NBP Narodowy Bank Polski

NBP Working Paper No. 269

Fiscal devaluation and economic activity in the EU

Piotr Ciżkowicz, Bartosz Radzikowski,
Andrzej Rzońca, Wiktor Wojciechowski

NBP Working Paper No. 269

Fiscal devaluation and economic activity in the EU

Piotr Ciżkowicz, Bartosz Radzikowski, Andrzej Rzońca, Wiktor Wojciechowski

Economic Research Department
Warsaw, 2017

Piotr Ciżkowicz – Warsaw School of Economics; pcizko@sgh.waw.pl
Bartosz Radzikowski – Center for Social and Economic Research; radzikowski.bartosz@gmail.com
Andrzej Rzońca – Warsaw School of Economics; andrzej.rzonca@gmail.com
Wiktor Wojciechowski – Warsaw School of Economics; wiktor.wojciechowski@sgh.waw.pl

Acknowledgements
We would like to thank participants of the 9th RCEA Macro-Money-Finance Workshop: Monetary and Fiscal Policy in the Next Recession for comments of the earlier draft of this paper.
The authors are grateful for the financial support of this research by Narodowy Bank Polski under the research grant program "VII konkurs NBP na projekty badawcze". None of the views expressed or conclusions drawn herein reflect those of Narodowy Bank Polski.

Published by:
Narodowy Bank Polski
Education & Publishing Department
ul. Świętokrzyska 11/21
00-919 Warszawa, Poland
www.nbp.pl

ISSN 2084-624X

Contents

Abstract

In the aftermath of the global financial crisis, a fiscal devaluation (hereafter: FD), understood as a shift in taxation from labor to consumption, has been debated as a possible tool of restoring competitiveness in peripheral countries of the Euro area. We contribute to this debate. Based on a set of panel and spatial panel models for the EU 27 over the period 1995 – 2014, we find that FD increases value added in exports, improves net exports, accelerates GDP and employment growth, and decelerates labour costs growth. These effects are nonlinear: stronger in the members of the Euro area and weaker in countries with either more coordinated or more centralised wage bargaining process, or more generous unemployment benefits. Most importantly, FD turns out not to be a beggar thy neighbour policy, at least in the EU. In our sample 'cooperative effect' of unilateral FD, which is beneficial for neighbouring countries, dominates by far 'competitive effect', which goes at the expense of other countries' competitiveness. Admittedly, FD implemented in one country can benefit other countries, provided that they are strongly integrated in global value chains. These findings are robust to changes in the estimation methods, the sample composition, the set of explanatory variables and the selection of a spatial weight matrix.

JEL Classification: C30, C33, E62, E63, E65, H30, H60, J32, J51

Keywords: fiscal devaluation, fiscal policy, tax structure, economic growth, labor market institutions, panel data models, spatial panel data models

1. Introduction

Brexit can be considered the turning point for the European Union (EU). It encourages to argue that either political leaders decide to deepen the European integration, or the EU project may collapse in the aftermath of next severe shocks because of its limited ability to adjust to such shocks. In particular, members of the Euro area can be perceived prone to shocks as they have no shock absorber as efficient as a free float. If they are affected by adverse shocks that call for lower wages relative to other countries, they cannot adjust through a change in one price, i.e. the exchange rate, but have to go through changes in thousands of thousands of wages, which is by far more difficult (see, e.g. Friedman, 1997). Abandonment of free float is often blamed for high unemployment which nine years after the outburst of the global financial crisis (GFC) still exceeds 20% in country such as Greece.

That said, the role of shock absorber may be played by a fiscal devaluation (hereafter: FD). There is a broad theoretical literature on the topic (see, e.g. Annicchiarico et al., 2014; EC, 2013; Engler et al., 2017; Fahri et al., 2014; Gomes et al., 2013; Hohberger and Kraus, 2015; Langot et al., 2012; Orsini et al., 2015; Pereira et al., 2014). The idea of FD is rooted in considerations by Keynes (1931), where he suggested that a combination of import tariffs and export subsidies could mimic the effects of exchange rate devaluation by causing import prices to increase and export prices to decrease. Nowadays, similar effects can be induced by fiscal policy measures: a cut of social security contribution paid by employers (hereafter: ESSC) and a rise in value added tax (hereafter: VAT). Provided that lower labour costs due to cut in ESSC are passed through into final prices, prices of domestic goods fall relative to import prices. The considered policy can be budget-neutral if the reduction in ESSC is entirely financed by the simultaneous VAT increase. While the latter affects imports, it has no effect on exports, as VAT is a destination-based tax. A combination of both tax changes enhances price competitiveness of domestic goods, while it dampens a demand for imports, at least in the short term, until wages adjust (see, e.g. Koske, 2013).

Moreover, the FD concept recalls a discussion on an age-old question of direct versus indirect taxation and the relationship of these taxes to economic growth and income inequality. Clearly, FD is in line with a growth-enhancing tax policy, based on the argument that VAT has less adverse effects on output than direct taxes levied on labour, including ESSC (see, e.g. OECD, 2008); however positive effects are more pronounced in a longer perspective (see, e.g. Baiardi et. al., 2017) On the other hand, based on Atkinson–Stiglitz theorem, greater reliance on labour taxes relative to consumption taxes reduces income inequality (Iosifidi and Mylonidis, 2017).

FD is not only a theoretical peculiarity. The European Commission recommended such a tax shift, inter alia, to Belgium, France, Italy, Latvia and Spain in 2011-2014. The Troika made its rescue program for

Portugal in 2012 conditional on implementing FD (see, e.g. Puglisi, 2014). In Spain and France the concept of FD was a subject of political debate (see, e.g. Garnier et al., 2014). Spain resonates a message that it is possible to reform countries' way out of an economic crisis, even within single currency regime: *We are the first population-rich country that embarked on a large-scale depreciation within a currency union*. [1] All in all, one can identify 33 episodes of FD[2] in the EU countries in the period 1995 – 2014. Interestingly, these episodes occurred mostly in the New Member States that have been thus far uncovered by empirical research.

While there are many theoretical papers on FD, the empirical literature on the topic is much less developed (see, e.g. Bosca et al, 2013; Franco, 2013; de Mooij and Keen, 2012). We add to this empirical literature.

Our sample covers the EU 27 countries[3] over the period 1995 – 2014. We estimate a set of panel and spatial panel data models of selected macro variables such as value added in export, net exports, GDP, employment and labour costs growth. We consider factors that according to the theoretical literature may lead to non-linearities in FD effects. We apply the approach by LeSage and Pace (2009) in order to correctly interpret spatial effects.

The paper makes four main contributions to the empirical literature on the topic:

Firstly, our sample includes the new EU member states where thus far effects of FD have been hardly researched.

Secondly, we analyse the impact of FD not only on export performance, that other empirical studies deal with[4], but also on a broader set of variables, including: GDP, employment and labour compensation per employee. Furthermore, in studying the impact of FD on export performance, we focus on domestic value added in gross export, which we find a more accurate indicator of export performance than net exports used in other papers. The indicator is less prone to problems such as inflated transfer prices. It is also not distorted, unlike net exports, by spill-overs from export activity to domestic demand and imports.

Thirdly, we consider factors that according to the theoretical literature matter for a magnitude and a persistence of FD effects. Other empirical papers do not analyse these factors, except for exchange rate

[1] Alvaro Nadal - main economic adviser to Mariano Rajo [in:] Pauly C. (2015)
[2] A change of ESSC to VAT ratio, expressed in percentage of GDP, at least by one standard deviation (0,086) within one year or two standard deviations (0,172) within two consecutive years.
[3] We omit Denmark because it finances social benefits mostly from PIT revenues.
[4] See Section 3 for the analysis of related literature.

regimes. In particular, we analyse an impact pf trade openness and some labour market institutions: features of wage bargaining process and generosity of unemployment benefits for FD effects.

Fourthly, we use spatial panel data models. They allow us to verify whether indeed unilateral FD is a beggar thy neighbour policy, which is suggested by theoretical literature on the topic. Other empirical papers leave this problem unaddressed.

