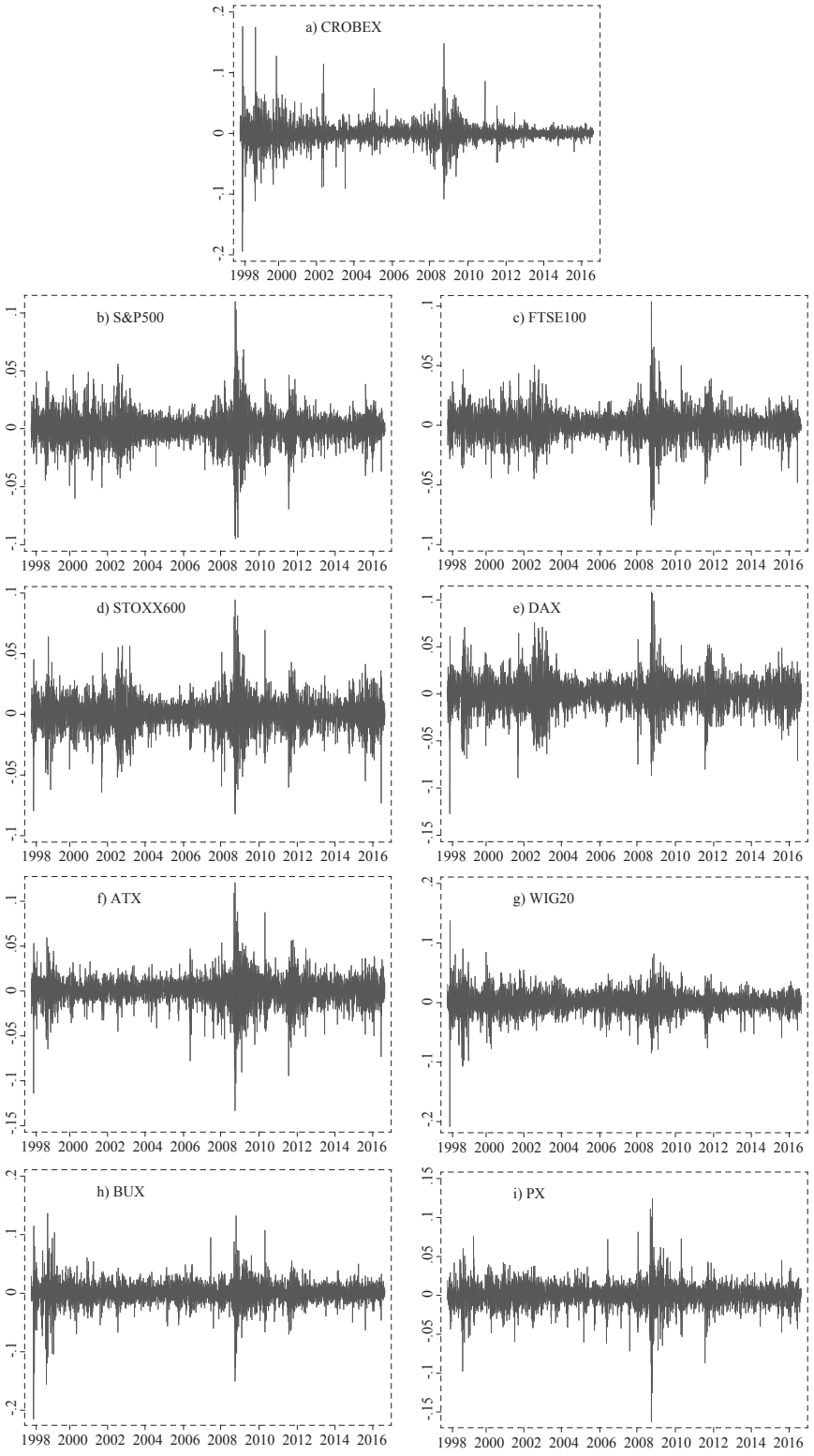

Table 1 provides descriptive statistics for all of the return series. The highest and lowest extreme values are observed for the ZSE, WIG20, BUX and PX indexes. Furthermore, the standard deviation shows that the returns of the FTSE100 and S&P500 are the least volatile. Excess kurtosis is reported for all return series and implies non-normality of distribution. Non-normality is also confirmed via rejection of the Jarque-Berra test null-hypothesis. The ARCH effects were found by means of ARCH (10) tests. We applied the augmented DickeyFuller (ADF) to check the presence of unit roots in the return data. As table 1 reveals, all index return series are found to be stationary since ADF rejects the null of a unit root at the 1% level.

Table 1

Descriptive statistics of return series

	ZSE	S&P500	FTSE100	STOXX600	ATX	DAX	BUX	PX	WIG20
Mean	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Median	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Max.	0.175	0.109	0.103	0.094	0.120	0.107	0.136	0.123	0.137
Min.	-0.194	-0.094	-0.083	-0.081	-0.133	-0.127	-0.214	-0.161	-0.207
Std. dev.	0.015	0.012	0.010	0.013	0.014	0.015	0.017	0.014	0.017
Skewness	-0.054	-0.194	-0.255	-0.285	-0.546	-0.241	-0.778	-0.476	-0.506
Kurtosis	24.923	10.606	9.869	8.021	11.095	7.622	16.693	14.274	11.836
Jarque-Berra (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
No. obs.	4,650	4,650	4,650	4,632	4,632	4,632	4,632	4,648	4,632
ADF	-18.222	-16.60064	-20.567	-20.954	-22.719	-20.399	-21.693	22.471	-23.877
Probability	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ARCH(10)	135.490	167.816	178.484	100.647	130.147	77.540	83.972	63.246	55.157
Probability	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

3.1 MODEL SELECTION

The asymmetric volatility in the covariance of different assets emerges due to differential volatility reaction to negative and positive shocks of the same magnitude. Furthermore, the existence of declining correlations between stock markets during the rising trends, rising correlations during the negative trends and generally higher correlations during the volatile periods imply that correlations between stock markets are dynamic and time dependent. Therefore, these correlations should be measured with proper dynamic correlation models that are able to account for time variation in the correlation structure. Here we find the dynamic conditional correlation model of Engle and Sheppard (2001) and the asymmetric dynamic conditional correlation model of Cappiello et al. (2006a) particularly suitable.

Our methodological procedure consists of two steps. In the first part we find the best-fitted GARCH model among several possibilities: Bollerslev's (1986) GARCH model, the exponential GARCH model of Nelson (1991), and the GJR-GARCH model of Glosten et al. (1993). In the second part we feed the residuals from the

first step into the DCC model and the ADCC model to choose the best fitted model between the two.

The residuals from the best fit GARCH model in the first stage are fed into the dynamic conditional correlation model of Engle and Sheppard (2001) and the asymmetric dynamic conditional correlation model of Cappiello et al. (2006a) in the second stage of the estimation. We then selected the best model between the two via AIC criteria. The dynamic conditional correlation model is defined as:

$$r_t \mid I_{t-1} \sim N(0, H_t) \tag{1}$$

where r_t is the return series, assumed to be normally distributed with a mean of zero, and I_{t-1} is the information set available in the previous period. H_t is a conditional covariance matrix assumed to be positive definite:

$$H_t = D_t R_t D_t \tag{2}$$

where D_t is a diagonal matrix of time-dependent volatilities from univariate GARCH models obtained in the first step that takes the shape:

$$D_t = \begin{bmatrix} \sqrt{\sigma_{1,t}^2} & 0 \\ 0 & \sqrt{\sigma_{2,t}^2} \end{bmatrix} \tag{3}$$

R_t is a time-varying correlation matrix of standardized residuals $\varepsilon_t = D_t^{-1} r_t \sim N(0, R_t)$ that takes the shape:

$$R_t = \begin{bmatrix} 1 & \rho_{12,t} \\ \rho_{21,t} & 1 \end{bmatrix} \tag{4}$$

where $\rho_{12,t} = \dfrac{E_{t-1}(q_{1,tq_{2,t}})}{\sqrt{E_{t-1}\left(q_{1,t}^2\right) E_{t-1}\left(q_{2,t}^2\right)}}$ is the conditional correlation estimation between two returns. The elements of R_t are obtained by using a series of standardized residuals as $R_t = Q_t^{*-0.5} Q_t Q_t^{*-0.5}$ where:

$$Q_t = (1 - \alpha - \beta)\bar{Q} + \alpha \varepsilon_{t-1} \varepsilon_{t-1}' + \beta Q_{t-1} \tag{5}$$

is the conditional covariance matrix of standardized residuals and describes the dynamic structure of the model, and Q_t^* is the diagonal matrix with the square root of the *i*-th standardized residual. The ε_t is the residual series from the first step of the estimation procedure, and $\bar{Q} = \mathrm{E}[\varepsilon_t \varepsilon_t']$ is the unconditional correlation matrix of the standardized residuals. The scalars α and β contain information on the effects of previous shocks and dynamic conditional correlations on current dynamic conditional correlations.

Cappiello et al. (2006a) extends the dynamic conditional correlation model so that it is able to factor in the heterogeneity of shock impacts on the correlation structure. The paper proposes an asymmetric dynamic conditional correlation model, where the dynamic structure of the model evolves according to the following equation:

$$Q_t = (1 - \alpha - \beta)\bar{Q} - \eta\bar{N} + \alpha\varepsilon_{t-1}\varepsilon'_{t-1} + \beta Q_{t-1}\eta\, n_{t-1}\, n'_{t-1} \qquad (6)$$

where α, β, η are estimated parameters, η contains the asymmetric effects, ε_t contains the residual series from the first estimation step, $\bar{Q}$ is an unconditional covariance matrix of residuals, $n_t = I(\varepsilon_t < 0) \cdot \varepsilon_t$ [1] is the matrix of asymmetric shocks, and $\bar{N}$ is an unconditional covariance matrix of n_t.

The estimation of the DCC model and the ADCC model is done via maximization of the quasi log likelihood function[2]:

$$L = -\frac{1}{2}\sum_{t=1}^{T}(nlog(2\pi) + 2log|D_t| + r'_t D_t^{-2} r_t - \varepsilon'_t\varepsilon_t + log|R_t| + \varepsilon'_t R_t^{-1}\varepsilon_t \qquad (7)$$

4 RESULTS OF THE EMPIRICAL ANALYSIS

The results of our analysis and subsequent discussion are presented in this section. First, we present the results for the full sample period and then proceed to the analysis of separate events that affected financial markets. The simple correlation coefficients are given in table 2 where relatively low average correlations can be observed. The results show that average correlations among markets are relatively similar and range between 0.25 and 0.31. The lower average correlation among CROBEX, S&P500 and FTSE100 stands somewhat in contrast to higher observed correlations with other developed and emerging European markets. This might imply a weaker integration of Croatian stock exchange into the global financial system and the greater importance of European and regional markets. Compared to the dynamic conditional correlation estimates from the table 3C, the simple average correlation coefficients show relatively similar values. However, within period trends between these two estimates differ significantly. The difference might be due to time variation of the correlation structure that dynamic conditional correlation estimates are able to capture.

The results of the best fitted GARCH models are presented in table 3A. The AIC criterion was used to find the best fitted model among GARCH, EGARCH and GJRGARCH alternatives. The results are along the lines of Dajcman (2013) who finds that univariate stock market returns have different best fit ARCH/GARCH models. A robustness check was also done with SIC criteria, and the results did not change. The parameter ω is the constant of the estimated model, α informs about the impact of past shocks, and β about the impact of past volatilities on the current

[1] $I(\varepsilon_t < 0)$ is a $1xk$ indicator function that takes on the value 1 when $\varepsilon_t < 0$ and 0 in other cases.

[2] Since the tests for the residuals of our univariate GARCH models show that they are not normally distributed.

conditional volatility. The leverage effects are captured in the parameter γ, which indicates the presence of asymmetric effects in the conditional variance for certain models. A bigger estimated α coefficient indicates stronger volatility reaction to the shock, a larger estimated β implies stronger volatility persistence (the shocks take longer to die out) and statistically different than zero γ coefficient informs about the presence of asymmetric effects in the conditional variance. For the overall period, the α coefficient ranges between 0.009 and 0.098 so it is possible to say that the reaction to news is strongest for FTSE100 index and weakest for STOXX600. It is worth noticing that α coefficient for CROBEX index also takes a high value (0.096) relative to other analysed markets. The β coefficient varies between 0.878 for BUX index and 0.976 for ATX which means that the shortest time is needed for a shock's impact on volatility to die out in the Hungarian and the longest in the Austrian stock exchange. This is similar to the results of Wang and Moore (2008), which also finds high persistence (parameter estimate close to one) of shocks on volatility. Statistically significant γ coefficient is observed for ATX, BUX, PX and WIG20 which means that positive news has a differential impact on the conditional variance relative to negative news. Therefore, these indices show asymmetric reactions to news. This result is again close to Wang and Moore (2008), which finds asymmetric reaction for every analysed emerging European market and Gijka and Horvath (2012), which finds asymmetry in conditional variance for BUX, PX and WIG index.