Our main findings are as follows:

Firstly, FD increases value added in exports and improves net exports. It accelerates GDP and employment growth. It decelerates growth of labour compensation per employee.

Secondly, effects of FD are non-linear. They are stronger in the members of the Euro area. By contrast, they are weaker in the countries either with more coordinated or centralised wage bargaining process or with higher unemployment benefits.

Thirdly, it follows from spatial effects analysis that FD is not beggar thy neighbour policy, at least in the EU. 'Cooperative effect' of unilateral FD, which is beneficial for neighbouring countries, dominates by far in our sample 'competitive effect', which goes at the expense of other countries' competitiveness. Admittedly, FD implemented in one country can benefit other countries, provided that they are strongly integrated in global value chains.

The findings are robust to changes in the estimation methods, the sample composition, the set of explanatory variables and the selection of a spatial weight matrix.

The remainder of the paper is organized as follows. The section two describes main mechanisms which FD operates through. The section three reviews related literature. It pays special attention to non-linearities of FD effects. The section four presents the data under study and briefly overviews stylized facts on FD in the EU countries. The section five discusses the estimation strategy and compares it with strategies used in most other studies on the topic. The section six presents results of econometric modelling and elaborates on their economic implications and policy conclusions. The section seven verifies the results' robustness. The section eight concludes.

2. Fiscal devaluation mechanism

FD is a tax policy dedicated to restoring price competitiveness in countries that are unable to devaluate their currencies. Clearly, the idea makes use of fiscal policy instruments to induce a similar effect to a nominal devaluation. Going into details, it assumes the reduction of labour costs, usually ESSC, in order to make domestic goods more price competitive, while offsetting fiscal costs of the reduction by an increase in the VAT revenue and thereby avoiding an increase in sovereign debt (Scheme 1 below).

The first measure, i.e. a cut in ESSC, reduces labour costs. If lower labour costs are passed through into good prices, domestic production becomes more price competitive, which in turn, increases exports and reduces imports.

The second measure, that is a rise in VAT, keeps budget balance unchanged. However, it leads to an increase in consumer prices (of both domestically produced and imported goods), which reduces a households' purchasing power. The lower real wages decrease private consumption. Since an increase in domestic prices is partially offset by lower production costs (due to the ESSC's reduction), households have an incentive to substitute imports with the domestic goods. Hence, imports decrease.

Thus, direct effect of FD is twofold. Lower ESSC increases price competitiveness of domestic goods, while higher VAT reduces demand for imports. In effect, exports become cheaper abroad and imports more expensive at home, contributing to a net exports' improvement, while keeping budget balance unchanged.

FD induces some indirect effects (second-round effects), too. A growth of export causes an increase in domestic output, which entails demand for labour and nudges nominal wages to increase. Simultaneously, lower private consumption provokes labour supply to increase, provided that the labour supply is sufficiently flexible. The growth of labour supply softens pressure on nominal wages' increase. While the increases in labour demand and labour supply affect nominal wages in the opposite directions, they both lead to an increase in employment and output. Lastly, an improvement in net exports contributes to an appreciation of the exchange rate.

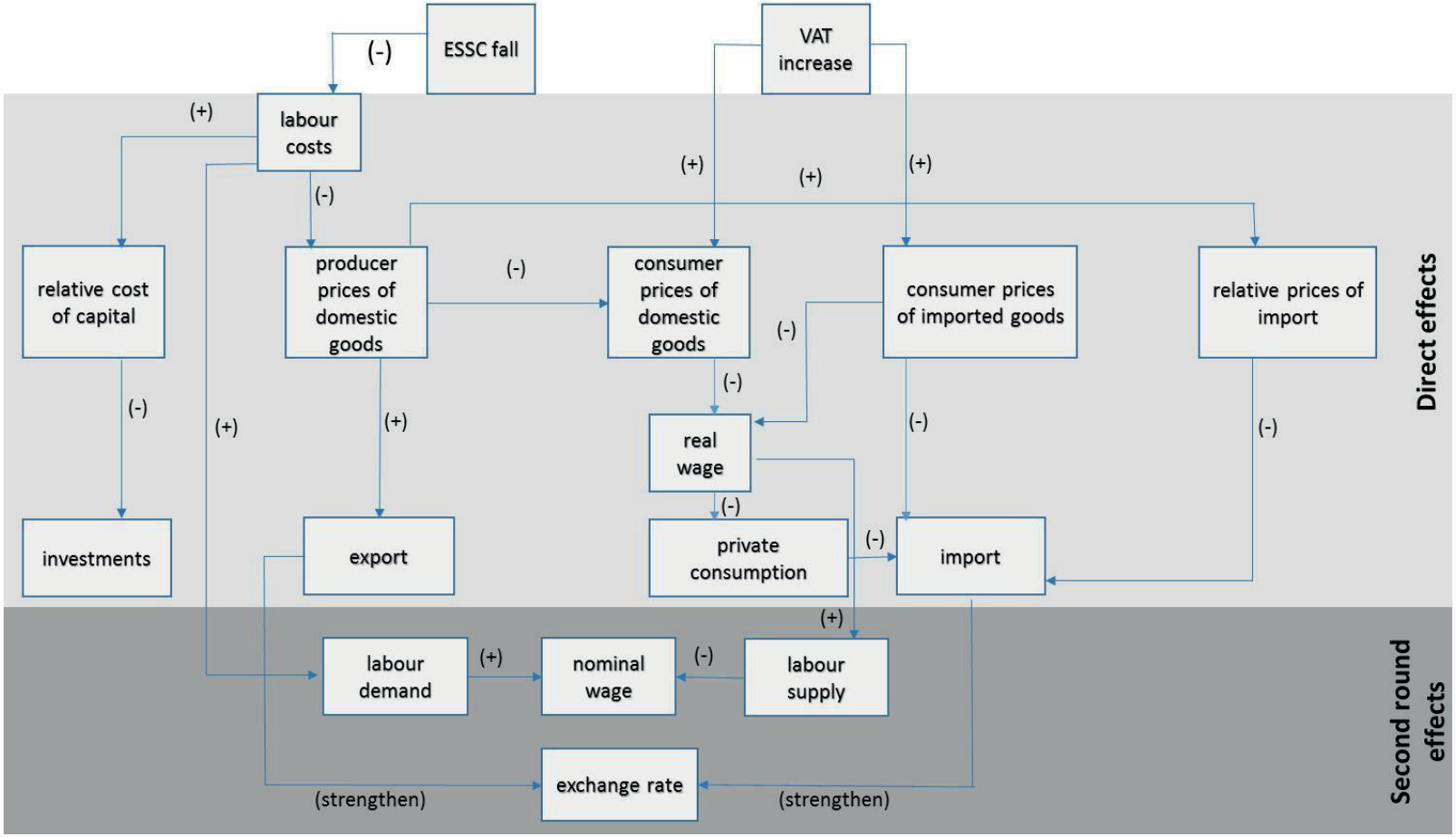
At this point it has been underlined that a magnitude and persistence of effects caused by FD for strengthening economic momentum depends heavily on adjustment processes on the labour market regarding nominal wage developments (direct effects) and income elasticity of labour supply (second-round effects).

As far as the first-round effects are concerned, a likely increase in retail prices caused by a raise of consumption taxes may induce workers to expect rises of nominal wages necessary to maintain their real

income level. A low speed or a limited scope of nominal wage adjustments following VAT increases can significantly amplify a magnitude of FD's effects for advancing economic activity. On the contrary, the faster and larger are nominal wage increases triggered by higher consumption taxes, the weaker and more short-lived are FD's implications. The discussed wage developments result from nominal or real wage rigidities. Although an issue of wage rigidities is frequently used in the literature, many studies do not provide a clear explanation how they are defined, especially whether they deal with upward or downward wage adjustments. For analysing effects of fiscal devaluation, it would be useful to distinguish upward nominal wage rigidity and downward real wage rigidity. High upward nominal wage rigidity implicates that workers accept their current nominal salaries despite observed price increases that lower their real income level. Similarly, low downward real wage rigidity indicates that workers accept a fall of their real wages caused by higher consumption tax and are unwilling to demand nominal pay rises to maintain real volume of consumption. Both wage rigidities can by determined by current or expected situation on the labour market (e.g. unemployment level), wage-setting institutions and regulations or policies that strengthen workers' position in wage bargaining process.

Turning to the second-round effects, a magnitude of FD's implications for economic activity can be hampered by low income elasticity of labour supply. Precisely, the weaker growth of households' labour supply induced by a fall of real incomes, the smaller rise of employment or the stronger wage pressure resulted from an increased labour demand induced by a cut of ESSC. Among factors determining income elasticity of labour supply one can point out a generosity of social transfers for which non-employed workers are eligible. An obvious example of these transfers are unemployment benefits.

Scheme 1: Channels of impact of a fiscal devaluation



Source: Own elaboration

3. Related literature

Related literature is twofold, if one applies a methodological framework used as the distinctive factor.

The first strand of literature includes majority of research on the topic. It is of theoretical nature and uses general equilibrium models, usually DSGE models calibrated on given country's data. It analyses FD as a shift from ESSC to VAT, mainly a reduction of revenue from ESSC by 1% of GDP and a simultaneous increase in VAT revenue of the same size. The discussed theoretical studies emphasize changes not only in net exports but also in other variables such as GDP, employment or effective exchange rate (see Table 1 and Table 5).

The findings from the theoretical literature point out that FD effects are nonlinear. It recalls the following mechanisms as those of crucial importance for FD effects:

i. FD requires an upward nominal wage rigidity. It assumes that households are not able to negotiate upward wage adjustment immediately, in reaction to a VAT increase (see, e.g. Bosca et al., 2013; EC, 2013; Engler et al., 2017; Fahri et al., 2014; Langot et al., 2014; Lipinska and von Thadden, 2012). Otherwise, a downward real wage rigidity triggers a nominal wage pressure weakening the effects of a fiscal devaluation.

ii. High wage elasticity of labour supply allows a fast adjustment of labour to lower consumption – more workers become willing to negotiate more hours for the same wage (see, e.g. Bosca et al., 2013). Generous social benefits hamper this adjustment (see, e.g. Orsini et al., 2015 or Pereira et al., 2014).

iii. Possibly low nominal price stickiness is required for a reduction in ESSC to be passed through into final prices without delay (see, e.g. Alla, 2015; EC, 2013; Engler et al., 2017; Gomes et al., 2013). If prices do not respond to changes in taxes, then effects of FD are blocked (see, e.g. Puglisi, 2014).

iv. FD has stronger effects in countries with a peg or in members of a monetary union than in countries with a free float where an appreciation of the nominal exchange rate (due to the

increased demand for exports and dampened demand for imports) reduces gains in price competitiveness (see, e.g. de Mooij and Keen, 2012 or Fahri et al., 2014).

v. The conclusions on spatial effects are partly ambiguous. Unilateral FD is considered more beneficial from a one country perspective, since its effects are not weakened (or, still worse, offset) by changes in taxes in neighbouring countries (see, e.g. Engler et al., 2017 or Gomes et al., 2013). If implemented multilaterally, FD could still improve the country's external position, although to a lesser extent. However, when the aim is to improve economic conditions in a monetary union as a whole, a broad FD is required (see, e.g. EC, 2013).

vi. FD has stronger effects in the short term than in the medium term. The more open the economy, the more clear the difference between the short and the medium term (see, e.g. Engler et al., 2017 or Koske, 2013). However, net exports may react according to a J-curve (with an initial trade balance deficit), in particular if the wealth effect (related to encouragement of firms by reduced ESSC to increase labour input) is sufficiently strong (see, e.g. Langot et al., 2012).

vii. Communication matters too for FD effects. First, if a VAT increase is anticipated, households advance their consumption, imports including (see, e.g. Franco, 2013 or Lipinska and von Thadden, 2012). Second, if the increase is considered temporary, the households have incentive to delay purchases (see, e.g. Bosca et al., 2013; EC, 2013; Franco, 2013).

viii. Effects of FD also depend on initial tax rates that affect incidence of tax avoidance or evasion (see, e.g. Bosca et al., 2013 or Koske, 2013).

ix. With regard to FD effects in the long run, the literature is rather inconclusive. According to some papers, FD is conducive to growth even in the long run because it results in less distortionary tax structure (see, e.g. Bosca et al., 2013; EC, 2013; Engler et al., 2017; Pereira et al., 2014). However, some authors suggest that FD effects disappear in the long

run due to wage adjustments (see, e.g. Annicchiarico et al., 2014; Correia, 2011; de Mooij and Keen, 2012; Koske, 2013).

The second strand of literature is much less developed. It is of empirical nature and applies various econometric methods. It focuses on a one country (see, e.g. Franco, 2013), the UE-15 (see, e.g. Bosca et al., 2013) or the OECD countries (see, e.g. de Mooij and Keen, 2012). It usually analyses an impact on net exports of tax changes in line with FD but separately for ESSC and VAT. (see Table 2). The studies agree on positive effects of FD on price competitiveness and find them particularly strong in members of a monetary union (see, e.g. Bosca et al., 2013; de Mooij and Keen, 2012).

However, the empirical research leaves unaddressed many issues raised in theoretical papers. Firstly, they exclusively study export performance. Consequently, they do not deal with GDP or employment growth. Secondly, they do not analyse factors that may affect a magnitude and durability of FD effects, except for exchange rate regime. Thirdly, they do not study spatial effects of FD on neighbouring countries. However, ignoring these effects can distort a picture of FD from the EU perspective. Theoretical literature points to a higher effectiveness of unilateral FD than multilateral one arguing that improvement in competitiveness of one country has to translate into a loss in competitiveness of other countries. However, this mechanism is hardly the only one that may cause spatial effects. These effects should be thus carefully studied.

4. Data and stylized facts

4.1 Data

Our sample covers the 27 EU countries over the years 1995 - 2014. It excludes Denmark because revenue from ESSC is almost non-existent in this country and changes of ESSC is a pillar of FD concept. For the whole period covered by our database, ESSC in Denmark amounted on average to only 0.1% of GDP (in comparison with 6,3% of GDP for the entire sample), and for eight years it was zero.[5]

To measure FD, we use a ratio of revenue from ESSC to revenue from VAT, as Bosca et al. (2013) proposed. We use the variable either as a non-cyclically adjusted (FD_{it}) or cyclically adjusted ($Cyclical\_\ FD_{it}$) ratios. We filter out cyclical component, applying EC (2014) methodology.[6] The data comes from the Eurostat and EC AMECO. They range from 0.22 to 2.17 for the former and from 0.22 to 2.13 for the latter ratio. In robustness check analysis, we follow the alternative approach to measure FD, used in the literature (see, e.g. Franco, 2013 or de Mooij and Keen, 2012). Namely, we use separate variables for revenue from ESSC and VAT respectively (expressed in percentage of GDP).

Since we analyse effects of FD not only on export performance, but on economic activity more broadly understood, we use five different dependent variables in the models.

We start with value-added exports (VAX_{it}). By using VAX, we address two distinct challenges arising from conventional trade data used in FD analysis. The first challenge is of measurement nature and is related to a double-counting. This challenge is the effect of using the gross value of goods at each border crossing, rather than the net value added between border crossings, which overstates the domestic content. The problem is aggravated by the development of multi-

[5] Employers in Denmark pay a number of minor contributions (ATP, AER, AES, LG etc), amounting to approximately DKK 8-10 ths per employee per year (EUR 1072-1340). Moreover, unlike in most other countries, there is no mandatory unemployment insurance in Denmark and employee can decide whether to take out such an insurance or not. Thus the burden of social benefits is financed mainly from income taxes, the rates of PIT are approx. 41% and 56%. In effect, despite the tax wedge in Denmark being close to the OECD average, it consists almost entirely of income taxes.