Table 2

Simple correlation coefficients for the full sample period (annual averages)

Year	S&P500	FTSE100	DJSTOXX	ATX	DAX	BUX	PX	WIG20
1997	0.340	0.616	0.432	0.716	0.749	0.689	0.811	0.823
1998	0.211	0.378	0.350	0.494	0.459	0.490	0.577	0.494
1999	0.051	-0.001	0.107	0.222	0.140	0.238	0.313	0.307
2000	0.041	0.014	0.119	0.135	0.161	0.059	0.207	0.261
2001	0.059	0.047	0.145	0.278	0.117	0.222	0.202	0.181
2002	-0.053	-0.079	-0.011	0.068	0.093	0.036	0.095	0.094
2003	0.184	0.026	0.212	0.213	0.086	0.202	0.133	0.139
2004	0.045	-0.016	0.110	0.172	0.163	0.158	0.066	0.075
2005	0.021	0.008	0.042	0.074	0.101	0.030	0.139	0.109
2006	-0.029	0.015	0.037	0.102	0.131	0.092	0.216	0.100
2007	0.095	0.058	0.226	0.285	0.306	0.285	0.253	0.277
2008	0.474	-0.129	0.668	0.673	0.658	0.672	0.545	0.563
2009	0.360	0.009	0.547	0.605	0.574	0.557	0.375	0.505
2010	0.230	-0.045	0.339	0.353	0.363	0.313	0.312	0.355
2011	0.302	-0.095	0.385	0.463	0.498	0.448	0.364	0.417
2012	0.272	-0.046	0.353	0.346	0.392	0.366	0.240	0.281
2013	0.059	0.031	0.089	0.130	0.077	0.132	0.051	0.044
2014	0.193	0.070	0.217	0.225	0.136	0.184	0.086	0.184
2015	0.220	-0.073	0.237	0.251	0.232	0.230	0.174	0.226
2016	0.290	-0.016	0.361	0.398	0.350	0.386	0.345	0.211
Average	0.168	0.039	0.248	0.310	0.289	0.289	0.275	0.282

Table 3A

Selected univariate GARCH models and parameter estimation results for the full sample period

Index	Model	ω	α	β	γ	*Logl*	AIC
CROBEX	sGARCH	0.012 (0.000)	0.096 (0.000)	0.902 (0.000)	–	-7,095.87	3.053
S&P500	sGARCH	0.049 (0.000)	0.089 (0.000)	0.897 (0.000)	–	-6,730.90	2.896
FTSE100	sGARCH	0.014 (0.000)	0.098 (0.000)	0.891 (0.000)	–	-6,220.28	2.677
STOXX600	sGARCH	0.024 (0.000)	0.009 (0.173)	0.899 (0.000)	–	-6,912.23	2.986
ATX	eGARCH	0.013 (0.000)	0.090 (0.000)	0.976 (0.000)	0.0448 (0.004)	-7,427.90	3.209
DAX	gjrGARCH	0.035 (0.000)	0.018 (0.003)	0.898 (0.000)	0.027 (0.110)	-7,911.81	3.418
BUX	eGARCH	0.039 (0.000)	0.017 (0.003)	0.878 (0.000)	0.029 (0.000)	-8,111.81	3.497
PX	gjrGARCH	0.041 (0.000)	0.017 (0.003)	0.925 (0.000)	0.036 (0.000)	-7,727.90	3.312
WIG20	gjrGARCH	0.044 (0.000)	0.016 (0.005)	0.944 (0.000)	0.040 (0.000)	-8,561.01	3.698

Table 3B

Selected bivariate asymmetric dynamic conditional correlation models and parameter estimation results for the full sample period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.007 (0.001)	0.989 (0.000)	–	-13,759.50	5.922
CROBEX – FTSE100	DCC	0.016 (0.003)	0.978 (0.000)	–	-13,157.02	5.663
CROBEX – STOXX600	ADCC	0.019 (0.001)	0.968 (0.000)	0.005 (0.338)	-13,846.02	5.973
CROBEX – ATX	ADCC	0.022 (0.000)	0.960 (0.000)	0.007 (0.500)	-14,364.07	6.196
CROBEX – DAX	ADCC	0.019 (0.001)	0.962 (0.000)	0.008 (0.375)	-14,774.70	6.374
CROBEX – BUX	DCC	0.018 (0.001)	0.952 (0.000)	–	-14,763.90	6.467
CROBEX – PX	DCC	0.017 (0.001)	0.976 (0.000	–	14,257.03	6.033
CROBEX – WIG20	DCC	0.0055 (0.068)	0.986 (0.000)	–	-15,452.06	6.666

Table 3B shows the parameter estimates of the best-fit A/DCC model, which was chosen so as to minimize AIC criteria. The parameters α and β are significant in every analysed case and show that past shocks and lagged correlations impact the current conditional correlation. Although the best bivariate correlation model for CROBEX and STOXX600 and for ATX and DAX is ADCC, the asymmetry

parameter γ is found to be statistically insignificant in all cases. This means that positive and negative news have the same effect on the co-movements between Croatian and other analysed markets. This finding generally complies with Syriopulos and Roumps (2009), which confirms asymmetry in correlations structure of Balkan countries as well as Gijka and Horvath (2012), which finds asymmetry in conditional variances but much less asymmetry in conditional correlation in the sample of Central European stock markets.

To be able to understand the trend of the dynamic correlations between the emerging Croatian and other analysed stock markets, we compute the annual averages of the daily dynamic conditional correlations. The results are shown in table 3C and figure 2. The computed correlations inform us about the degree of international integration of the Croatian market with other markets.

Table 3C

Dynamic conditional correlation estimates for the full sample period (annual averages)

Year	S&P500	FTSE100	DJSTOXX	ATX	DAX	BUX	PX	WIG20
1997	0.169	0.239	0.429	0.465	0.437	0.480	0.194	0.542
1998	0.226	0.329	0.405	0.407	0.414	0.483	0.286	0.402
1999	0.138	0.189	0.270	0.248	0.259	0.343	0.287	0.296
2000	0.053	0.125	0.201	0.213	0.141	0.238	0.212	0.307
2001	0.085	0.154	0.263	0.177	0.237	0.231	0.183	0.268
2002	0.028	0.058	0.154	0.142	0.131	0.195	0.113	0.245
2003	0.160	0.222	0.254	0.158	0.242	0.215	0.188	0.240
2004	0.136	0.171	0.216	0.213	0.198	0.189	0.186	0.215
2005	0.070	0.091	0.148	0.166	0.133	0.198	0.195	0.233
2006	-0.010	0.049	0.151	0.168	0.147	0.253	0.215	0.225
2007	0.074	0.180	0.244	0.249	0.249	0.233	0.212	0.297
2008	0.187	0.409	0.475	0.446	0.462	0.339	0.394	0.415
2009	0.307	0.474	0.503	0.469	0.457	0.343	0.420	0.385
2010	0.253	0.351	0.368	0.363	0.334	0.306	0.366	0.350
2011	0.210	0.258	0.303	0.294	0.288	0.250	0.262	0.299
2012	0.273	0.356	0.344	0.348	0.342	0.277	0.306	0.312
2013	0.114	0.140	0.215	0.176	0.205	0.199	0.184	0.231
2014	0.154	0.205	0.238	0.183	0.225	0.199	0.164	0.277
2015	0.190	0.205	0.225	0.222	0.221	0.238	0.230	0.297
2016	0.222	0.299	0.338	0.306	0.332	0.292	0.307	0.283
Average	0.152	0.225	0.287	0.271	0.273	0.275	0.245	0.306

The results show that the full-period average correlation of the Croatian stock exchange with other analysed markets is relatively small, around 0.25. This shows a relatively low level of international financial integration, especially compared to the 0.6 found for Central European stock markets (see Horvath and Petrovski, 2013). The authors also find higher correlations for Croatian market than reported here but both correlation dynamics follow a very similar trend. This might be due to the difference in applied methodologies. Our results are similar to those of

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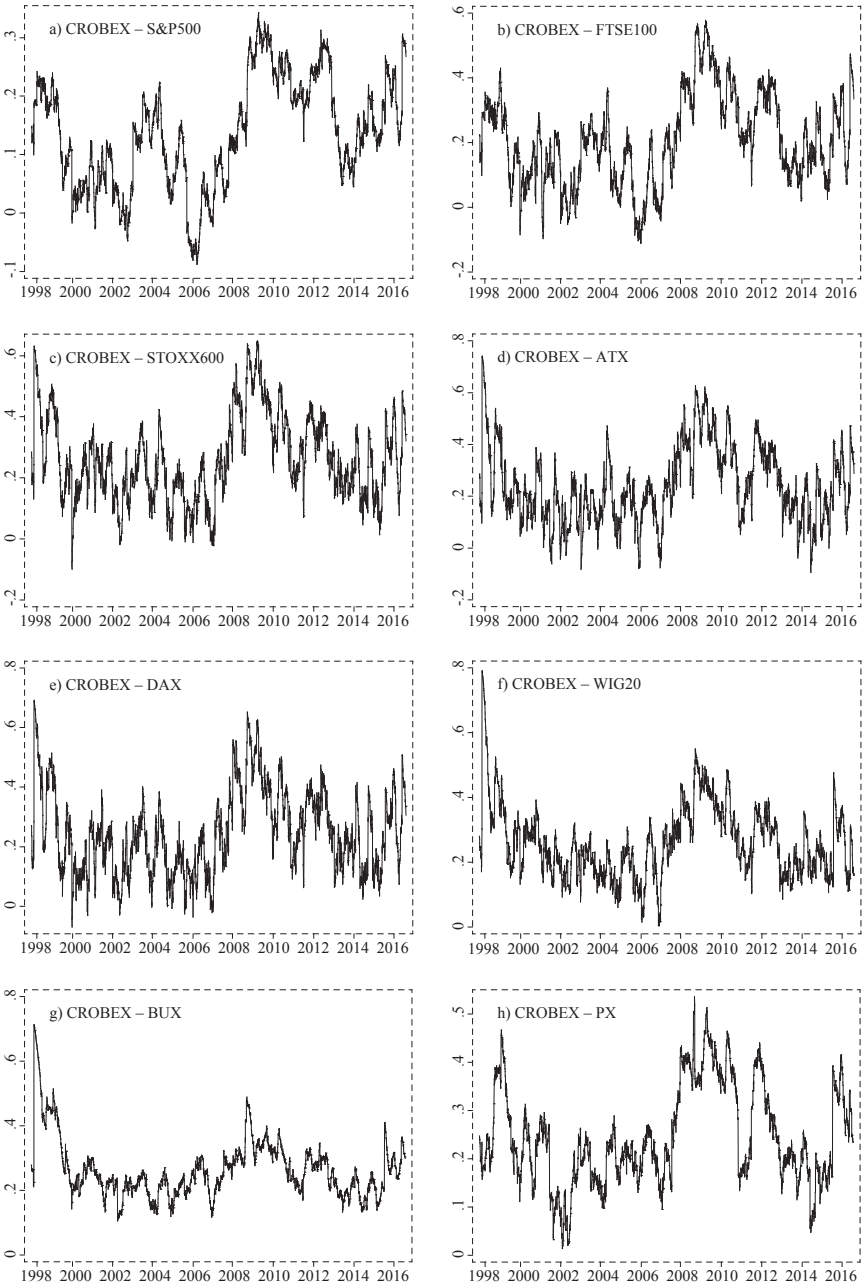
Ivanov (2014), which reports modest levels of financial integration for Croatian market. However, the author finds that integration levels have a rising trend over time, which could not be confirmed in our analysis.

FIGURE 2

Conditional correlations from the estimated A/DCC model



The generally low to modest financial integration levels reflect the short history of the Croatian stock exchange, small market capitalization, banking-oriented domestic financial system and weak long term economic growth. The degree of Croatian stock market integration is lowest with the US and UK markets and highest with the Polish and Hungarian market. The overall integration is strongest with nearby markets and seems to be influenced by the gravity effect. This could reflect historical ties and economic similarities of the countries in the region where regional investors are better informed about trends and developments in their neighbourhood and can better assess risk and profit opportunities.

The initial integration levels of the Croatian market with other European markets are quite high, while its integration with the US and UK markets is relatively low. Its integration dynamics with all markets has a falling trend until 2003, after which it stays relatively low all the way up to the subprime crisis. Some divergence of integration trends can be observed between US and UK markets on one side and all other European markets on the other. This might point to a different degree of integration and shock transmission dynamics from global (US, UK) and European markets. Like Wang and Moore (2008) we find that the subprime crisis caused a drastic rise of correlation among all of the observed indices, where the biggest relative increase of correlation coefficients was observed for the UK and US markets. It is also interesting to note that it took almost a year longer for the CROBEX – S&P500 pair to come to its integration peak than other indices which shows especially low Croatian financial integration with US markets and slow financial shock transmission from global markets. The period after the subprime crisis is also very interesting because there seems to be some convergence in correlation coefficients between Croatian and all other analysed markets, including the US and the UK. However, this could be related to Croatia's EU integration and accession process as well.

Next, we turn to the analysis of how four important events in the last two decades affected the process of international financial integration of the Croatian stock exchange.

4.1 THE RUSSIAN CRISIS

First we want to investigate the effect of the Russian currency crisis on the co-movement of the Croatian stock market with other markets. To investigate the impacts of this incident, we split our sample into two periods. The first period is from the beginning of our sample, 3 September 1997, until the beginning of the Russian crisis on 16 August 1998 as reported by Forbes (2004). The second period starts on 17 August 1998 and ends on 31 December 1999. Ideally, we would want to split the sample into three periods so that the crisis period could be analysed separately, but due to the insufficiently long period of the crisis, we split the sample in two.

Table 4A

Dynamic conditional correlation estimates for the Russian crisis (period averages)

	S&P500	FTSE100	DJSTOXX	ATX	DAX	BUX	PX	WIG20
Pre-crisis	0.241	0.329	0.454	0. 747	0.462	0.493	0.213	0.542
Post-crisis	0.113	0.198	0.297	0.257	0.302	0.371	0.309	0.313

The pre- and post-crisis period averaged correlation coefficients between the Croatian market and other markets are given in table 4A. The respective results of the univariate GARCH and A/DCC models are given in tables 4B-4F in the appendix. We can see that financial integration levels before the Russian crisis were quite high in general, whereas the integration levels with European markets were especially high. The results show that the Croatian stock market experienced a significant decrease in conditional correlations with all of the analysed markets in the post-crisis period. Since the integration levels of all analysed pairs decreased in the post-crisis period, we conclude that the Russian crisis caused the Croatian stock market to disintegrate with the world market and EU markets.

4.2 THE DOT-COM AND 9/11 CRISES

In this part we analyse the impact of the dot-com crisis and 9/11 shocks on the process of Croatian international stock market integration. The dot-com crisis started on 10 March 2000, when the NASDAQ index peaked and in the aftermath of that event, the United States faced another shock, the 9/11 terrorist attacks, so we assume that the joint impacts of these two shocks continued until the end of the 2002. We divided our sample into three periods: a pre-crisis period from 1 January 1999 until 9 March 2000; a crisis period from 10 March 2000 to 31 December 2002, and a post-crisis phase from 1 January 2002 until 31 December 2003.

Table 5A

Dynamic conditional correlation estimates for the dot-com and 9/11 crisis (period averages)

	S&P500	FTSE100	DJSTOXX	ATX	DAX	BUX	PX	WIG20
Pre-crisis	0.057	0.083	0.141	0.112	0.103	0.319	0.269	0.253
Crisis	0.030	0.078	0.163	0.107	0.118	0.222	0.168	0.191
Post-crisis	0.127	0.165	0.182	0.122	0.175	0.214	0.188	0.104

Table 5A shows the correlation coefficients between the Croatian market and each of the other analysed markets during the pre-crisis, crisis, and post-crisis periods. The results of the respective univariate GARCH and A/DCC models are given in tables 5B-5G in the appendix. We see that integration levels in the pre-crisis period are generally low for all markets but especially low for the US and UK markets. This implies that the Croatian stock market was not integrated into global markets before the dot-com and 9/11 events, although some degree of integration with European markets was present in the pre-crisis period. We generally observe a slight fall in correlation with most of the markets, but the crisis somewhat increased integration levels with the broad European and German markets to a

minor extent. The fall in correlation with the US, UK, Austrian, and Polish markets was minor, so we conclude that there was no significant effect of these events on Croatian financial integration. The post-crisis period is characterized by rising correlations with all markets except the Polish market. However, it is worth noting that this increase was highest for the US and UK markets, which reached about the same integration levels as the other analysed European markets. We interpret that as the dot-com and 9/11 events benefitting Croatia's integration into the international financial system. It is also interesting to see that there has been some evidence of regional disintegration in the post-crisis period, specifically with the Polish market, which might point to a differential impact of global and regional financial shocks.