[6] By filtering revenues for cyclical effects, we correct for one important source of endogeneity in the independent variable - common shocks affecting tax bases.

country production. Global value chains imply that more and more intermediates go to their final destination indirectly. VAX controls for this effect by combining input-output tables and bilateral trade data for many countries (see, e.g. Johnson and Noguera, 2012). The second problem is of economic nature. Net export which is used in most other empirical papers (see, e.g. Franco, 2013 or de Mooij and Keen, 2012) may be blurred by spill overs from export activity to domestic demand and, finally, imports. VAX is free of such distortions. To cover the whole period under consideration, we combine the data sets from two World Input-Output Database tables (for the years 1995 – 2010 and 2010 – 2014 respectively).

To allow comparisons of our results with those from other empirical studies, we examine effects of FD on net exports (NX_{it}). We take the data from the Eurostat.

The next three dependent variables are selected to test the findings from the theoretical papers. They point to significant positive effects of FD on output and employment growth triggered by a fall in labour costs. Hence, we consider GDP (GDP_{it}), employment ($EMPL_{it}$) and labour costs per employee ($WAGE_{it}$) growth. We take the data on GDP and employment growth from Eurostat, while the data on labour costs per employee comes from OECD.

To analyze factors that according to theoretical literature may affect magnitude and durability of FD effects, we consider, first, the membership in Euro area (*EURO*), defined as a binary variable, which assign the value of 1 to years of the membership of a given country in the monetary union and zero otherwise. Second, we take into account trade openness of an economy (*OPEN*). It is measured as a sum of exports and imports in relation to GDP. The data comes from the Eurostat. Lastly, we envisage some labour market institutions, which could affect wage rigidities or elasticity of labour supply. As our sample includes both the old and new EU members (OMS and NMS), i.e. advanced and emerging economies, we are heavily constrained in a selection of relevant institutional variables by data availability. Specifically, we select only those institutional variables that are consistent and comparable for all EU countries and cover the longest time span.

The existing empirical literature points that downward real wage rigidity is positively associated with high collective bargaining coverage and a degree of wage bargaining centralization (e.g. Babetký et al., 2010; Messina et al., 2010). The results suggest that features of wage bargaining significantly determine strength at which FD affects wage adjustments and thus

macroeconomic performance. As a relevant measure describing workers' strength in wage negotiation we use centralisation of wage bargaining index from J. Visser's ICTWSS (version 5.1) database updated in September 2016.

Besides wage bargaining institutions, also other policies and institutions, like tax wedge or generosity of unemployment benefits contribute to wage rigidity or responsiveness of employment to adverse economic shocks (e.g. Bertola and Rogerson, 1997; Bertola, 1999). Our study directly examines an impact of tax wedge on labor market and macroeconomic performance since FD involves a decrease of ESSC. As a measure of generosity of unemployment benefits we use net replacement rates for: (i) single workers (*NRR_single*) and (ii) one earner couple with two children (*NRR_couple*), earning an average salary in the economy. There is no single source of data on net unemployment replacement rates covering all EU countries for the whole period considered. Thus, we combine Vliet and Caminada database (Version 1.0 updated in January 2012) that covers the period 1995-2009 and OECD Tax and Benefit database including data from the year 2000 onwards.

A list of the additional explanatory variables is rather standardised in the cross-country literature (see e.g. Calderon et al., 2002 or Abbas et al., 2011). It includes cyclically adjusted primary balance ($CAPB_{it}$), output gap ($Output\ gap_{it}$), nominal effective exchange rate ($NEER_{it}$) and unemployment rate ($Unemp_{it}$). We take the data for the first two variables from EC AMECO. The data for the remaining two variables comes from the Eurostat.

Detailed definitions of all variables and their data sources are presented in the Table 6. It is followed by the descriptive statistics in the Table 7, both in the last section of this paper.

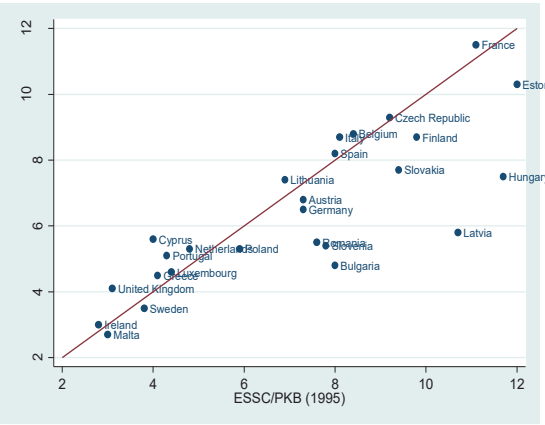
4.2 Stylized facts

One may draw the following stylized facts from the initial data inspection:

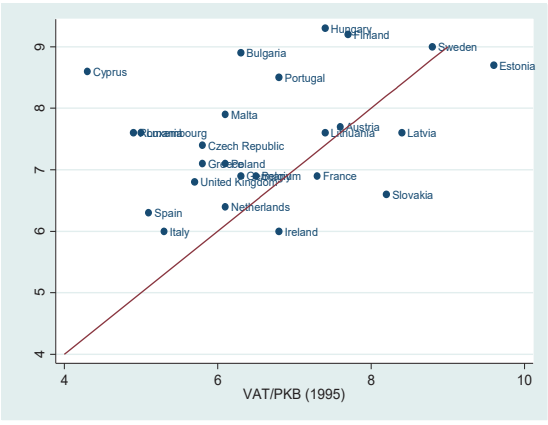
(i) In 1995-2014 the average revenue from ESSC was relatively stable among the OMS and amounted to 6.2% of GDP (Graph 1). By contrast, in the NMS it was gradually declining from 8.0% of GDP in 1995 to 6.4% of GDP. Among all analysed countries, it fell the most in Latvia, Hungary and Bulgaria (by more than 3% of GDP).

(ii) In 1995 the average revenue from VAT amounted to 6.5% of GDP in the OMS and 6.8% of GDP in the NMS. In the following years, it increased to 7.3% of GDP in the OMS and to 8.3% of GDP in the NMS. Its sharp decline in 2009 after the outburst of GFC, was very short lived. However, aggregate picture masks considerable differences across countries, in particular among the NMS (Graph 2). For example, while revenue from VAT surged in Cyprus (by 4.3% of GDP) or Bulgaria (by 2.6% of GDP), it fell in Slovakia (by 1.6% of GDP) or Latvia (by 0.8% of GDP).

Graph 1. Social security contribution paid by employers (ESSC/GDP) in EU countries in 1995 and 2014



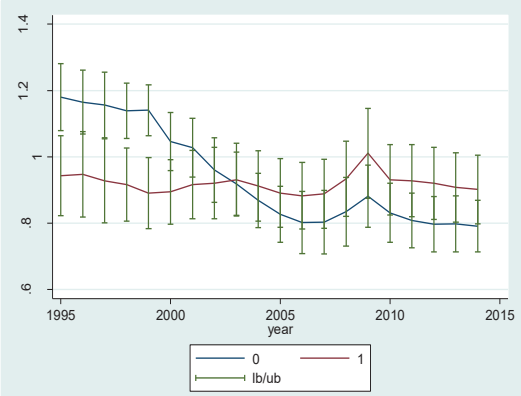
Graph 2. VAT revenues (% GDP) in EU countries in 1995 and 2014



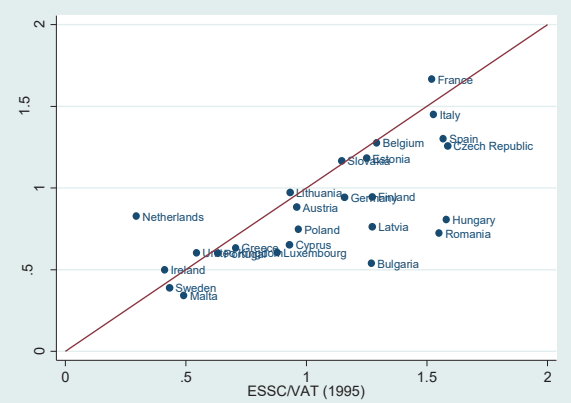
Source: own elaboration

(iii) In the NMS the average ratio of ESSC to VAT revenue declined from almost 1.2 in 1995 to 0.8 in 2014 (Graph 3). By contrast, in the OMS it was stable and amounted to 0.9 in the whole analysed period. That said, almost all countries under study experienced some FD (i.e. a fall of ESSC to VAT revenue ratio), although its size varied substantially (Graph 4). It was the largest in Romania, Hungary and Bulgaria.

Graph 3. An average ESSC/VAT ratio in old and new EU member states.



Graph 4. ESSC/VAT ratio changes in EU countries between 1995 and 2014



Source: own elaboration

(iv) It follows from a simple calculation of coefficients of pairwise correlation that FD was correlated with key dependent variables at high significance level and in line with the economic intuition (see Table 3). Precisely, FD was associated with a larger domestic value added in gross export, an improvement in net export, faster growth of GDP and employment, and slower growth of nominal compensation per employee.

(v) We identify 45 episodes of major changes in ESSC to VAT revenue ratio (see Table 8-10). We define them as periods during which the ratio shifts by at least one standard deviation of its annual changes (approx. 0.086) within one year or two standard deviations (approx. 0.172) within two consecutive years. We find 33 episodes of FD (a fall of ESSC to VAT revenue ratio) and 12 episodes of fiscal

revaluations (FR – a rise of ESSC to VAT revenue ratio). Note that we arbitrarily select the major changes of ESSC to VAT revenue ratio only for some descriptive analysis on how these changes affected key macroeconomic variables. In the pairwise correlation and panel econometric analysis we use all available data.

(vi) Major changes in ESSC to VAT revenue ratio occurred much frequently in the NMS (25 FD and 8 FR) than in the OMS (8 FD and 4 FR).

(vii) Almost all major FD were achieved by a fall of revenue from ESSC (28 out of the 33) and a simultaneous rise of revenue from VAT (31 out of the 33). The average fall of revenue from ESSC amounted to 0.6% GDP, and the average rise of revenue form VAT amounted to 0.8% GDP. Interesting exceptions are Latvia (1997) and Estonia (2011-2012) were FD resulted from a fall of revenue from both sources, but a fall of revenue from ESSC was larger than from VAT. Similarly, almost all major FR resulted from an increase of revenue from ESSC (by 0.53% GDP on average) accompanied by a decrease of revenue from VAT (by 0.69% GDP on average).

(viii) During majority of major FD (25 out of the 33 episodes) GDP growth accelerated (on average by 0.6 percentage point). In turn, major FR (11 out of the 12 episodes) were generally accompanied by slowdown of GDP growth (on average by 0.5 percentage point).

(ix) GDP growth accelerations during major FD were usually associated with employment growth accelerations (18 out of the 21 episodes of 'expansionary' FD[7]). Employment growth decelerated only in 2 out of the 8 episodes of major FD not accompanied by GDP growth accelerations, but in 11 out of the 12 episodes of major FR.

[7] In three episodes of expansionary fiscal devaluation we have not got data on employment growth rates. Other apparent inaccuracies between paragraphs in the number of episodes of a given type are also due to a lack of relevant data.

(x) An impact of major changes of ESSC to VAT revenue ratio on labour costs is not clear cut. During 12 out of the 17 episodes of major FD for which we have all relevant data, growth of labour compensation per employee decelerated, as expected. However, during 6 out of the 8 episodes of major FR (for which we have necessary data), it decelerated too. Apparently, it was more affected by an economic slowdown, common during FR, than by an increase in ESSC.

(xi) During 19 out of the 30 episodes of major FD a share of export in country's value added increased. By contrast, the minority of major FD (11 out of the 32) were accompanied by an improvement in net exports to GDP ratio. Possibly, GDP growth acceleration increased imports more than a fall in labour costs strengthened exports. In the case of major FR, almost all of them led to a drop in a share of export in countries' value added (9 out of the 12) and a worsening in net exports (11 out of the 12).

(xii) There were 7 episodes of 'contractionary' major FD and 1 episode of 'expansionary' major FR in our database. 'Contractionary' FD occurred in Cyprus (2000-2003), Romania (2005), Czech Republic (2008-2009), Slovakia (2011), three times in Hungary (2003-2004, 2009-2010 and 2012) and in Spain (2012-2014). The 'expansionary' FR occurred in Czech Republic in 2006. Note however that in Cyprus FD was accompanied by a positive output gap. In Romania FD was achieved in spite of an increase of revenue from ESSC (by 0,5% GDP), which was rare in other cases. Besides, both GDP and employment growth accelerated in the two years (2006-2007) following FD. In Hungary first FD was accompanied by a positive output gap and GDP growth accelerated with one year lag. The two another FD episodes in this country occurred directly after outburst of the GFC and sovereign debt crisis in the Euro Area and could hardly outweigh their adverse effects. As Hungary was among countries that had accumulated huge sovereign and private debt, it was severely hit by these crises (in 2009 it was forced to ask international organizations for financial assistance). Similar explanation applies to Spain. However, it is worth remarking that just a year after FD began in Spain, a recession in this country became shallower and two years later its economy re-

started to grow. GFC was also responsible for poor economic performance during FD in Czech Republic, while boom prior to the crisis' outburst had more than compensated for negative growth effects of previous FR. Lastly, in Slovakia FD was transient and followed by major FR that by 2013 pushed ESSC to VAT revenue ratio to the highest level since 2003.

(xiii) To check whether features of wage negotiation settings may indeed matter for effects of FD, we calculate correlation coefficients of ESSC to VAT revenue ratio and the dependent variables for all data in our sample and separately for all quartiles or quantiles of two variables characterising wage negotiation system (i.e. *cwb* and *level*). Then we perform a multivariate test of equality of correlation coefficients for each quartiles/quantiles of relevant variable[8] (see Table 11 and 12). It follows that along distribution of *cwb* and *level* the considered correlation coefficients were significantly different for the net export to GDP ratio, a share of export in value added and labour compensation per employee. They were also statistically different for GDP and employment growth along quantiles of *level*. The findings suggest that features of wage negotiation system may be a source of non-linearities in FD effects.

(xiv) We carry out the same exercise for the generosity of unemployment benefits. It follows that net replacement rates, either for single workers (see Table 13) or for couples with children (see Table 14), influenced correlation coefficients for employment growth, a share of export in value added and labour compensation per employee. Their impact on correlation coefficients for GDP growth and net export to GDP ratio is inconclusive. It was highly significant for replacement rates for couples, but not for single workers.

(xv) Similar analysis suggests that membership in the Euro area could affect strength at which FD influences a share of export in value added and labour compensation per

[8] Due to limited number of observation in our dataset we performed the equality test by quartiles of cwb. As variable *level* has discrete values from 1 to 5 we performed the test by quantiles.

employee (see Table 15). In turn a degree of countries' openness seems to matter for strength of FD effects on employment, export performance, and labour compensation per employee (see Table 16).

5. Analytical framework and estimation strategy

On the base of the findings from the existing literature discussed in the previous section, one can formulate a set of hypotheses concerning the impact of FD on economic performance. They have been divided into three broad groups. The first one (**Hypothesis 1**) relates to main channels through which the discussed shift in structure of tax revenues affects economic performance. The second group (**Hypothesis 2**) deals with factors causing non-linear FD effects for economic performance. Lastly, in the third group (**Hypothesis 3)** we consider whether FD implemented in one country spills over into other countries' economic performance. All hypotheses are explained in detail below.

As presented on Scheme 1, **Hypothesis 1** can be further decomposed into three complementary hypotheses:

- **Hypothesis 1a**: **Strengthened export activity is the most important channel through which FD boosts economic performance.** An enhanced price competitiveness resulted from a reduced ESSC should make their export prices lower and ultimately increase foreign demand for their goods. Simultaneously, a compensating increase of revenues from VAT ought to hamper domestic demand. In effect, we assume FD strengthens export performance.
- **Hypothesis 1b**: **FD enhances GDP growth rate.** Although we assume that FD advances economic performance mainly by export expansion, we hypothesise that it also enhances GDP growth rate. As we described on Scheme 1 in Section 2 the increased revenues from VAT automatically reduce real wages and thus also diminish households' consumption expenditure. Concurrently, reduced ESSC decreases labour costs and then, due to enhanced relative cost of capital, also diminish investment outlays. On a theoretical ground, it is not possible to verify whether positive FD effects on export performance assumed in Hypothesis 1a dominates its negative implications for domestic consumption and investment expenditures. An impact of FD on GDP growth rate must be then examined empirically.
- **Hypothesis 1c**: **FD decreases labour costs and accelerates employment growth.** It can be expected that due to reduced ESSC, FD should result in lower total cost per employee and thus in strengthened labour demand.