4.3 THE SUBPRIME MORTGAGE CRISIS

In this part we analyse the subprime crisis, an event that had a profound effect on global financial markets and developed into one of the biggest economic crises in modern history. The impact of this crisis was especially strong in emerging European countries and Croatia as well, causing a massive fall in index values in the stock market and a protracted recession in the real economy. To analyse the impact of the subprime mortgage crisis, we divided the sample into three periods: a pre-crisis period from 1 January 2005 until 31 July 2007; a crisis period from 1 August 2007 to 31 March 2009 (as defined in Manda, 2010); and a post-crisis period from 1 April 2009 until 31 December 2011.

Table 6A

Dynamic conditional correlation estimates for the subprime mortgage crisis (period averages)

	S&P500	FTSE100	DJSTOXX	ATX	DAX	BUX	PX	WIG20
Pre-crisis	0.002	0.039	0.121	0.136	0.100	0.219	0.197	0.112
Crisis	0.263	0.454	0.547	0.526	0.531	0.324	0.361	0.487
Post-crisis	0.279	0.376	0.403	0.413	0.381	0.296	0.346	0.370

The results of our analysis are shown in table 6A. The respective results of the univariate GARCH and A/DCC models are shown in tables 6B-6G in the appendix. It can be seen that integration levels of the Croatian market with all other analysed markets were very low in the pre-crisis period and that there was nearly zero co-movement with the US and UK markets. The subprime crisis caused correlation coefficients to rise dramatically, the biggest increases being with the US and UK markets. The integration levels of all markets rose to similar levels, which were among the highest in the overall analysed period. In the period after the crisis, the integration levels fell somewhat but stayed relatively high. This finding is similar to that of Horvat and Petrovski (2012), who document an increase in co-movements in the period before the crisis and subsequent fall to lower but positive values after the crisis.

We conclude that the subprime crisis was a global financial shock that affected all market correlations and possibly had a contagious effect on the Croatian stock market. The subprime mortgage crisis caused the Croatian stock market to become more integrated with the global and European markets, as well. Furthermore, the degree of integration was stable, since, during the post-crisis period, the integration levels stayed relatively high for all markets.

4.4 EU ACCESSION

The effect of Croatian EU accession on its international financial integration is analysed in this section. EU integration was a long-term process, in which negotiations started years before Croatia's actual joining of the EU. Since we wanted to minimize the overlapping of periods, we decided to split the sample into two periods: the announcement period from 1 July 2011, when the negotiations ended and the entry period was announced, until 1 July 2013, when Croatia joined the EU; and the post-accession period from 1 August 2013 to 31 December 2015.

Table 7A

Dynamic conditional correlation estimates for EU accession (period averages)

	S&P500	FTSE100	DJSTOXX	ATX	DAX	BUX	PX	WIG20
Announcement	0.370	0.305	0.333	0.364	0.330	0.262	0.286	0.275
Post-accession	0.169	0.184	0.202	0.156	0.219	0.213	0.193	0.208

The results of the univariate GARCH and A/DCC models are given in tables 7B-7E in appendix. The results in table 7A show that integration levels during the announcement period were relatively high and very similar for all markets. This result is close to Cappiello et al. (2006b), which documents the increase in international financial integration of Central European markets in the period before EU accession. However, we see the main effects of EU accession in the reduction of Croatian financial market segmentation with global and EU markets and not necessarily in increasing its financial integration (see Egert and Kocenda, 2011). It is possible that investors perceived the Croatian market as less risky and that integration increased due to stronger integration in the EU financial system. The post-announcement period is characterized by a significant drop of correlation in all markets. It is interesting that the fall in correlation is relatively equal for all of the analysed markets, and we interpret this as the benefit that EU accession brings. In other words, the major effect of EU accession on the international financial integration of the Croatian market is less segmentation but not necessarily deeper integration.

5 CONCLUSION

This study investigates the history of the international stock market integration of Croatia. The focus of the analysis is on general integration trends in the last two decades as well as the effects of several regional and global financial events that characterize that period. We used asymmetric/dynamic conditional correlation models to analyse market co-movements (integration). Our results have implica-

tions for international portfolio diversification strategies, address the literature on market efficiency, and provide information about the macroeconomic harmonization process in the enlarged EU.

Our data set is based on daily values of closing stock market index prices and spans the period from 3 September 1997 to 19 August 2016. We made use of this data to calculate index returns for every analysed market and use it in our empirical models to calculate correlations. Furthermore, we split the data into several sub-samples in order to analyse the effects of the Russian crisis, the dot-com and 9/11 shocks, the subprime mortgage crisis, and Croatia's EU accession on the dynamics and level of Croatian international financial integration. The results for the full sample point to a relatively low level of international financial integration. The degree of integration is lowest with the US and UK markets and highest with the nearby Polish and other EU markets. This might point to a certain degree of market segmentation and implies differential shock transmission from global and EU financial markets on Croatian market.

The results show that the Russian crisis, even though regional in its origin, caused the Croatian market to disintegrate relatively equally from global and regional financial markets. We did not find strong immediate effects of the dot-com and 9/11 shocks on Croatian international financial integration. However, there is some evidence that these incidents made Croatia more integrated into the global financial system, as its correlations with all markets somewhat converged in the post-crisis period. The subprime mortgage crisis had a profound effect on Croatian market integration when correlation coefficients spiked to their historically highest levels. Finally, Croatia's EU accession increased financial integration levels, but we see the main effect as a further convergence in correlation coefficients for all markets in the post-announcement period, which made Croatian financial integration less segmented.

Disclosure statement

No potential conflict of interest was reported by the authors.

APPENDIX

RUSSIAN CRISIS

TABLE 4B

Selected univariate GARCH models and parameter estimation results for the pre-Russian crisis period

Index	Model	ω	α	γ	β	*Logl*	AIC
CROBEX	sGARCH	1.587 (0.002)	0.384 (0.005)		0.558 (0.000)	-501.785	5.007
S&P500	sGARCH	0.067 (0.206)	0.145 (0.018)		0.830 (0.000)	-319.208	3.201
FTSE100	sGARCH	0.042 (0.299)	0.132 (0.021)		0.853 (0.000)	-306.173	3.071
STOXX600	eGARCH	0.058 (0.099)	-0.279 (0.000)	0.132 (0.201)	0.874 (0.000)	-329.931	3.316
ATX	sGARCH	0.354 (0.028)	0.438 (0.001)		0.560 (0.000)	-380.268	3.804
DAX	sGARCH	0.226 (0.145)	0.308 (0.000)		0.690 (0.000)	-398.881	3.989
BUX	sGARCH	0.212 (0.036)	0.288 (0.000)		0.570 (0.000)	-377.662	4.158
PX	sGARCH	0.07188 (0.315)	0.160 (0.025)		0.668 (0.000)	-335.377	3.321
WIG20	eGARCH	0.446 (0.000)	-0.368 (0.000)	0.546 (0.000)	0.822 (0.000)	-506.267	5.062

TABLE 4C

Selected bivariate asymmetric/dynamic conditional correlation models and parameter estimation results for the pre-Russian crisis period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.000 (0.998)	0.979 (0.000)		-814.818	8.176
CROBEX – FTSE100	DCC	0.004 (0.764)	0.983 (0.000)		-796.573	7.995
CROBEX – STOXX600	aDCC	0.033 (0.589)	0.497 (0.061)	0.140 (0.405)	-814.322	8.181
CROBEX – ATX	DCC	0.106 (0.046)	0.639 (0.000)		-850.348	8.528
CROBEX – DAX	DCC	0.077 (0.089)	0.708 (0.000)		-873.038	8.752
CROBEX – BUX	DCC	0.075 (0.054)	0.608 (0.000)		-863.490	8.433
CROBEX – PX	DCC	0.000 (0.887)	0.946 (0.000)		-804.113	8.256
CROBEX – WIG20	DCC	0.1062 (0.014)	0.598 (0.000)		-976.138	9.773

TABLE 4D

Selected univariate GARCH models and parameter estimation results for the post-Russian crisis period

Index	Model	ω	α	γ	β	δ	*Logl*	AIC
CROBEX	sGARCH	0.048 (0.000)	0.123 (0.000)		0.848 (0.000)		-1,023.41	2.991
S&P500	eGARCH	0.015 (0.022)	-0.175 (0.000)	0.131 (0.000)	0.956 (0.000)		-1,054.26	3.083
FTSE100	sGARCH	0.034 (0.020)	0.0755 (0.000)		0.898 (0.000)		-1,032.99	3.018
STOXX600	sGARCH	0.046 (0.023)	0.114 (0.000)		0.857 (0.000)		-1,081.22	3.153
ATX	eGARCH	0.026 (0.000)	-0.114 (0.000)	0.174 (0.000)	0.972 (0.000)		-1,286.79	3.760
DAX	sGARCH	0.041 (0.036)	0.097 (0.000)		0.884 (0.000)		-1,186.65	3.466
BUX	sGARCH	0.054 (0.000)	0.162 (0.000)		0.912 (0.000)		-1,368.42	3.556
PX	sGARCH	0.042 (0.022)	0.096 (0.000)		0.872 (0.000)		-1,221.45	3.412
WIG20	sGARCH	0.041 (0.036)	0.097 (0.000)		0.884 (0.000)		-1,186.65	3.466

TABLE 4E

Selected bivariate models and parameter estimation results for the post-Russian crisis period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.012 (0.381)	0.961 (0.000)		-1,249.83	8.160
CROBEX – FTSE100	DCC	0.049 (0.015)	0.931 (0.000)		-1,188.46	7.763
CROBEX – STOXX600	DCC	0.048 (0.057)	0.938 (0.000)		-1,237.20	8.079
CROBEX – ATX	DCC	0.008 (0.358)	0.962 (0.000)		-1,232.79	8.050
CROBEX – DAX	aDCC	0.041 (0.057)	0.928 (0.000)	0.019 (0.685)	-1,313.21	8.577
CROBEX – BUX	DCC	0.000 (0.288)	0.954 (0.000)		-1,411.32	8.336
CROBEX – PX	aDCC	0.043 (0.000)	0.956 (0.000)	0.022 (0.225)	-1,397.34	8.621
CROBEX – WIG20	DCC	0.094 (0.126)	0.360 (0.433)		-1,372.82	8.956

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TABLE 5B

Selected univariate GARCH models and parameter estimation results for the pre-dot-com and 9/11 period

Index	Model	ω	α	γ	β	δ	*Logl*	AIC
CROBEX	sGARCH	1.269 (0.026)	0.221 (0.000)		0.518 (0.000)		-857.067	4.337
S&P500	eGARCH	0.049 (0.075)	-0.195 (0.000)	0.027 (0.472)	0.890 (0.000)		-647.875	3.289
FTSE100	sGARCH	0.039 (0.241)	0.023 (0.148)		0.935 (0.000)		-565.582	2.869
STOXX600	sGARCH	0.050 (0.138)	0.043 (0.025)		0.912 (0.000)		-598.827	3.036
ATX	gjrGARCH	0.026 (0.052)	0.048 (0.063)	0.057 (0.145)	0.895 (0.000)		-553.632	2.814
DAX	sGARCH	0.061 (0.116)	0.048 (0.007)		0.919 (0.000)		-695.427	3.523
BUX	sGARCH	0.002 (0.052)	0.028 (0.000)		0.955 (0.000)		-421.736	2.145
PX	gjrGARCH	0.048 (0.032)	0.045 (0.000)	-0.047 (0.054)	0.962 (0.000)		-793.558	3.892
WIG20	gjrGARCH	0.049 (0.048)	0.049 (0.001)	-0.032 (0.119)	0.949 (0.000)		-787.256	3.991

TABLE 5C

Selected bivariate models and parameter estimation results for the pre-dot-com and 9/11 period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.000 (0.998)	0.920 (0.000)		-1,513.53	7.680
CROBEX – FTSE100	DCC	0.012 (0.223)	0.965 (0.000)		-895.32	4.565
CROBEX – STOXX600	DCC	0.011 (0.203)	0.946 (0.000)		-1,207.31	6.137
CROBEX – ATX	DCC	0.008 (0.778)	0.800 (0.000)		-1,410.83	7.173
CROBEX – DAX	DCC	0.000 (0.999)	0.870 (0.000)		-1,549.85	7.873
CROBEX – BUX	DCC	0.577 (0.000)	0.375 (0.000)		-1,822.21	8.923
CROBEX – PX	DCC	0.466 (0.000)	0.394 (0.000)		-1,744.37	8.647
CROBEX – WIG20	DCC	0.451 (0.000)	0.477 (0.000)		-1,632.89	8.296

TABLE 5D

Selected univariate GARCH models and parameter estimation results for the dot-com and 9/11 crisis period

Index	Model	ω	α	γ	β	δ	*Logl*	AIC
CROBEX	sGARCH	0.089 (0.002)	0.059 (0.000)		0.899 (0.000)		-1,236.83	3.560
S&P500	eGARCH	-0.002 (0.698)	-0.070 (0.031)	0.078 (0.013)	0.951 (0.000)		-950.66	2.742
FTSE100	sGARCH	0.078 (0.030)	0.100 (0.000)		0.854 (0.000)		-1,138.37	3.278
STOXX600	sGARCH	0.039 (0.034)	0.126 (0.000)		0.857 (0.000)		-1,178.63	3.393
ATX	eGARCH	-0.010 (0.000)	-0.075 (0.000)	0.0148 (0.496)	0.973 (0.000)		-858.56	2.478
DAX	eGARCH	0.050 (0.074)	0.114 (0.000)		0.876 (0.000)		-1380.57	3.972
BUX	sGARCH	0.193 (0.022)	0.000 (0.000)		0.955 (0.000)		-1,470.98	4.028
PX	sGARCH	0.166 (0.054)	0.067 (0.000)		0.877 (0.000)		-1,270.98	3.867
WIG20	sGARCH	0.151 (0.062)	0.0548 (0.003)		0.896 (0.000)		-1,380.20	3.971