We check for validity of **Hypotheses 1a-1c**, using a set of panel data models based on dataset from 27 EU countries over the years from 1995 to 2014. The general specification of the models used is as follows:

$$Y_{\mathrm{it}} = \alpha_i + \beta\ \mathrm{FD}_{\mathrm{it}} + \boldsymbol{X_{it}\gamma} + \varepsilon_{it} \qquad \text{(Eq. 1)}$$

where:

- Y_{it} - a measure of economic performance; we use five different variables depending on which hypothesis is verified (Eq. 1.1 – Eq. 1.5):
  - **Hypothese 1a**: share of value-added exports in overall value-added of the economy (VAX_{it}) (Eq. 1.1); the net exports in percentage of GDP (NX_{it}) is a difference between exports and imports in relation to GDP (Eq. 1.2)
  - **Hypothesis 1b:** annual growth rates of real GDP (GDP_{it}) (Eq. 1.3),
  - **Hypothesis 1c:** employment dynamics ($EMPL_{it}$) (Eq. 1.4) and labour costs dynamics ($WAGE_{it}$) (Eq. 1.5) reflecting a number of workers in the economy and total labour compensation per employee, respectively.
- FD_{it} – following Bosca et al. (2013) we use a relation between ESSC and VAT revenues as a key explanatory variable; decrease of the variable is interpreted as FD, because it means either the relative decrease in ESSC revenues or/and increase of VAT revenues; we modify the definition of the variable as a part of robustness check (see Section 7).
- β – structural parameter measuring the impact of FD on a considered indicator of economic performance; negative (positive) and statistically significant estimate means that FD (decrease in FD_{it} variable) improves (deteriorates) measure of economic performance;
- $\boldsymbol{X_{it}}$ – vector of control variables; we use the same, rather standard[9], set of controls which consists of: cyclically adjusted primary balance ($CAPB_{it}$), output gap ($Output\ gap_{it}$), nominal effective exchange rate ($NEER_{it}$), and unemployment rate ($Unemp_{it}$). Below we outline the main interrelations in favour of applying the above set of control variables.

[9] See e.g. Calderon C. et al. (2002), Abbas S. et al. (2011)

The channel through which fiscal policy affects the net exports is intuitive. A fiscal expansion tends to increase domestic demand (including imports) and entails a trade deficit, while fiscal consolidation may have an opposite effect, according to a twin deficits hypothesis (see, e.g. Bluedorn and Leigh 2011). However, under some circumstances reducing fiscal imbalances may trigger private sector expenditures, what is called non-Keynesian effects (see, e.g. Rzońca and Ciżkowicz 2005). That means the expected sign of $CAPB_{it}$ is ambiguous and it depends on which of these two effects prevail. An impact of fiscal policy measures on the net exports might be significantly influenced by current state of the economy, namely whether it operates above or below its capacity. In the first case, i.e. when actual output of the economy surpasses its potential output, which is captured by positive output gap, excess domestic demand due to fiscal expansion is more likely to result in additional imports. In the latter, when actual output of the economy is below its potential (negative output gap), the additional domestic demand stemming from fiscal expansion is more likely to be met by an increased production of domestic goods and services, rather than through imports (see, e.g. Abbas et al. 2011). Thus, it appears that while investigating an impact of fiscal policy measures on export performance it is necessary to control for $Output\ gap_{it}$.

An impact of nominal effective exchange rate - a measure of the value of a currency against a weighted average of several foreign currencies - is straightforward. An increase in $NEER_{it}$ reflects an appreciation of the domestic currency against the weighted basket of currencies of trading partners. It means that a surge of $NEER_{it}$ is expected to be accompanied by a deterioration of export performance. High unemployment rate ($Unemp_{it}$) indicates not only a lower number of people able to consume, but also a lower propensity of households to spend and companies to expand investments. This leads to a weaker aggregate demand, imports including. Hence, high unemployment rate should strengthen the net exports so the expected impact of $Unemp_{it}$ on export performance is likely to be positive.

We estimate the above models (Eq. 1.1 – 1.5) using a set of panel data estimators. We begin with a fixed effects (FE) estimator, which assumes homogeneous coefficients of the explanatory variables but allows for a different constant term for particular countries, i.e. specific characteristics of a given country, which are not described by control variables but affect the dependent variable.

The results, based on FE estimator, may be biased due to several methodological problems. The first one is a possible cross-sectional dependence (or spatial correlation) of error terms. In the analysed model, this is equivalent to the assumption that there are unobserved time-varying omitted variables common for all countries, which impact individual states. Actually, the results of the Pesaran's test for cross-sectional dependence indicate that this is a characteristic of the data set used. If these unobservable common factors are uncorrelated with the independent variables, the coefficient estimates based on FE regression are consistent, but standard errors estimates are biased. Therefore, we use the Driscoll and Kraay (1998) nonparametric covariance matrix estimator (DK) which corrects for the error structure spatial dependence. This estimator also addresses the second problem, namely a standard errors bias due to a potential heteroscedasticity and autocorrelation of the error terms.

The consistency of the estimators presented above may be also affected by the third problem, i.e. endogeneity due to a potential correlation between the regressors and the error term. For example the relationship between FD measure and GDP growth (Eq. 1.3) may result not from the impact generated by fiscal devaluation, but from cyclical factors influencing both tax revenues structure and economic growth simultaneously. We use several approaches to address this issue. Firstly, we use instrumental variables in a two-step generalised method of moments estimator (GMM), adopting first lags of analysed variables as instruments. Notice that this estimator is asymptotically consistent yet it may be biased when applied to such short samples as ours. Secondly, we use cyclically adjusted ESSC and VAT revenues following EC (2014) methodology of reducing cyclical component. Thirdly, in the robustness analysis we extend our basic specifications with time fixed effects as well as with the dummy variable identifying years after the outbreak of global financial crisis.

Taking into account all of the above issues, we use three types of panel data estimators: fixed effects (FE) Driscoll-Kraay with corrected standard errors (DK) and two-step generalised method of moments (GMM). At the same time, we are aware that the obtained results could be affected by some of the abovementioned problems and that the conclusions drawn on their basis should be taken with caution.

In the next step, we focus on **Hypothesis 2.** The analysis of previous literature (see Section 3) and stylized facts (see Section 4) gives rise to decomposition of **Hypothesis 2** into four sources of nonlinearities:

Hypothesis 2a: **An impact of FD on economic performance is stronger among countries with fixed exchange rates than those with floating rates.** To the best of our knowledge, exchange rate regime is the only one feature affecting a magnitude of FD implications for economic growth that has been verified empirically (see, e.g. de Mooij and Keen 2012). As we outlined in the scheme 1 in Section 2, provided a floating exchange rate FD leads to an appreciation of domestic currency. The stronger is this effect, the weaker FD influences export performance.

Hypothesis 2b: **The larger country's trade openness, the stronger FD enhances economic performance.** In the theoretical literature, it is argued that trade openness elevates FD implications for economic momentum (see, e.g. Engler et al. 2017). A developed international trade co-operation or involvement in global value chains seem to be an important factor causing FD to strengthen export performance. On the other hand, subdued trade links with other countries may result in a limited improvement of export performance despite an enhanced price competitiveness stemming from FD.

Hypothesis 2c: **Wage bargaining solutions that foster high downward real wage rigidity (or low upward nominal wage rigidity) weakens an impact of FD on economic performance.** According to the earlier discussion, speed and the extent of wage adjustments following FD could significantly determine its impact on economic momentum. If workers force immediate wage hikes to maintain real value of their incomes after an increase of VAT revenues, then a magnitude of FD for economic performance, especially for advancing export activity, is unlikely to be substantial.

Hypothesis 2d: Due to enhanced wage pressure exerted by generous unemployment benefit system, FD does not result in either employment growth, improvement in export performance or advancing GDP growth rate. High benefit replacement rates discourage unemployed people from accepting job offers and boost their wage expectations. In effect, despite an increased labour demand resulting from the reduced ESSC, an influence of FD on labour market and general economic situation is limited.

We check for validity of **Hypotheses 2a-2d** using a set of panel data models with interacting variables of the following general form:

$$Y_{\mathrm{it}} = \alpha_i + \beta\, FD_{\mathrm{it}} + \vartheta FD\_Z_{\mathrm{it}} + \varphi Z_{it} \; + \boldsymbol{X_{it}\gamma} + \varepsilon_{it} \qquad \text{(Eq. 2)}$$

where Y_{it},, FD_{it} , $\boldsymbol{X_{it}}$ and β have been described previously and

- Z_{it} – variable measuring potential source of nonlinearity depending on which hypothesis is verified:
    - **Hypothesis 2a**: the Eurozone membership (*EURO*) (Eq. 2.1) included as a binary variable, which reflects a time of the membership in EMU.
    - **Hypothesis 2b:** trade openness of the economy (*OPEN*) (Eq. 2.2) measured as a sum of exports and imports in relation to GDP.
    - **Hypothesis 2c:** indices of centralisation of wage bargaining (*CWB*) (Eq. 2.3) and of predominant level at which wage bargaining takes place (*LEVEL*) (Eq. 2.4) as measures describing workers' strength in wage negotiation
    - **Hypothesis 2d:** two measures of net replacement rates for workers earning an average salary in the economy: single workers (*NRR_single*) (Eq. 2.5) and one earner couple with two children (*NRR_couple*) (Eq. 2.6) as a measure of generosity of unemployment benefit system
- FD_Z_{it} – interactive variable which is a product of FD_{it} and Z_{it}
- ϑ– structural parameter defining to what extend the change of Z_{it} variable influences the impact of fiscal devaluation (drop in FD_{it}) on a particular measure of economic performance (Y_{it}); the overall impact of fiscal devaluation on economic performance is defined by

$$\frac{\partial Y_{\mathrm{it}}}{\partial FD_{\mathrm{it}}} = \beta \; + \vartheta Z_{\mathrm{it}}$$

if the sign of ϑ is the same (opposite) as the sign of β , increase in Z_{it} reinforces (reduces) the impact of fiscal devaluation on economic performance.

Each of the non-linearities (Eq. 2.1 – Eq. 2.6) is analysed for each out of five measures of economic performance (Y_{it}) that generates 30 separate models.

Finally, we analyse **Hypothesis 3** which assumes that the positive effects of FD on economic performance spills over into other countries principally through the export channel. One can distinguish between two offsetting effects that could emerge from FD implemented in one country for its neighbouring states. The first one, which we call '*competitive effect'*, assumes that improved cost competitiveness resulted from FD in one country goes at the expense of the competitiveness of another country. It means that the more countries apply a discussed tax shift, the smaller would be their capability to boost economic performance (see e.g. de Mooji and Keen, 2012; EC, 2013). The second – '*cooperative effect*' - states that FD in one country could be beneficial for neighbouring countries providing that they are sufficiently integrated within global value chains. We hypothesise that in terms of VAX and net exports the second effect dominates within the EU countries, mainly due to wide trade co-operation and increasing role and complexity of global value chains in foreign trade. To our best knowledge this explanation has not been tested neither in theoretical nor in empirical literature[10]. On the other hand we assume that FD should not exert significant spatial impact in case of other dependent variables.

We check **Hypothesis 3** using spatial panel data framework. This type of models allows to decompose the impact of fiscal devaluations into three channels:

A. **Local impact**[11]: the effects induced by FD in one country on performance of the country's economy;
B. **Spatial impact**: externalities to neighboring countries; in case in which competitive effect exerts stronger impact than cooperative effect, one can expect that FD in one country would reduce economic performance in neighboring countries and *vice versa.*
C. **Reverse inductions**: if FD in one country alters economic performance of neighboring states, this change may generate some induced effects (positive or negative) from the neighboring states to the country which implemented FD in the first place.

[10] European Commission (2013) indicates that „(…) the expansionary effects of shifting to a more efficient tax structure are beneficial for other countries as well", however they do not define potential channels of the impact.
[11] The effects of channel A are called "direct impact" in most of the literature. However, in the following paragraphs, the methodology developed by LeSage J. and Pace R.K. (2009) is used to interpret estimates from spatial panel models. They use the term "direct impact" to define the joint effects of channel A and C. To avoid confusion, the effects of channel A are labeled "local impact".

To take into account the above channels we estimate panel Spatial Durbin Models (hereafter, SDMs) of the form:

$$Y_{\mathrm{it}} = \alpha_i + \rho(\boldsymbol{WY})_{\mathrm{it}} + \beta\ \mathrm{FD}_{\mathrm{it}} + \delta(\boldsymbol{WFD})_{\mathrm{it}} + \boldsymbol{X_{it}\gamma} + (\boldsymbol{WX})_{\boldsymbol{it}}\boldsymbol{\theta} + \varepsilon_{it} \qquad \text{(Eq. 3)}$$

where Y_{it}, FD_{it}, $\boldsymbol{X_{it}}$ and β have been described previously, **W** is an 27×27 weight matrix[12], ρ is spatial autoregressive coefficient of the spatial lags of dependent variable $(\boldsymbol{WY})_{it}$ δ is the coefficient of spatial lags of fiscal devaluation measure $(\boldsymbol{WFD})_{it}$ and vector $\boldsymbol{\theta}$ contains the coefficients of spatial lags of $(\mathbf{WX})_{\mathrm{it}}$.

At least three important methodological aspects of the above models should be considered.
The first is the validity of the SDM specification over many other spatial models developed in the theoretical literature. The choice of SDM is justified by at least two factors. First, as noted by researchers, (see, e.g., LeSage and Fischer 2008), SDM nests most other specifications used in empirical research, including those with spatially autocorrelated error terms, such as Spatial Error Models (hereafter, SEMs). Second, SDM yields unbiased coefficient estimates if the true data-generation process is SEM (see, e.g. Elhorst 2010). That being said, the validity of SDM over SEM is examined by testing hypothesis $\mathrm{H}_0: \beta + \rho\ \delta = 0$ for Model 12 and $\mathrm{H}_0: (\beta + \rho\ \delta = 0$ and $\boldsymbol{\gamma} = \rho\ \boldsymbol{\theta}$) form Model 13. The rejection of the particular hypothesis indicates that the SDM specification properly describes the data. On the contrary, if the hypothesis is not rejected, then the spatial dependence is due to a spatially autocorrelated error term. In this case the SDM model will yield unbiased but inefficient estimates and using SEM model instead of SDM would increase the efficiency.

The second issue is the choice of the weight matrix structure. **W** has been constructed as an inverse distance matrix based on the driving distance[13] between capitals of every pair of countries. The matrix has been row-normalized so that the sum of all elements in each row equals 1. We realize that the strength of economic relationships between countries is neither simple nor fixed over time, however describing connectivity using non-spatial measures of

[12] The construction of **W** is discussed in detail in the following paragraphs
[13] The Google Distance Matrix API has been used, and the data were gathered on April, 2nd 2017

proximity creates more serious problem: endogeneity of weight matrix (see, e.g. LeSage and Pace, 2014)[14].