TABLE 5E

Selected bivariate models and parameter estimation results for the dot-com and 9/11 period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.000 (0.998)	0.920 (0.000)		-1,513.53	7.680
CROBEX – FTSE100	DCC	0.012 (0.223)	0.965 (0.000)		-895.32	4.565
CROBEX – STOXX600	DCC	0.011 (0.203)	0.946 (0.000)		-1,207.31	6.137
CROBEX – ATX	DCC	0.008 (0.778)	0.800 (0.000)		-1,410.83	7.173
CROBEX – DAX	DCC	0.000 (0.999)	0.870 (0.000)		-1,549.85	7.873
CROBEX – BUX	DCC	0.000 (0.568)	0.956 (0.000)		-1,756.92	8.994
CROBEX – PX	DCC	0.572 (0.879)	0.534 (0.000)		-1,589.74	8.177
CROBEX – WIG20	DCC	0.451 (0.000)	0.477 (0.000)		-1,632.89	8.296

TABLE 5F

Selected univariate GARCH models and parameter estimation results for the post-dot-com and 9/11 period

Index	Model	ω	α	γ	β	δ	*Logl*	AIC
CROBEX	sGARCH	0.016 (0.135)	0.034 (0.013)		0.952 (0.000)		-730.117	2.978
S&P500	sGARCH	0.008 (0.143)	0.029 (0.006)		0.957 (0.000)		-622.322	2.540
FTSE100	gjrGARCH	0.006 (0.089)	0.005 (0.668)	0.047 (0.017)	0.956 (0.000)		-564.725	2.311
STOXX600	gjrGARCH	0.015 (0.021)	0.006 (0.734)	0.128 (0.002)	0.910 (0.000)		-652.934	2.669
ATX	sGARCH	0.046 (0.308)	0.073 (0.044)		0.861 (0.000)		-602.566	2.460
DAX	sGARCH	0.018 (0.135)	0.074 (0.000)		0.913 (0.000)		-836.468	3.409
BUX	sGARCH	0.067 (0.567)	0.096 (0.067)		0.785 (0.000)		-892.217	2.966
DAX	sGARCH	0.019 (0.478)	0.064 (0.000)		0.978 (0.000)		-847.155	3.522
WIG20	eGARCH	0.001 (0.564)	0.0478 (0.000)	0.035 (0.000)	0.996 (0.000)		-801.450	3.271

TABLE 5G

Selected bivariate models and parameter estimation results for the post-dot-com and 9/11 period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.019 (0.365)	0.917 (0.000)		-1,347.70	5.512
CROBEX – FTSE100	DCC	0.007 (0.426)	0.980 (0.000)		-1,271.10	5.209
CROBEX – STOXX600	DCC	0.071 (0.027)	0.706 (0.000)		-1,379.04	5.639
CROBEX – ATX	aDCC	0.014 (0.395)	0.936 (0.000)	0.014 (0.519)	-1,327.43	5.433
CROBEX – DAX	DCC	0.019 (0.073)	0.957 (0.000)		-1,558.00	6.365
CROBEX – BUX	DCC	0.027 (0.008)	0.997 (0.000)		-1,733.22	6.685
CROBEX – PX	DCC	0.020 (0.055)	0.978 (0.000)		-1,655.10	6.467
CROBEX – WIG20	DCC	0.000 (0.899)	0.931 (0.008)		-1,532.08	6.260

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TABLE 6B

Selected univariate GARCH models and parameter estimation results for the pre-subprime mortgage crisis period

Index	Model	ω	α	γ	β	δ	*Logl*	AIC
CROBEX	sGARCH	0.272 (0.000)	0.274 (0.000)		0.443 (0.000)		-848.33	2.655
S&P500	sGARCH	0.025 (0.022)	0.053 (0.000)		0.894 (0.000)		-657.45	2.060
FTSE100	sGARCH	0.015 (0.040)	0.063 (0.000)		0.898 (0.000)		-579.05	1.816
STOXX600	gjrGARCH	0.038 (0.000)	-0.221 (0.000)	0.002 (0.937)	0.942 (0.000)		-662.30	2.078
ATX	eGARCH	0.006 (0.512)	-0.142 (0.000)	0.166 (0.000)	0.926 (0.000)		-911.51	2.855
DAX	sGARCH	0.060 (0.024)	0.101 (0.001)		0.827 (0.000)		-827.05	2.589
BUX	sGARCH	0.078 (0.003)	0.458 (0.000)		0.948 (0.000)		-1,452.66	3.532
DAX	sGARCH	0.071 (0.784)	0.526 (0.418)		0.921 (0.000)		-1,397.77	3.459
WIG20	eGARCH	0.009 (0.015)	0.025 (0.241)	0.116 (0.050)	0.989 (0.000)		-1,091.26	3.415

TABLE 6C

Selected bivariate models and parameter estimation results for the pre-subprime mortgage crisis period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.0176 (0.094)	0.966 (0.000)		-1,503.86	4.719
CROBEX – FTSE100	DCC	0.018 (0.151)	0.960 (0.000)		-1,409.02	4.430
CROBEX – STOXX600	DCC	0.011 (0.298)	0.957 (0.000)		-1,528.45	4.795
CROBEX – ATX	DCC	0.011 (0.359)	0.961 (0.000)		-1,757.78	5.510
CROBEX – DAX	DCC	0.003 (0.800)	0.964 (0.000)		-1,652.63	5.188
CROBEX – BUX	DCC	0.019 (0.667)	0.988 (0.000)		2,578.33	6.366
CROBEX – PX	DCC	0.023 (0.541)	0.974 (0.089)		-2,341.22	6.225
CROBEX – WIG20	DCC	0.017 (0.114)	0.955 (0.000)		-1,927.81	6.046

TABLE 6D

Selected univariate GARCH models and parameter estimation results for the subprime mortgage crisis period

Index	Model	ω	α	γ	β	δ	*Logl*	AIC
CROBEX	sGARCH	0.188 (0.018)	0.222 (0.000)		0.759 (0.000)		-838.207	4.128
S&P500	eGARCH	0.033 (0.000)	-0.171 (0.000)	0.123 (0.000)	0.976 (0.000)		-831.024	4.098
FTSE100	sGARCH	0.030 (0.121)	0.146 (0.000)		0.852 (0.000)		-730.960	3.602
STOXX600	eGARCH	0.027 (0.007)	-0.192 (0.000)	0.075 (0.059)	0.975 (0.000)		-798.428	3.938
ATX	sGARCH	0.144 (0.069)	0.149 (0.000)		0.835 (0.000)		-911.964	4.490
DAX	sGARCH	0.072 (0.043)	0.153 (0.000)		0.845 (0.000)		-814.222	4.010
BUX	sGARCH	0.187 (0.335)	0.189 (0.000)		0.948 (0.000)		-817.657	4.230
PX	sGARCH	0.075 (0.087)	0.112 (0.000)		0.874 (0.000)		-834.447	4.230
WIG20	sGARCH	0.085 (0.153)	0.0911 (0.001)		0.896 (0.000)		-882.125	4.343

TABLE 6E

Selected bivariate models and parameter estimation results for the subprime mortgage crisis period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.026 (0.109)	0.928 (0.000)		-1,659.48	8.188
CROBEX – FTSE100	DCC	0.061 (0.003)	0.902 (0.000)		-1,511.40	7.462
CROBEX – STOXX600	DCC	0.035 (0.141)	0.915 (0.000)		-1,576.28	7.780
CROBEX – ATX	DCC	0.050 (0.095)	0.804 (0.000)		-1,679.81	8.288
CROBEX – DAX	DCC	0.074 (0.015)	0.819 (0.000)		-1,575.50	7.777
CROBEX – BUX	DCC	0.043 (0.062)	0.865 (0.000)		-1,593.23	7.922
CROBEX – PX	DCC	0.049 (0.326)	0.905 (0.000)		-1,578.13	8.102
CROBEX – WIG20	DCC	0.002 (0.749)	0.979 (0.000)		-1,664.30	8.212

Table 6F

Selected univariate GARCH models and parameter estimation results for the post-subprime mortgage crisis period

Index	Model	ω	α	γ	β	δ	*Logl*	AIC
CROBEX	sGARCH	0.048 (0.000)	0.123 (0.000)		0.848 (0.000)		-1,023.41	2.991
S&P500	eGARCH	0.015 (0.022)	-0.175 (0.000)	0.131 (0.000)	0.956 (0.000)		-1,054.26	3.083
FTSE100	sGARCH	0.034 (0.020)	0.075 (0.000)		0.898 (0.000)		-1,032.99	3.018
STOXX600	sGARCH	0.046 (0.023)	0.114 (0.000)		0.857 (0.000)		-1,081.22	3.159
ATX	eGARCH	0.026 (0.000)	-0.114 (0.000)	0.174 (0.000)	0.972 (0.000)		-1,286.79	3.760
DAX	sGARCH	0.041 (0.036)	0.097 (0.000)		0.884 (0.000)		-1,186.65	3.466
BUX	sGARCH	0.054 (0.042)	0.086 (0.000)		0.962 (0.000)		-1,011.23	2.885
PX	sGARCH	0.039 (0.064)	0.092 (0.000)		0.894 (0.000)		-1,039.84	2.999
WIG20	sGARCH	0.041 (0.036)	0.097 (0.000)		0.884 (0.000)		-1,186.65	3.466

Table 6G

Selected bivariate models and parameter estimation results for the post-subprime mortgage crisis period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.000 (0.999)	0.914 (0.000)		-2,066.35	6.047
CROBEX – FTSE100	DCC	0.036 (0.158)	0.785 (0.000)		-2,003.32	5.864
CROBEX – STOXX600	DCC	0.037 (0.140)	0.855 (0.000)		-2,042.42	5.977
CROBEX – ATX	aDCC	0.051 (0.009)	0.908 (0.000)	0.014 (0.700)	-2,252.50	6.592
CROBEX – DAX	aDCC	0.036 (0.524)	0.729 (0.000)	0.055 (0.644)	-2,158.95	6.320
CROBEX – BUX	DCC	0.026 (0.189)	0.966 (0.000)		-2,047.59	6.00
CROBEX – PX	DCC	0.037 (0.136)	0.845 (0.000)		-2,018.22	5.912
CROBEX – WIG20	DCC	0.064 (0.244)	0.758 (0.003)		-2,185.96	6.401

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TABLE 7B

Selected univariate GARCH models and parameter estimation results for the announcement period

Index	Model	ω	α	γ	β	δ	*Logl*	AIC
CROBEX	sGARCH	0.017 (0.038)	0.058 (0.002)		0.909 (0.000)		-577.732	2.331
S&P500	sGARCH	0.045 (0.008)	0.137 (0.000)		0.824 (0.000)		-696.614	2.808
FTSE100	eGARCH	-0.001 (0.766)	-0.138 (0.000)	0.065 (0.078)	0.981 (0.000)		-662.568	2.675
STOXX600	eGARCH	0.002 (0.610)	-0.160 (0.000)	0.041 (0.000)	0.980 (0.000)		-726.550	2.932
ATX	sGARCH	0.019 (0.112)	0.047 (0.001)		0.943 (0.000)		-916.754	3.690
DAX	sGARCH	0.031 (0.081)	0.072 (0.001)		0.913 (0.000)		-867.097	3.491
BUX	sGARCH	0.006 (0.459)	0.084 (0.000)		0.921 (0.000)		-798.514	3.124
PX	sGARCH	0.031 (0.985)	0.051 (0.000)		0.962 (0.000)		-801.044	3.266
WIG20	sGARCH	0.018 (0.096)	0.066 (0.000)		0.924 (0.000)		-807.977	3.254

TABLE 7C

Selected bivariate models and parameter estimation results for the announcement period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.064 (0.244)	0.758 (0.003)		-2,185.96	6.401
CROBEX – FTSE100	DCC	0.012 (0.068)	0.982 (0.000)		-1,233.24	4.986
CROBEX – STOXX600	DCC	0.010 (0.122)	0.985 (0.000)		-1,298.36	5.248
CROBEX – ATX	DCC	0.017 (0.090)	0.978 (0.000)		-1,456.72	5.882
CROBEX – DAX	DCC	0.011 (0.057)	0.984 (0.000)		-1,416.62	5.721
CROBEX – BUX	DCC	0.052 (0.325)	0.956 (0.000)		-1,385.76	5.244
CROBEX – PX	DCC	0.012 (0.074)	0.896 (0.000)		-1,399.21	5.635
CROBEX – WIG20	aDCC	0.015 (0.055)	0.979 (0.000)	0.001 (0.921)	-1,365.01	5.519

TABLE 7D

Selected univariate GARCH models and parameter estimation results for the post-accession period

Index	Model	ω	α	γ	β	δ	*Logl*	AIC
CROBEX	sGARCH	0.013 (0.741)	0.037 (0.477)		0.907 (0.000)		-422.023	1.429
S&P500	sGARCH	0.058 (0.002)	0.199 (0.000)		0.727 (0.000)		-653.439	2.209
FTSE100	eGARCH	-0.030 (0.039)	-0.223 (0.000)	0.123 (0.007)	0.952 (0.000)		-619.138	2.094
STOXX600	sGARCH	0.028 (0.039)	0.123 (0.000)		0.857 (0.000)		-814.607	2.747
ATX	sGARCH	0.309 (0.029)	0.116 (0.004)		0.648 (0.000)		-917.427	3.092
DAX	sGARCH	0.031 (0.045)	0.102 (0.000)		0.883 (0.000)		-938.051	3.161
BUX	sGARCH	0.034 (0.084)	0.355 (0.000)		0.978 (0.000)		-924.025	3.332
PX	sGARCH	0.048 (0.123)	0.024 (0.120)		0.877 (0.000)		-889.051	3.665
WIG20	eGARCH	0.006 (0.235)	-0.078 (0.001)	0.089 (0.084)	0.973 (0.000)		-862.443	2. 613

TABLE 7E

Selected bivariate models and parameter estimation results for the post-accession period

Index pairs	Model	α	β	γ	*Logl*	AIC
CROBEX – S&P500	DCC	0.000 (0.997)	0.887 (0.000)		-1,067.06	3.624
CROBEX – FTSE100	DCC	0.045 (0.333)	0.481 (0.010)		-1,030.41	3.501
CROBEX – STOXX600	DCC	0.037 (0.357)	0.797 (0.012)		-1,222.20	4.138
CROBEX – ATX	DCC	0.027 (0.220)	0.836 (0.000)		-1,330.35	4.501
CROBEX – DAX	DCC	0.027 (0.140)	0.906 (0.000)		-1,345.52	4.554
CROBEX – BUX	DCC	0.035 (0.566)	0.795 (0.000)		-1,328.64	4.347
CROBEX – PX	DCC	0.000 (0.412)	0.741 (0.000)		-1,202.54	4.255
CROBEX – WIG20	DCC	0.000 (0.998)	0.905 (0.000)		-1,280.62	4.334

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Crowdfunding – Croatian legal perspective and comparison to other sources of financing

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Abstract

Crowdfunding is a new way of financing ideas by raising small amounts of money from a large number of people, typically via the internet. Most countries do not have special legislation governing crowdfunding but some countries like the United States, Italy, France, the United Kingdom and Germany have amended their legislation with provisions specifically designed for crowdfunding. The first aim of this research was to examine which existing legislation could be applied to crowdfunding as well as to review whether there is a need in the Croatian system to introduce new legislation designed specifically for crowdfunding issues. The second research aim was to compare crowdfunding with other sources of financing in order to decide whether it can represent a substitute for them or only a possible complementary instrument.

Keywords: crowdfunding legislation, crowddonating, crowdrewarding, crowdinvesting, crowdlending, comparison with other sources of financing

1 INTRODUCTION

1.1 DEFINITION

Crowdfunding is a way of funding a project or venture by raising money from a large number of people who each contribute a relatively small amount, typically via the internet (Oxford Dictionaries, 2016). It usually includes a project owner (an entrepreneur, fund raiser), the internet platform that acts as a sort of intermediary through which the third participant, individuals from the crowd, give their money in order to finance a specific project developed by the project owner.

1.2 HISTORICAL DEVELOPMENT

Although crowdfunding tends to be presented as a new way of financing projects, it has to be clearly stated that it has a long existence. The best known historical example of crowdfunding comes from the USA and concerns the pedestal of the Statue of Liberty. The Statute itself was a gift of the French people to the American citizens, but in order to install it firmly, a pedestal had to be built, for which there were no funds available. The famous publisher Joseph Pulitzer came upon the idea of publishing an ad in his newspaper *New York World* in 1885, inviting all people to donate as much as they could for this purpose crying: "Let us not wait for the millionaires to give us this money. It is not a gift from the millionaires of France to the millionaires of America, but a gift of the whole people of France to the whole people of America." Some donated only one dollar but roughly 125,000 people participated in the campaign and the sum collected actually exceeded the money needed for construction. In gratitude to all the donors, *New York World* published their names, regardless of the size of the donation (National Park Service, 2016).

Although there are many examples similar to this, crowdfunding turned into a global phenomenon only in the 2000s and its success was determined by two important circumstances. One of them was the global financial crisis that struck

the world in 2008 (World Bank, 2013) and made it hard for entrepreneurs to get financing through bank loans. With bank loans unavailable, other sources of financing like friends and family circles proved to be insufficient, and capital markets and business angels required more professional fund raisers, an equity gap thus being created (Lefèvre and Popescu, 2015). At the same time, world wide web 2.0 was developed and enabled better interaction and communication among its users (François, 2015) which fostered the progress of social media (MySpace, Facebook, LinkedIn) and together with that the blossoming of a whole set of websites based on a collaborative economy like Airbnb, Uber, Blablacar and Groupon. The lack of financing sources on the one hand and the possibility of communicating easily with a large number of people on the other were highly inspirational tools for people searching for money, and the crowd all of a sudden became an important investor; thus crowdfunding evolved.

1.3 CROWDFUNDING IN NUMBERS

Although it was perceived in the beginning as a marginal way of collecting smaller amounts of money for artistic projects, some of the most successful campaigns showed that crowdfunding could be effectively used as a financing instrument for considerable amounts as well. One of the first examples of that kind was certainly the campaign for the smart watch Pebble, which connects wirelessly to a smartphone and serves as an on-the-wrist notification centre. The campaign that started in 2012 over the internet platform Kickstarter managed to raise the amount of 10.3 million dollars whereas the target amount was only 100,000 dollars (Cunningham, 2012).

According to recent figures provided by the research firm Massolution (2015), currently in the world we have 1,250 active crowdfunding platforms. In 2014 the crowdfunding industry raised 16.2 billion dollars, more than twice as much as in 2013 when funds collected amounted to 6.1 billion dollars. The trend of steep growth continued in 2015, when 34.4 billion dollars was raised.

Compared to these world numbers, Croatian figures are still quite small. Although there are a few Croatian crowdfunding platforms (www.doniralica.hr, www.croinvest.eu, www.croenergy.eu), statistical data from foreign platforms show that Croatian fundraisers prefer to seek funding on foreign crowdfunding platforms due to the larger number of potential investors and the enhanced chances for successful financing.

By keeping track of Croatian projects on foreign crowdfunding platforms, it can be determined that 63 Croatian projects were introduced to crowdfunding in 2015, with only 23 of them managing to collect the needed funds. In total, the amount of 751,457.42 dollars was collected from 7,673 backers. The international internet platform most popular with Croatians is Indiegogo with 47 Croatian projects in 2015 and the average amount per Croatian campaign of 10,000 dollars (Hafner, 2016).

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The palette of projects being financed through crowdfunding is very wide – it stretches from new technological gadgets and individual artistic endeavours to the financing of club transfers of professional football players (Favrod-Coune and Nafissi-Azar, 2016).

1.4 RESEARCH GOALS

The first aim of this research is to analyse the legal aspects of crowdfunding in Croatian law by reviewing the existing Croatian legislation and testing its application in crowdfunding in order to determine if it does cover all its aspects. In this research, the legislation of countries that introduced new legislation specifically designed for crowdfunding (USA, Italy, France, UK and Germany) will be also reviewed and in the light of this comparative approach it will be considered whether Croatian legislation needs to be amended. The second aim of this research is to compare crowdfunding with other sources of financing. The costs involved will be compared to the costs of other sources of financing and all the related advantages and disadvantages of crowdfunding will be examined in order to conclude whether it represents a substitute for the classical sources of financing or merely a complementary instrument. The greater purpose behind this research is to provide a sound legal and practical overview for project owners so that they can be confident when engaging in crowdfunding activities.

2 CROATIAN LEGISLATION COVERING CROWDFUNDING

The legal framework of crowdfunding could be categorized in three different approaches. The first approach is to forbid some types of crowdfunding and this approach has been used by some countries, including Japan (François, 2015). The second approach is to pass laws specifically designed for crowdfunding, adopted for instance in the USA, Italy, France, UK and Germany. The third approach is being used by the majority of countries and that is to review the existing legislation and analyse in which way it should be applied to crowdfunding. Since in Croatia there are no specific laws to either forbid or further regulate certain types of crowdfunding, the conclusion must be that Croatia has taken the third approach. In the next chapters we will analyse under which legal institutes crowdfunding should be categorized and what the implications are.

Due to the fact that crowdfunding represents a source of financing in which the main actors (project owner, crowdfunding platform and individuals from the crowd) usually act/reside in different countries, in case of a dispute, often it will be a challenge to determine the jurisdiction and applicable law (see more in Kunda, 2016). Since aspects of private international law would exceed the scope of this article, they will not be further elaborated upon and the legal perspective of crowdfunding in the chapters below will be given from the point of Croatian law.

When talking about the legal aspects of crowdfunding, it needs to be explained that crowdfunding has developed into four different types and each of them tackles different parts of legislation; they are crowddonating, crowdrewarding, crowdlending and crowdinvesting (Ancelle and Fischer, 2016).

2.1 CROWDDONATING

Crowddonating is the type of crowdfunding in which some project is financed by donations of people who do not expect anything in return. Although the motives of backers are charitable, which is why this type of crowdfunding is described by some authors as altruism (Gierczak et al., 2016), it is important to note that donations may also fund for-profit enterprises (Bradford, 2012).

2.1.1 Gift contract

Legal qualification of this type of crowdfunding is rather easy since donation and gift are synonyms (Friganović, 2011) and donation can be therefore qualified as a gift contract that is regulated in the Croatian Law on Obligations. According to article 479 of the Croatian Law on Obligations, a gift contract is concluded when a donor commits to give a thing or other property right to a person who accepts the gift without doing anything in return. The legal provisions of the Law on Obligations define what is considered to be a gift, in what form the contract needs to be concluded, and in which cases the gift can be revoked, and so on, but all these stipulations are of minor significance in the crowdfunding sense of donation.

2.1.2 Tax issues

However, categorisation as donation is very important from the perspective of tax law, for the person receiving the donation as much as for the donor. According to article 6, 7 and 13 of the Law Concerning the Financing of Units of Local Government and Regional Self-Government, individuals and legal entities that in the Republic of Croatia receive money as a gift, need to pay 5% of the donated sum as taxes. Since from chapter 1.3 of this article it can be seen that Croatian project owners tend to collect funds on foreign internet platforms, this means that they are not receiving a gift in the Republic of Croatia and therefore these provisions will not be applied to them. However, if the donation takes place through a Croatian internet platform, these provisions do apply but it is to be noted that according to article 14 of the same act, gifts tax is not paid in certain cases; for example, if a gift is received from a spouse or linear relatives or if it is given for the purposes laid out by separate regulations.

From the perspective of donor, it is to be noted that according to article 36, paragraph 12 of Croatian Income Tax Act, a taxpayer may have his/her personal allowance increased by gifts in kind and in cash given in Croatia and transferred to giro accounts of associations and other persons engaged in cultural, educational, scientific, health-care, humanitarian, sports-related or religious activities pursuant to special regulations, up to 2% of the taxpayer's income for which the annual tax return was submitted and the annual income tax assessed in the previous year. A similar provision exists also in article 7, paragraph 7 of Croatian Profit Tax Act. In these cases, money donated through Croatian internet platforms could be used in certain cases in order to deduct taxes to be paid, resulting in an additional motivation for donors to participate in crowdfunded campaigns.

2.2 CROWDREWARDING

In reward-based crowdfunding, project owners usually determine amounts that are to be paid and in return, depending on the amount, they provide a certain reward to the donor. This reward can for example be a t-shirt, badge or some other memorabilia but it can be also a product for whose production itself the collected money has been used. Therefore, some authors (Bradford, 2012) tend to divide this type of crowdfunding into two different types: one which uses souvenir-like objects representing a pure reward model of crowdfunding, whereas the other one can be called a pre-purchase model of crowdrewarding. This distinction is quite important since these different subcategories of reward-based crowdfunding are indeed covered by different aspects of legislation.

2.2.1 Pure reward based crowdfunding

An example of reward based crowdfunding is to be found in the case of the Goulash Disco Festival of Balkan music, which took place from 3-6 September 2013 on the Island of Vis in Croatia and was entirely funded by donations through the internet platform Ulule (Ulule, 2013). Depending on the size of donation (6-10,870 dollars or more) the donor in return got different kinds of rewards ranging from having his or her name listed on the website of the Festival, getting a postcard from the festival or the status of a god materialized in a statue to be built on the beach.

Regarding the legal aspects of pure reward-based crowdfunding, everything that was written for crowddonating is also relevant. According to article 489 of the Croatian Law on Obligations such cases involve mutual gifts according to which if it is agreed that the person accepting a gift gives a gift in return, the gift exists only for the value in excess of such donation. This is to say that only the part of a donor's gift that exceeds the value of the gift (memorabilia) received will be regarded as a gift. As for the first part of the "gift" that has a counter-value in the memorabilia received, one can see this legal relationship as a sale purchase agreement regulated under articles 376-473 of Croatian Law on Obligations. However, due to the specific circumstances of this deal, the real counter value of the donated souvenir cannot be estimated (consider the aforementioned example of god status materialized in a statue) since it has a rather sentimental value; therefore it is better to treat the whole deal as a gift contract in both directions.

2.2.2 Pre-purchase model

A nice Croatian example of reward-based crowdfunding that partially uses a pre-purchase model is a project called Enfojer that conducted a campaign on the internet platform Indiegogo in 2013. Enfojer is presented as an "old school darkroom for smartphones," namely it is a portable enlarger that enables you to develop real photographs from digital images saved on your phone. In this campaign, the first 100 donors (described as Early Herd Special) receive an Enfojer kit for the discounted price of 250 dollars (Indiegogo, 2013).

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Although the name pre-purchase suggests that the legal transaction behind this crowdfunding model is to be categorized under sale-purchase agreement, we have to carefully examine if that is the final classification. Obvious answers are not always correct, for it has to be taken into account that crowdfunded projects very often entail innovative products as seen in the above example of Enfojer. The products cannot be produced easily and are often dependent on the creative talent of precise creators who themselves cannot be easily replaced either. Therefore, although under article 380, paragraph 3 of the Croatian Law on Obligations, an object of a share purchase agreement can be a thing that does not yet exist, under article 591, paragraph 3 of the same law where the parties to the contract have the particular value of the producer's work in mind, an agreement will always constitute a contract for work that is regulated in articles 590-619 of the Croatian Law on Obligations.

Having that in mind, one needs to beware of the implications of such categorisation, especially concerning the right to terminate the contract and liability for product defects. According to article 597 of Croatian Law on Obligations, the producer needs to finish a product in the time that was determined by the contract. Usually, in the case of the pre-purchase model of crowdfunding, it is clearly stated on the internet platform when the product can be expected. If during the production it becomes obvious that the producer is not following an agreement and that he is not doing what he should, under article 598 of Croatian Law on Obligations the orderer can warn him about it and give him a certain deadline to comply, and if he does not do it, the orderer can terminate the contract and claim for damages. The delivered products are not to be seen as "test examples" that do not have to satisfy any standards; the producer bears full responsibility that its products really function as was agreed. If the product shows certain defects, under article 604, paragraph 1 and 608, paragraph 1 of Croatian Law on Obligations, the orderer must examine the product as soon as possible and without delay inform the producer about the defect claiming for the repair within the defined deadline. If the producer refuses to repair a product due to extensive costs, the orderer can claim a price reduction or termination of contract, and in both cases he has the right to claim damages under article 608, paragraph 3 of Croatian Law on Obligations. Under article 605 of the Law on Obligations, the producer is liable for hidden defects as well but only if they are noticed within 2 years from the delivery of the product. In the event of a substantial defect, under article 609 of the Law on Obligations, the orderer can terminate a contract without asking for repair and claim damages. It is also to be stated that the orderer can, under article 619 of Croatian Law on Obligations terminate the production agreement as long as the product is not finished, but in this case he has to pay a remuneration to the producer, which will be reduced by the costs that the producer did not have and for the profit that the producer made or deliberately omitted.

In cases where the parties to the contract do not have a particular value of the producer's work in mind, the contract could be classified as a sale purchase agreement that is regulated by articles 376-473 of Croatian Law on Obligations.

However, having in mind the definition of crowdfunding put forward in chapter 1.1 of this article, where it is stated explicitly that the purpose of crowdfunding is funding of a project or venture, it seems that neither of the possible categorizations of the pre-purchase model into the group of existing nominated contracts of the Law on Obligations matches completely. Indeed, this purpose is not even mentioned in a contract for works or a sale purchase agreement, which leads us to the conclusion that the pre-purchase model of crowdfunding would be best understood as a specific form of contract that falls under the category of innominate contracts; the key principle of the Law on Obligations is party autonomy (Gorenc, 2005) which means that parties are free to determine what kind of contract they are concluding, who their partners are and what the content of the contract will be. In the case of nominate contracts, the Law on Obligations makes it easier for the parties to contract since the law provides them with the description of their duties and obligations in case they do not determine them on their own.

In a case in which the parties wish to conclude a contract that cannot be categorized under any of the nominated contracts, they can determine the content of the contract on their own. In this case however, they are bound by the restrictions of article 2 of the Law on Obligations that requires that parties regulate their obligations in compliance with the Constitution of the Republic of Croatia, its mandatory laws and the morals of the society.

2.3 CROWDLENDING

Crowdlending is a type of crowdfunding where the borrowers through an internet platform find lenders who lend them money in return for interest. Although the Croatian platform Croinvest states that it also offers this type of crowdfunding, on its website there is no proof that such a model has ever been used. It may be possible that some Croatian entities have used this model on foreign platforms, but because websites providing crowdlending usually require registration before their databases can be accessed, it is not possible to check this easily. However, in order to explain this model better, we can use the example of the prominent US-American internet platform Prosper that operates this crowdfunding model.

Using Prosper, borrowers can borrow 2,000-35,000 dollars depending on the duration of the loan, which can be 3 or 5 years, and lenders get their money back together with a certain interest. Before listing a loan on their website, Prosper credit checks applications to ensure that the borrowers can afford the loan and to ensure that they meet all the eligibility criteria. This listing needs to attract a sufficient number of investors in order to reach a requested loan amount. If investors commit a sufficient amount of funds to the loan, the borrower will receive the requested loan.

2.3.1 Loan contract

The relationship that is created between the borrower and the lender in this type of crowdfunding can be categorized as a loan contract that is regulated in articles 499-508 of the Law on Obligations. In a loan contract, the lender is obligated to lend a certain amount of the money to the borrower, who commits to return the same amount of the money. Under article 500 of the Law on Obligations interest is not obligatory but in the case of crowdlending it is usually agreed upon. Since the crowdlending platform acts merely as an intermediary, it is not to be treated as a party to the contract (Crnić, 2012).

What is interesting to have in mind when submitting this relationship to the category of a classical loan contract is that according to article 506 of the Law on Obligations, the borrower can renounce the contract up until he receives the money, but in this case the lender can claim for damages, if any. In the context of crowdfunding it is particularly interesting to see what happens if a loan is not used for the purpose that was agreed upon. Usually, on crowdlending sites you can find touching stories on how the money is going to be used. Article 508 of the Law on Obligations regulates a loan with a purpose in a way that in case the purpose of the loan has been determined in the loan contract, the lender can terminate the contract if the borrower uses the money for another purpose. So, if the purpose is determined in the contract, it presents an essential element of the contract (Gorenc, 2005). However, if the loan is paid in time with the interest agreed upon, it is very likely that the lenders will not wish to terminate it.

2.3.2 Banking and payment services regulation

In the case of crowdlending it is necessary to analyse whether the internet platform provides banking services and therefore needs to be regulated under the Croatian Credit Institutions Act. According to article 7 of this act, banking services include receiving deposits or other returnable funds from the public and approving credits from these funds, for its own account. In the case of crowdlending platforms, it cannot really be said that it is approving credits for its own account but more likely it is to be seen as an intermediary between a borrower and a lender that conclude a loan contract; therefore, it is not to be treated as a credit institution that would require approval from Croatian National Bank according to article 56 of the Credit Institutions Act.

It is to be noted that this means that money paid via crowdlending platforms is not secured by the deposit insurance system run by State Agency for Deposit Insurance and Bank Resolution under Deposit Insurance Act. According to article 7, paragraph 1 of this act, deposits up to 100,000 euros are protected in the event of a credit institution's bankruptcy.

However, depending on the structure of interaction between the borrowers, lenders and crowdlending platform, it may be possible that the crowdlending platform will perform one of the payment services from article 3 of Act on Payment Trans-

actions and therefore would need to acquire an appropriate licence from the regulatory authority.

2.4 CROWDINVESTING

Crowdinvesting is also known under the term equity crowdfunding and it represents a type of crowdfunding in which people provide money in return for a share in the profit from the business that is to be funded with that money. The way in which this share is transmitted is very different and depending on that, it will impinge on totally different legislative issues.

2.4.1 Stocks in joint-stock company

If the future business of the crowdfunded company is organized as a joint-stock company in which every investor that participated in the crowdfunding campaign will receive stock in return, one needs to take into account the provisions of the Croatian Commercial Companies Act that regulate joint-stock companies.

2.4.1.1 Prospectus

Besides that, when offering shares to the public, which is what actually happens in this sort of crowdfunding, one also needs to take into account the provisions of the Croatian Capital Markets Act. According to article 354 of the Capital Markets Act, a public offer of securities is not allowed in Croatia unless the prospectus has been previously approved by Croatian Financial Services Supervisory Agency is published. The prospectus is to be made according to Commission regulation 809/2004 of 29 April 2004 implementing Directive 2003/71/EC of the European Parliament and of the Council as regards information contained in prospectuses as well as the format, incorporation by reference and publication of such prospectuses and dissemination of advertisements. This document needs to provide an investor with basic information about the issuer and the securities offered, but in practice this basic information stretches to around 400 pages (Đurđenić, Simić and Krunić, 2016).

However, it is to be noted that according to article 342, paragraph 1, point 7 of the Capital Markets Act the prospectus is not required in the case of offers that in a 12-month period do not exceed the amount of 5,000,000 euros. Since the amounts of the Croatian crowdfunded campaigns according to the available information do not exceed this amount, prospectus regulation will not be triggered. We have to consider that on 30 November 2015 the European Commission published a proposal for a regulation supplementing Directive 2003/71/EC of the European Parliament and of the Council with regard to regulatory technical standards for approval and publication of the prospectus and dissemination of advertisements and amending Commission Regulation 809/2004. According to article 1, paragraph 3, point d) of this proposal, the amount of 5,000,000 euros is to be raised to 10,000,000 euros but the member states will have the possibility of setting it at 500,000 euros. If Croatia decides to set a lower amount at which the publication of a prospectus becomes obligatory, there is a greater chance that some of the crowdfunded campaigns will need a prospectus.

2.4.1.2 Investment services regulation

Besides a prospectus, when offering shares to the public, internet platforms need to take into account special regulations considering investment services. That is, the reception and transmission of orders in relation to shares is considered to be one of the investment services under article 5, paragraph 1, point 1 of Croatian Capital Markets Act and investments services under article 6 of the same act can only be offered by investment firms or credit institutions that have obtained special approval from regulating authorities such as the Croatian Financial Services Supervisory Agency or Croatian National Bank. In order to obtain such approval, companies need to satisfy very strict organizational requirements and their management also needs to get special licences. The fee payable to the Croatian Financial Services Supervisory Agency for the approval of the stated investment service alone costs 10,000 kunas according to article 4, paragraph 3, point 1 of Regulation on the type and the amount of fees and administrative charges of the Croatian Financial Services Supervisory Agency. Due to the high starting costs, it is expected that crowdinvesting activities including the offer of shares in Croatia will be operated by already existing investment firms.

2.4.2 Shares in limited company

If one wants to finance a business by collecting money in return for shares in a limited company, the provisions of the Commercial Companies Act that regulate a foundation and management of such company have to be taken into account. Since according to article 385, paragraph 1 of the Commercial Companies Act, shares in a limited company cannot be expressed in the form of securities, the current prospectus regime will not be triggered. It is to be noted that in some countries public offers of shares in a limited company also require a prospectus that needs to be approved by a regulatory authority; such an obligation exists for instance in Germany, according to article 1, paragraph 2, and article 6 of the Investments Act. No such obligation exists in Croatia for now and therefore it would be possible to offer shares in a limited company by public offer in Croatia without a prospectus approved by a regulatory authority. However, it is to be noted that even in these cases, a certain form of informative memorandum containing basic information on the company would be highly recommended because it would positively contribute to investor protection.

2.4.3. Silent partnerships

A convenient form of financing business by crowdinvesting is also possible in the form of silent partnership which is regulated under articles 148-158 of the Commercial Companies Act. When compared to limited companies, silent partnerships are much easier to enter into since they require a contract that is not subject to a particular form and that is why they are easier to conclude by means of distant communication like the internet. In the case of the limited companies, according to article 387, paragraph 1 of the Commercial Companies Act a limited company is founded by a contract that needs to be signed in the form of a notarial act or in the form of a private document confirmed by a notary. The same form is required

under article 412, paragraph 3 of the Commercial Companies Act for the transfer of a share in the limited company. Since these forms require the personal presence of an investor and entail certain costs, silent partnerships are a more favourable form of investment in crowdfunding. Under article 148, paragraph 1 of the Commercial Companies Act, a silent partnership is established by the contract according to which one person (the silent partner) invests some property value into the company of another person (the entrepreneur) and that is how he gets a right to participate in the profit and loss of the entrepreneur.

Although the silent partner does not have full informational rights comparable to those of the shareholder in a limited company, according to article 150 of the Commercial Companies Act, he has a right to examine financial statements and demand copies of them in order to check if they are correct and he has a right to get clarifications if needed. Exactly these supervisory rights of the silent partner constitute an important point of distinction between a silent partnership and profit participating rights. That is, the profit of the company can also be granted by a company to a person that invests some property value into the company in return for a right to participate in the profits (Barbić, 2013). However, a holder of a profit participating right does not have supervisory powers over the entrepreneur.

Supervisory powers of a silent partner distinguish a silent partnership from the loan contract as well. This distinction is however rather obvious since in the case of the loan contract, it is interest that is agreed upon, and not a share in profit, as in the case of a silent partnership (Gorenc et al., 2008).

2.4.4 Alternative investment fund

If an internet platform collects money from investors with the aim of investing in some company, there is a concern that by doing so it performs the activity of an alternative investment fund which is defined under article 3, point 2 of the Alternative Investment Funds Act as an investment fund founded with the purpose of raising funds through public or private offer and of investing these funds in different types of property in line with a predetermined strategy and investment aim, exclusively for the benefits of the shareholder in such an alternative investment fund. Although the law does not define a strategy or investment aim, these terms suggest that one needs to have the possibility to choose among various investments according to one's strategy and investment aim and actively manage such decisions. In the case of crowdfunding, the internet platform invests according to the orders of crowdfunders into the given company and it does not have discretionary powers in doing so; therefore, it does not constitute an alternative investment fund (Saria and Stocker, 2015; Hooghiemstra and De Buysere, 2016).

3 COMPARATIVE LEGAL ANALYSIS

Although most of the countries in the world have not introduced new legal rules for crowdfunding, some countries have decided to do so. In the paragraphs that follow, we will be briefly outlining the legislation of the following countries – USA, Italy, France, UK and Germany, which have passed laws specifically

designed for crowdfunding. As will be seen, in these legislative actions, crowddonating and crowdrewarding have not been caught up by the new legislation, the scope of legislation being mostly limited to crowdinvesting and crowdlending.

3.1 USA

On 5 April 2012 President Obama signed the Jumpstart Our Business Startups Act or JOBS Act, with the intention of encouraging the funding of US small businesses by easing various securities regulations. On 30 October 2015, additional rules regarding equity crowdfunding were introduced in Title III of the act. It is to be noted that before the JOBS Act it was not allowed to offer securities in the USA without complying with the burdensome 1933 Act Registration and Disclosure Requirements and 1934 Act Periodic Reporting Requirements (Hazen, 2012). Before explaining the outlines of JOBS Act, it should first be stressed that term security under American law has a much wider scope than in European law. Namely, under US law, the term security does not only include stocks or other traditional investment vehicles, but also interests in partnerships and limited liability companies that fall within the scope of the investment contract under the so-called Howey test (Bradford, 2012). Since the costs of compliance with the financial regulations were very high for smaller companies, the JOBS act created a special regime that enables emerging growth companies (issuers that had total annual gross revenues of less than 1,000,000,000 dollars) to offer securities under certain conditions.

In this way they can raise amounts up to 1,000,000 dollars per year via crowdfunding platforms that need to be registered with the US Securities and Exchange Commission (SEC) as a broker/dealer or as a funding portal. They also must register with one or more self-regulatory organizations like the Financial Industry Regulatory Authority (FINRA). The obligation to register as a broker/dealer actually provides a substantial advantage to this industry (Cunningham, 2012) since it can push existing financial actors into new business models. Under the JOBS Act, investors are limited in two ways: first of all they cannot invest more than 5% or 2,000 dollars of their yearly net income if their net income is less than 100,000 dollars (if it is higher, they can spend 10% of income) and second, crowdfunded securities may not be transferred by the purchaser of such securities during the one year period beginning on the date of purchase, unless some special conditions apply. Although this trading restriction has a strong impact on the liquidity of these securities, the intention behind it was to prevent manipulation in the form of "pumping up" the price of a security by posting untrue or exaggerated information (Cunningham, 2012).

3.2 ITALY

With Law Decree number 179 ("Further urgent measures for economic growth of the country") dated 18 October 2012 that was converted into law on 17 December 2012, Italy has received a legal act that regulates equity based crowdfunding. The law was additionally clarified by a regulation number 18592 from 26 June 2013.

With the new legislation in force only innovative start-up companies (that must satisfy several conditions to be treated as such) can raise amounts up to 5,000,000 euros per year via an Italian equity crowdfunding platform, which is significantly more than in the USA (Lerro, 2014). The management of such web platforms is reserved for investment firms and banks authorized to provide investment services as well as for companies entered in a special register managed by Commissione Nazionale per le Società e la Borsa (Consob).

In order for the offer on the crowdfunding platform to be effective, at least 5% of the financial instruments offered have to be subscribed by professional investors, bank foundations or innovative start-up incubators. In this way legislators ensured more credibility for crowdfunded offers because it is expected that professional investors, when compared with simple investors, perform more serious due diligence before investing into something. The web platform must take care that the collected funds for each offer are deposited in an escrow account in the issuer's name at the bank or investment firm.

It is exactly prescribed which information on the offer must be available at the crowdfunding platform and it must include for example the information on the risk of losing the entire investment and the risk of illiquidity and information on the withdrawal right. Namely, the crowdfunding platform must grant non-professional investors a withdrawal right from the subscription, free of any charge, within 7 days from the order. It is to be noted that withdrawal rights in this form are usually not granted in investment contracts so this presents an additional protection for the investors.

3.3 FRANCE

Unlike the USA and Italy which have decided to regulate only crowdinvesting, on 1 October 2014 in France legislation that deals with crowdinvesting, crowdlending and crowddonating came into force (Clasen, 2015; Ancelle and Fischer, 2016).

Until that date, all offers of securities with a total amount of more than 100,000 euros were subject to the obligation to publish a prospectus. According to new regulations offers of securities through a crowdfunding platform up to the total amount of 1,000,000 euros are exempt from the obligation to publish a prospectus. However, the issuer still has to provide some information such as project description, management structure, existing financial reports or estimated calculations, explanation of the costs that will be charged to an investor, and information on the risk assessment. Besides classic investment advisors that can deal with all sorts of securities, advisors on participative investments are introduced as a new category of intermediaries that can only deal with shares and fixed rate bonds and cannot accept funds from investors (except for their own fees).

In the field of crowdlending, according to the new French legislation it is possible for legal persons and natural persons that undertake some professional activity or

need a loan in order to fund their studies to borrow funds up to 1,000,000 euros with a maximum duration of 7 years. Only natural persons can be lenders in the case of interest-bearing loans and their participation is limited up to an amount of 1,000 euros per project. Regulatory, crowdlending platforms have been labelled as intermediaries in participative investments. Intermediaries in participative investments cannot perform transfer of funds between lenders and borrowers unless they obtain the status of a payment establishment.

Both advisors on participative investments and intermediaries in participative investments have to comply with certain rules of good conduct.

3.4 UNITED KINGDOM

In the UK crowdinvesting and crowdlending have been explicitly regulated by Policy statement 14/4 that was put forward by the Financial Conduct Authority (FCA) and came into force on 1 April 2014. This kind of regulation means that platforms that offer crowdinvesting and crowdlending have to comply with both the specific regulation and also the general rules that apply to firms regulated by FCA (Ancelle and Fischer, 2016).

With regard to crowdinvesting, new consumer protection rules are created according to which firms may only make direct offer promotions to retail consumers who meet certain criteria: those who take regulated advice, those who qualify as high net worth or sophisticated investors, or those who confirm they will invest less than 10% of their net assets in this type of security. Their rules also require firms to check whether customers understand the risks if they do not take regulated advice (FCA, 2015).

With regard to crowdlending, the rules that apply make sure that consumers interested in lending to individuals or businesses have access to clear information; in this way they can assess the risk and understand who will ultimately borrow the money. Additionally, some core consumer protection requirements apply to firms operating in this market. For example, client money must be protected and firms must meet minimum capital standards. Finally, the FCA requires that firms that run these platforms have resolution plans in order to ensure that in the event of the platform collapsing, loan repayments will continue to be collected and returned to those who lent money (FCA, 2015).

3.5. GERMANY

Although one would expect Germany to be a pioneer in the regulation of crowdfunding, the Retail Investor's Protection Act that regulates crowdfunding in Germany was adopted only on 23 April 2015 and came into force on 10 July 2015, three years after the US regulation.

With the new legislation, if an offer does not exceed 2.5 million euros, there is no need to publish a prospectus, but the offer needs to consist of certain investment

types such as profit-participating loans, subordinated loans and other similar financing forms and investments. These investments can only be offered by platforms that offer investment consulting and investment brokerage. Despite the absence of a prospectus, issuers still need to prepare an investment information sheet that must contain essential information about the investment and a warning that the investment is associated with significant risks and can result in the total loss of the money invested.

When investing, natural persons are limited to an amount of 1,000 euros per issuer; however, if they can prove they have at least 100,000 euros of freely available assets, they can invest up to 10,000 euros per issuer.

Although crowdfunding associations deem this legislative action to be positive (European Crowdfunding Network, 2015), some authors criticize it for several reasons, especially because of the fact that the prospectus exemption does not relate to all types of investments and all types of securities (Klöhn and Hornuf, 2015).

3.6 EUROPEAN UNION

At the EU level there is still no legislation that is designed specifically for crowdfunding, but some doubts whether crowdfunding needs to be regulated were publicly raised in 2013. That year the European Commission opened a 3-month public consultation under the title *Crowdfunding in Europe? Exploring the added value of potential EU action*. The ultimate objective of this consultation was to gather data about the needs of market participants and to identify the areas in which there is a potential added value in EU action to encourage the growth of this new industry, either through facilitative, soft-law measures or legislative action (European Commission, 2013). Following the consultation process, on March 27, 2014 the European Commission published a Communication on Crowdfunding in which it proposes to promote industry best practices, raise awareness and facilitate the development of a quality label, closely monitor the development of crowdfunding markets and national legal frameworks and regularly assess whether any form of further EU action – including legislative action – is necessary (European Commission, 2014).

With the purpose of achieving these goals, in June 2014 the European Commission founded the European Crowdfunding Stakeholder Forum – an expert group of high level representatives of associations of concerned stakeholder groups and national authorities that regularly meets and helps the Commission explore future actions in this field.

In May 2016 the European Commission published its report on the EU crowdfunding sector together with a press release in which it was stated that there was no strong case for an EU level framework at this point, but that developments in the sector would remain under review (European Commission, 2016).

4 COMPARISON WITH OTHER SOURCES OF FINANCING

In the following chapters crowdfunding will be primarily compared with bank loans and capital markets as other sources of financing, but the relation to other sources of financing may be involved as well. Advantages and disadvantages will be reviewed from the perspective of project owners but not investors.

4.1 ADVANTAGES

4.1.1 Wider scope of potential investors

If you want to ask for a credit from a bank in Croatia, you are limited to 27 credit institutions that have such a licence in Croatia (Croatian National Bank, 2016). When searching for funding in capital markets, you are also limited to investors that actively engage there. However, with crowdfunding you gain access to all the ordinary people that use the internet, have different interests and can also emotionally relate to the project that is being presented and decide to invest in it. People want something that they cannot buy at every store and they enjoy thinking that they have helped finance something truly special (Flebbe, 2015). Besides, crowdfunding has high multiplication potential (François, 2015) which some authors describe as "herd behaviour" (Hornuf and Schwienbacher, 2015) so financing goals can be reached very quickly.

It is also to be noted that the scope of potential investors is widened also through the lifting of geographical barriers (Grabner, 2015). With crowdfunding platforms that operate worldwide, a local project can successfully be funded by people who live on the other side of the world, as evidenced by 23 Croatian projects having been successfully financed in 2015 through foreign crowdfunding platforms (Hafner, 2016).

4.1.2 Simple administrative processing

Only a look at the list of documents that banks in Croatia usually require for entrepreneurial loans can be demotivating – registration document, tax statements for previous years, excerpts from income and expenses lists, list of long-term property, confirmation on debt to tax authority, bank account statements, confirmation from credit register (Erste&Steiermärkische Bank d.d., 2016). So, before (or after) coming to the bank, an entrepreneur that wants funding for a certain project needs to invest additional time to collect all the needed documents. The administrative burden with crowdfunding will depend on the internal rules of each platform, though generally in crowdfunding portals the focus is on the project itself and no additional administrative tasks are required from a project owner. This makes it easy for him to process the financing request. Besides, banks or business angels usually tend to perform certain due diligence before agreeing to financing and that takes time so crowdfunding presents usually a faster way of financing (Lefèvre and Popescu, 2015).

4.1.3 Market sounding

Probably one of the biggest advantages of crowdfunding is its ability to test the market while at the same time raising funds for a certain project. This advantage is most visible with new products that are yet to be developed and produced by the help of crowdfunding. The more backers a crowdfunding campaign for such products has, the more potential buyers of the finished products can be expected (Golić, 2016). Therefore, crowdfunding is a great way to test out new ideas and weed out bad business ideas at an early stage before a considerable amount of money is wasted in their investment (Pope, 2011).

4.1.4 Networking

Obviously, crowdfunded projects have more visibility than projects that are financed by bank loans or capital markets. Besides easier market research as described in the previous chapter of this article, this circumstance allows the project owners to network more effectively with other entrepreneurs with similar or complementary projects. Thus, networking proves to be one of the most important motivators for crowdfunders (Čondić-Jurkić, 2015).

In order to show the potential of networking in the example, let us go back to the project Enfojer referred in chapter 2.2.2 of this article. The campaign for "Old school darkroom for smartphones" will most likely attract the producers of photo paper who in turn offer their collaboration with the project owners. It could also get the attention of specialised stores of photo equipment that might want to include the new product in their range.

4.1.4 Wisdom of crowds

Crowdfunding platforms usually provide an effective communication channel that enables project owners to exchange information with investors. In this way, as explained in previous paragraphs of this article, crowdfunders have an opportunity to get feedback from market participants, to meet potential new partners but to improve their projects as well. Described as wisdom of crowds (Baumann, 2014; Golić, 2016) or crowdsourcing (Stucki, 2014), the ability of a crowd to provide effective solutions through online consultation is not to be underestimated. One of the creators of the first Croatian computer game that was financed through crowdfunding (Legends of Dawn) mentioned that one of the motives behind choosing crowdfunding as a way of financing the new game Wave of Darkness was to have direct contact with the buyers who can give them suggestions (Hafner, 2015).

4.2 DISADVANTAGES

Although crowdfunding bears certain risks for investors such as risk of fraud, lack of transparency, possible dilution of ownership and illiquidity (Čondić-Jurkić, 2015; Vedantam, 2016), which will not be further elaborated upon in this article, it is not to be forgotten that project owners also have to deal with some disadvantages when engaging in this source of financing.

4.2.1 Marketing efforts

Administrative burdens like collecting the set of necessary documentation for bank loans or drafting a prospectus for capital markets characterise other sources of financing. However, crowdfunding challenges project owners to engage more intensively in marketing activities when preparing their campaign (Grabner, 2015). Usually, on crowdfunding platforms a certain project is presented through a video that has to be sufficiently interesting, informative and motivating. Besides a video, one has to actively advertise the project in social media in order to profit from the multiplication potential of crowdfunding.

Many good projects fail only due to the fact that project owners do not invest enough effort in marketing. A good Croatian example of that is the computer game Red Solstice that first tried to receive funding in 2012 via the platform Indiegogo. Of the requested 10,000 dollars they managed to get only 3,000 dollars. In 2014 they repeated the campaign via the platform Kickstarter requesting 50,000 dollars and this time they succeeded. In the second campaign they used a more sophisticated PR campaign that was run by professionals and they maintained a high level of interaction with the backers of the game (Šojer, 2014).

Good communication forms part of marketing efforts and is crucial for the success of a crowdfunding campaign (Gross, 2014). Through interaction with project owners, backers obtain better information and they get a feeling that somebody is fully involved in the project. According to the research of Reservoir Funds, 86% of project owners regularly communicate on social networks (Arnaud des Abbayes, 2015), either by posting comments or uploading photos or videos related to the campaign. This can be very time consuming since it means that one has to stay online and alert during the whole day, which is not always easy to combine with an everyday schedule.

4.2.2 Intellectual property exposure

As a consequence of the wider scope of potential investors comes a wider scope of persons who can steal the business idea. In certain cases, crowdfunded campaigns for innovative products feature the characteristics of a certain product and provide enough information which enables other persons to realise the idea. The misuse of an innovative idea can be prevented by protecting intellectual property in time but usually the development of the idea depends on the financial means that are to be collected by campaign. Therefore, at an early stage, the information on the product is not yet specific enough to go through patent procedure. However, it is to be noted that the finalisation of the product strongly depends on the skills and experience of a developer so not every project can be successfully completed by any other person besides the initial project owner.

4.2.3 Risking future funding

Failure to collect funds via crowdfunding can create bad marketing for the project. In the case of a bank loan, if a bank refuses to finance an entrepreneur, he can easily go to another bank that does not have to know about the decision of the first

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bank. In the case of a project that fails to raise means by crowdfunding, the whole internet population knows about it and can form a negative opinion on the project based on the fact that it did not manage to get funding. So, other means of financing or upcoming projects of the same developer can be negatively influenced by this experience.

5 COSTS OF CROWDFUNDING

In the following paragraphs the costs and potential gains for investors will not be analysed but the costs will be calculated from the perspective of project owners.

5.1 PLATFORM COSTS

The average costs of crowdfunding are not easy to determine since they will depend on the type of crowdfunding platform and internal rules of the platform. However, in order to get a better overview of the costs, these will be presented with the example of three crowdfunding platforms – Indiegogo, the most used foreign platform by Croatian project owners that offers both the crowddonating and crowdrewarding models; Prosper, one of the world's most successful crowdlending platform and Seedrs, one of the best known crowdinvesting platforms.

Indiegogo, which attracts the most Croatian project owners, charges a fee of 5% on all collected funds. In addition to the fees of the platform, as is stated on their website, one has to reckon with the fees of payment processors such as Pay Pal and credit card companies that amount to 3-5% of the raised amount (Indiegogo, 2016). It is to be noted that for now Croatian crowdfunding platforms that offer crowddonating do not charge fees and therefore they should be more appealing to Croatian project owners, but due to the wider scope of investors on foreign platforms, project owners still prefer to list their projects there.

When compared with the transparency of fees for crowddonating and crowdrewarding, the costs of crowdlending were not so easy to find out. Namely, in order to get the exact interest rates from crowdlending platforms, one usually needs to provide a platform with the information on the employment status and annual income, as well as information on real estate property and possible mortgages. The possible rate will then depend on the rating given by the platform based on the information collected and the terms of loan. However, **Prosper** publicly announced a scale of possible interest rates that range from 5.32-31.90% (Prosper on Rates, 2016). Beside the interest rate, with Prosper one needs to reckon with a closing fee, a percentage of money that will be deducted from the amount that is to be paid as a loan on the borrower´s account. This percentage can range from 0.5-4.95% (Prosper on Fees, 2016).

Seedrs, one of the most well known crowdinvesting platforms, has a very clear administrative fee that is fixed to 7.5% of the total funds that are raised, but if there is only one new investor on the project the fee is reduced to 3.75% of the raised funds (Seedrs, 2016). This shows that the network of Seedrs investors is very

limited and not so dynamic, thus every new investor in the network is highly appreciated.

In order the better to show the costs of crowdfunding, they are presented in the table below on the example of raising 10,000 euros, calculated with the lowest possible fees, and in case of a crowdlending with a repayment time of 3 years.

Table 1

Estimated costs of crowdfunding platforms in EUR on the example of 10,000 euros

	Interest rate percentage	Interest rate amount (A)*	Platform fee percentage	Platform fee amount (B)	Payment fee percentage	Payment fee amount (C)	Total (A+B+C)
Indiegogo	/	/	5	500	3	300	800
Prosper	5.32	1,082.38	0.50	50	/	/	1,132.38
Seedrs	/	/	3.75		/	/	375

**Based on annuity repayment.*

Source: Calculation of the author, Indiegogo, Prosper, Seedrs.

5.2 MARKETING COSTS

As explained in chapter 4.2.1 of this article, marketing is very important for the success of crowdfunding campaigns. Although many project owners tend to do the marketing of the project on their own, if there are bigger goals one needs to think about hiring a professional marketing expert to take charge of determining a strategy, creating a promotional video, booking advertisements, etc.

The costs of marketing services are hard to determine since they will depend on the scope of the services included and the prestige of the marketing agency that has been hired. However, according to the estimate of one American digital marketing agency, costs for marketing efforts are estimated at 15,000 dollars (Command Partners, 2016).

5.3 COMPARISON WITH BANK LOANS

Since all information is not shown on banks' websites, in order to arrive at the costs that banks usually charge for personal and entrepreneurial loans, for the purpose of this research, an inquiry was sent to all banks in Croatia requesting information on the interest rates and additional costs that are charged in the case of a loan in the amount of about 10,000 euros with a repayment time of 3 years. The amount of the loan has been chosen based on the fact that in 2015 the average amount that was asked for by Croatian project owners on foreign crowdfunding platforms was 10,000 dollars (Hafner, 2016). Out of 27 credit institutions in Croatia that were sent the inquiry, a response was received from 6 of them. Only 2 responses included the numerical information about the interest rates and incurred costs while other banks replied in standardized form that all the available information can be found on their website and/or that each request is processed individually and therefore the exact calculation may vary.

By comparing the received information with the available information on the websites of banks in Croatia, it can be concluded that entrepreneurial loans are usually issued with an interest rate of 7-8.5% and an administrative charge of 1% of the claimed amount. It is also to be noted that in certain cases other costs (like public notary's costs) may be incurred. In order to better show the sum of costs that arises on an entrepreneurial bank loan of 10,000 euros, we show them in the table below, calculated with the repayment period of 3 years. Again, for the purpose of calculation, the lowest interest rate is used.

Table 2

Estimated costs of bank loan on the example of 10,000 euros

Repayment time	Interest rate percentage	Interest amount in EUR (A)*	Administrative charges percentage	Administrative charges amount in EUR (B)	Total in EUR (A+B)
3 years	7	1,431.55	1	100	1,531.55

**Based on annuity repayment.*

Source: Calculation of the author, Veneto banka d.d., Sberbank d.d.

If the costs of bank loans are compared with the costs of crowdfunding, it can be concluded that the total costs of a bank loan go beyond the costs of a crowdfunding platform. However, it is to be noted that hiring an external marketing expert in crowdfunding campaigns significantly increases the costs of crowdfunding pushing them far beyond the costs of bank loans.

It seems that banks have already recognized the competitive potential of crowdfunding so some of them have started to get shares in crowdfunding platforms. One such example is the case of Berliner Volksbank that in 2013 acquired a share in the German crowdinvesting platform Bergfürst. The experts that participated in the study of St. Gallen University on the development of crowdfunding predict that by the year 2020 10% of banks in the German-speaking area will actively cooperate with crowdfunding platforms and that 5% of them will have their own crowdfunding platforms (Blohm et alia, 2015).

5.4 COMPARISON WITH CAPITAL MARKETS

Analysis of the costs that may occur when raising money in capital markets would require extensive analyses of the clearing company charges, regulated market fees, financial intermediaries' rates, administrative fees and so on that go beyond the framework of this research. Therefore, in order to show the costs that arise, the data from some of the prospectuses that have been published in Croatia in 2015 have been used to analyse these costs, more specifically ones that had a clear indication of the amount of the funds that have been raised and a clear presentation of the costs. The texts of prospectuses have been derived from the list of approved prospectuses that can be found on the website of the Croatian Financial Services Supervisory Agency (Hanfa, 2016). These costs are shown in the table below.

Table 3

Costs of raising money in capital markets with example of some issues of securities from 2015

Issuer	Funds raised in millions of HRK	Date of prospectus approval	Amount of costs in millions of HRK	Costs as percentage of funds raised
Hrvatska poštanska banka d.d.	550	30.10.2015	6.2	1.13
Tankerska next generation d.d.	104.3	16.10.2015	1.2	1.15
Podravka d.d.	Up to 510	19.6.2015	4	0.78
Luka Rijeka d.d.	300	19.6.2015	2.3	0.77
Petrokemija d.d.	253.04	6.3.2015	0.9	0.36
Granolio d.d.	94.02	27.2.2015	2	2.13
HTP Korčula d.d.	Up to 66.02	13.2.2015	0.23	0.35
Tankerska next generation d.d.	app. 241.1	16.1.2015	app. 7.3	3.03
Average				1.21

Source: Calculation of the author, Croatian Financial Services Supervisory Agency.

It should be noted that it is hard to compare the cost of crowdfunding with the costs of raising money in capital markets since crowdfunding has usually been used by Croatians in order to collect smaller amounts of money (average 10,000 dollars as stated in Hafner, 2016), whereas the prospectuses used in this research served to raise considerable funds (as seen in table 3). However, when the average percentage of costs in capital markets (1.21%) is compared to the percentage of costs that crowdfunding platforms charge (3.75% and more as showed in paragraph 5.1. of this article), it can be concluded that the costs of crowdfunding are significantly higher. Still, it has to be taken into account that costs in capital markets are based on economy of scale. Only some of the fixed costs that appear in the issuing of securities, such as a fee for the approval of prospectus that is to be paid to the Croatian Financial Services Supervisory Agency (according to article 4, paragraph 2 of Regulation on the type and amount of fees and administrative charges of the Croatian Financial Services Supervisory Agency) amounts to almost 4,000 euros which goes beyond all the stated costs on the crowdfunding example from chapter 5.1 of this article.

6 CONCLUSION

All types of crowdfunding can be categorized under certain existing law institutes as elaborated upon in chapter 2 of this article. Therefore, no new laws specifically to regulate crowdfunding are needed.

It has to be taken into account that the countries that undertook legislative actions concerning crowdfunding aimed them mostly at crowdlending and crowdinvesting and not on the other types of crowdfunding. In these countries a smaller offer of securities already constituted a need to publish a prospectus and the new legis-

lation first of all aimed to allow securities offer without burdensome prospectus regime for higher amounts as well. In Croatia, the threshold that triggers the obligation to publish a prospectus is set to more than 5,000,000 euros and as crowdfunding campaigns usually have goals far below this amount, they are not affected by prospectus regulation.

When compared with other sources of financing, crowdfunding offers numerous advantages such as a wider scope of potential investors, simple processing, market sounding, networking and the possibility to gain input from the crowd. In terms of basic costs it also proves to be more affordable than bank loans. It can be hardly compared with capital markets since they usually serve to collect significant means and their costs are based on the economy of scale. Therefore some fixed costs in capital markets go far beyond the costs of a usual crowdfunding campaign, although the percentage of costs in the funds raised seems to be much lower in capital markets.

However, when compared with other sources of financing, crowdfunding in order to be successful requires significant marketing efforts. If a project owner does not possess the skills and experience in marketing, he or she has to reckon with additional costs of external marketing experts that can seriously raise the costs of a campaign and make it more expensive than other sources of financing. Therefore, crowdfunding cannot totally replace existing sources of financing.

Still, the examples presented through this article show that crowdfunding has been mostly used to finance creative projects that have problems with traditional funding. Therefore, it should be seen as a supplement to the existing financing models, and can be used when these models fail. It seems that banks have also recognized crowdfunding as a profitable alternative so some of them have started to achieve gains by actively supporting crowdfunding platforms.

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Fiscal federalism 2016
Making decentralisation work

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The OECD's *Fiscal Federalism 2016 – Making Decentralisation Work* analyses in which institutional frameworks and to what extent fiscal autonomy of sub-central governments (hereinafter: SCGs) is desirable and possible on both the expenditure and the revenue sides. The book is the latest publication by Fiscal Federalism Network, created in 2004 with the aim of providing OECD countries with analytical and statistical support and facilitating decision-making in the organization of fiscal relations across levels of government. Each of the six accessible and easy-to-read chapters abounds with case studies and cross-country analyses, consistently with the purpose of the book – to analyse and propose reform options for intergovernmental fiscal frameworks and sub-central public finance.

What is the extent to which SCGs are given autonomy? The first chapter provides an overview of *fiscal decentralization and intergovernmental fiscal reforms in OECD countries*. It is emphasized that standard fiscal indicators – such as sub-central spending and revenue shares or the size and composition of intergovernmental grants – are insufficient for an assessment of the multidimensional concept of fiscal decentralization. This is why a proposal to use the new, institutional indicators – such as tax autonomy, spending power or intergovernmental grant conditionality – can be seen as a completely new approach to the assessment of fiscal decentralization. While standard indicators are based solely on the fiscal capacities of SCGs, new indicators are defined by their institutional capacities and relations with upper-tier government. This makes particular sense in countries where tastes, preferences and attitudes towards the public sector vary according to jurisdictions.

Fiscal rules and frameworks are concerned with how historical turning points can create the basis for constitutional reform options in today's environment. Although constitutional set-ups vary widely from one country to another, all differences can be reduced to a single dimension – the level of constitutional decentralization, within which three types of federation are distinguished: decentralized, integrated and (somewhere in-between) quasi-decentralized. This chapter contributes to the understanding of intergovernmental relations and fiscal decentralization by emphasizing the need for coherence of fiscal constitutions – for example, how much spending autonomy matches tax autonomy or whether fiscal rules are aligned with the fiscal responsibility of state and local governments. Although fiscal constitution is a country-specific term, some common elements are highlighted on the path toward greater coherence, which should be useful to policy makers in the implementation of constitutional or other policy reforms.

Chapter 3 addresses *the opportunities and challenges of property taxation* as a typical local tax. Since upper-tier governments determine the tax base, any reform of property tax regimes must therefore be tied to reforms of intergovernmental fiscal frameworks. That is why part of this chapter is about a property tax that is revenue neutral, which requires amendments to both spending and taxation across all tiers of government. Although in most OECD countries, since 2008, property tax as a share of sub-central tax has begun to rise again, due to different fiscal

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constitutions, frameworks and rules, the chapter concludes that property tax reform is deeply country-specific and must be carefully implemented to fit specific circumstances. Therefore, it is a great challenge to find common elements of reform options for all OECD countries, especially considering different constitutional settings in unitary and federal governments.

Taxes or grants: which revenue source for sub-central governments? SCGs are trying to establish a balance between own taxes and intergovernmental transfers, which is conditioned by decisions at all levels of government. Although the importance of own sources of funding is clear, the chapter also states that intergovernmental grants still have a role to play, as they can help reduce differences in tax raising capacity or inter-jurisdictional externalities. However, for that purpose they would have to be around half of their current size. First, if the fiscal autonomy and spending power of SCGs (and thus own tax revenues) increase, the role of intergovernmental grants becomes less important. Grants do not give SCGs much freedom to decide on their spending levels. Second, unlike grants, own taxes increase government accountability and may affect citizens' greater involvement in budget processes. This is because most grants are earmarked for specific purposes and citizens have no impact on the allocation of these funds. Third, reliance on grants affects SCGs' sustainability as, unlike own taxes, grants tend to ease the budget constraint and lead to overspending.

Chapter 5 discusses a very important topic in the context of fiscal decentralization – *monitoring SCG borrowing*. It explores and analyses how different SCG borrowing mechanisms work in OECD countries. Among other things, the most discussed are fiscal rules and direct control by higher levels of government. The chapter is permeated with useful examples of completed and started fiscal reforms and expenditure and debt restrictions. Also, one box is devoted to the effects of bailout expectations – a situation of economic stress when SCGs may expect central governments to bail them out with additional resources, which again points to the importance of the adequate establishment and management of intergovernmental fiscal relations.

Finally, the last chapter presents the definition, scope and preliminary results of a pilot study on *the extent to which SCGs enjoy autonomy in the design of public services*. The chapter provides evidence of the limited power of SCGs over their own spending that could have negative effects on public service efficiency. The study was carried out in a five countries[1] in 2009 and has resulted in the introduction of a new SCG spending power indicator. Since the spending power of SCGs is largely determined by the legal frameworks, rules and regulations of the upper tier government, the new indicator takes into account different categories of autonomy, which should explain the extent of control that SCGs exert over the

[1] Of the five countries taken in the pilot study, Germany and Switzerland are federal and Denmark, Portugal and the Slovak Republic are unitary.

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budget. The main findings show that spending power varies across countries and services and is often shared. However, the final indicator seems not yet to have been determined, although the results of the pilot study and its possible application to more countries in future studies can only contribute to the re-design of individual elements of spending responsibility across all tiers of government. In that sense, this chapter makes the biggest contribution of the entire book.

In general, the book is very well structured, divided into six, clearly presented chapters. Though the chapter contents can act as separate stories, what pervades each of them is the importance of adequate fiscal constitutions so that relations between central and sub-central governments can support fiscal decentralization and the autonomy of SCGs. In this book, the reader is confronted with the compilation of some of the most salient policy issues in fiscal federalism, where many examples illustrate the current fiscal policies, but also the policy reform options. For example, chapter 3 provides guidelines for reforming the tax on immovable property that can contribute to a strategic shift away from taxation of labour towards less distorting taxes.

Compared to the previous edition of fiscal federalism – OECD (2013) where the main contribution was the guidelines for fiscal reform based on the set of country case studies in Blöchliger and Vammalle (2012) – this book seems to be much more specific in developing a new institutional indicator for measuring the spending power of SCGs. Although the spending power indicator tree is applied to only the five countries in the pilot study, application to a number of countries would probably help re-design the assignment of spending responsibility at all levels of government. Therefore, the book is mandatory reading for all policy makers and is also useful for individuals, civil society groups, professional associations and the private sector. The book should also be of particular interest to all citizens concerned with their local community in order to get acquainted with legal possibilities and constraints and the possibilities of engaging in decision-making processes at the local level.

Although budget transparency and public participation are mentioned in certain parts of some chapters (e.g. chapter 5 on transparency and chapter 4 on civic engagement), the impression remains that much more devotion should have been made to this topic. In order for public finances to become more efficient, equitable and sustainable, greater government accountability and citizens' trust are needed. Due to this, local budget transparency can serve as the basis and the first step for direct public participation in budget processes in order for a more efficient resource allocation to be achieved. For if citizens are satisfied with the services they receive, the level of autonomy, intergovernmental relations and spending power remain at the level of concept.

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