The third issue concerns the valid interpretation of estimates from SDM. As indicated by LeSage and Pace (2009), the point estimates of spatially lagged variables cannot be directly used to test the hypothesis of the existence of spatial spillovers. This means that even negative (positive) and significant estimates of δ cannot be interpreted as an indication that FD in one country has a positive (negative) effect on economic performance of neighboring countries. Based on LeSage and Pace (2009), matrices of the partial derivative effects of the form have been constructed:

$$\frac{\partial \boldsymbol{Y}}{\partial \boldsymbol{FD}} = \boldsymbol{S}\ (\boldsymbol{W}) = \left(\boldsymbol{I}_{NT} - \rho\ (\boldsymbol{I}_T \otimes \boldsymbol{W})\right)^{-1} (\boldsymbol{I}_{NT}\beta\ + (\boldsymbol{I}_T \otimes \boldsymbol{W})\delta \qquad \text{(Eq. 4)}$$

and the following three scalar summary measures have been calculated for the estimates' interpretation:

- *Direct impact,* which is the average of the diagonal elements of the Matrix 1, measures the change in economic performance of the country due to changes in FD in the country. *Direct impact* differs from estimates of β : it measures the influence of FD not only through **channel A** (local impact) but also through **channel C** (reverse inductions) because it also includes the effect of a feedback loop. The scale of the feedback loop effects may be calculated as the difference between the *direct impact* measure and β estimates, as *direct impact* estimates include the effects of channels A and C, whereas β include only channel A effects.

- *Indirect impact* is the average of the off-diagonal elements of Matrix 1; it measures the spatial impact of FD described in **channel B,** namely the cumulated change in particular measure of economic activity in neighboring countries due to the change in FD in *i*-th country.; a negative (positive) and statistically significant value of *indirect impact* indicates that the positive (negative) effects of FD are not restricted to a country implementing FD but spill over into neighboring countries.

[14] *Having said that we check robustness of the results by changing the W matrix specification*

- *Total impact* is the sum of *direct* and *indirect impact*; it measures the aggregated impact of change in FD exerted through **channels A, B** and **C.**

6. Estimation results and implications

We start the econometric analysis with a verification of the first group of hypotheses (1a-1c) referring to main channels through which FD affects economic performance. They have been put forward in detail in the Section 5.

Table 17 presents estimates of the coefficients of Eq.1 using fixed-effects estimator. It includes estimates for our baseline (col. 1-5) and cyclically adjusted (col. 6-10) measure of FD. The results show that an application of the first indicator provides only slightly higher estimates of FD_{it} than the latter. All in all, they are very similar both in terms of their significance and magnitude. In the following interpretation of the results we thus focus on the baseline definition of FD_{it}.

- Negative and statistically significant estimates of FD_{it} coefficients in models of value added in export (col. 1) and net exports (col. 2) indicate that FD unambiguously advances export activity. Clearly, for the average country in the sample, a decrease of FD_{it} indicator by one standard deviation (approx. 0.37) causes an improvement of value added in export by 3.6% of GDP and net exports by 1.9% of GDP. Note that applying $Cyclical\_FD_{it}$ provides very similar and still highly statistically significant results for its impact for export activity (col. 6-7). This then yields strong support for **Hypothesis 1a**.

- The results point that FD significantly strengthens annual GDP growth rate irrespectively which of its measures we apply. That implies that the favourable effect of FD on export performance confirmed in Hypothesis 1a outweighs its likely negative impact on other components of aggregate demand, in particular on consumption. For the average country in the sample, a decrease of FD_{it} indicator by one standard deviation accelerates annual GDP growth rate by about 1 percentage point. This then clearly supports **Hypothesis 1b**.

- Lastly, the estimates indicate that FD significantly and unambiguously improves the price competitiveness on the domestic labour market. On average, a decrease of FD_{it} indicator by one standard deviation decelerates growth of labour compensation per employee by 2.6 percentage points (col. 5). This implies a strong pass-through of ESSC

reduction into total labour costs. In effect, FD of a considered size accelerates the employment growth by 1.4 percentage point (col. 4). The results provide clear support for **Hypothesis 1c**.

Before we move to the empirical verification of the consecutive hypotheses, we estimate coefficients of the Eq. 1 using two other estimators, namely DK and GMM (see Table 18). Application of DK estimator leaves the results unaffected (col. 1-5) in comparison with those we discussed above. On the other hand, GMM estimator (col. 6-10) returns somewhat higher estimates of FD effects for export performance, GDP and employment growth. The consistency of the GMM2S estimator depends however on the validity of the instruments used. To test for this we applied Hansen's J-test of overidentifying restrictions. The joint null hypothesis is that the instruments are uncorrelated with the error term and that the excluded instruments are correctly excluded from the estimated equation. The test statistics for all equations indicates that the null hypothesis cannot be rejected[15]. To sum up, irrespective of the applied estimator the results yield support for **Hypotheses 1a-1c** and the differences between particular results are not significant. Because of that in following sections we present the results for FE estimator.

In order to allow comparisons of our results with those from the previous studies, we use estimates from Table 17 to compute an impact of a decrease of revenue from ESSC by 1% of GDP and a simultaneous increase of revenue from VAT by 1% of GDP (point estimations based on mean of variables, see Table 4). It follows that tax shift of 1% of GDP from ESSC to VAT improves net exports from 1.14 to 1.19% of GDP, and increases VAX from 2.24 to 2.91% of GDP. The results are comparable to those obtained by Bosca et al. (2013), who find an improvement in the net exports from 1.4 and 2.8% of GDP. However, they are much weaker than those of de Mooij and Keen (2012). These authors find increase of the net exports of between 2.8 and 4.0% of GDP.

[15] It should be stressed that even in this case the GMM estimator may be subject to a weak instrument problem meaning that the excluded instruments are only weakly correlated with the endogenous regressors (see Stock et al., 2002). If the assumption that error term has IID distribution is dropped, relevant weak instruments test is Kleibergen and Paap (2006) Wald rank F statistic. Unfortunately in analyzed cases critical values for this test are not available.

The tables 19, 20 and 21 present estimates of the augmented version of the model (Eq. 2) that we use to examine **Hypotheses 2a-2d** that relate to non-linear implications of FD for economic performance.

Results shown in table 19 provide primary support for **Hypothesis 2a** indicating that positive impact of FD on export performance is significantly stronger in countries with fixed exchange rate than those using floating currency regime. Specifically, estimates for FD_{it}*$EURO$ is highly significant and negative for VAX (col. 1) and the net exports (col. 2). According to the estimates, one can conclude that in countries with fixed exchange rate an average magnitude of FD effects for VAX is by a third stronger than among the states using floating currency regime. The results indicate that this effect is even stronger for net exports. The above findings confirm main conclusions from the existing literature. However, the results do not prove any significant influence of Eurozone membership on a magnitude of FD effects for GDP growth rate (col. 3). One plausible explanation for this finding is that a shift from direct into indirect taxation increases relative cost of capital and thus leads to a decline of investment expenditures. This result requires further elaboration. Similarly, estimates of FD_{it} * $EURO$ are not significant for employment growth rate (col. 4) and compensation per employee (col. 5). This comes as no surprise since Eurozone membership itself is unlikely to have any impact on labour or wage adjustments.

According to the further results presented in table 19, trade openness has no statistically significant effect on the strength at which FD influences VAX, net exports, GDP and employment growth rates (columns 6-9), as it was assumed in **Hypothesis 2b.** However, the results indicate (col. 10,) that high trade openness decreases an impact of FD on curbing of domestic labour cost pressure (estimate of FD_{it}*$OPEN$ is positive and has opposite sign to β coefficient for FD_{it}). For average country in the sample, an increase of trade openness by one standard deviation (approx. 36% GDP) causes a decline of compensation per employee growth rate achieved by fiscal devaluation to fall by a quarter. We see that this may result from an elevated price competition among countries with the above average exposure to international trade. Given that total compensation per employee growth rate is likely to be already subdued in countries highly involved in global value chains due to a high pressure for keeping their prices under control, one can expect that FD are there followed by a limited slowdown of total labour

cost. Similarly, the higher trade openness and thus the stronger international price competition, the weaker pass-through of any increase of direct taxation into total labour costs.

Table 20 yields strong support for **Hypothesis 2c** assuming that wage rigidities stemming from wage bargaining solutions cause significant non-linear implications of FD_{it} variable for export performance and compensation per employee growth rate. Specifically, the estimates indicate that one unit increase of wage centralisation index or an upshift of the level at which wage bargaining predominantly takes place by one step diminish a magnitude of effects resulted from FD_{it} variable for value added in export and net exports by about a fifth. More centralised wage bargaining or higher level at which they usually take place reduce an impact of FD for compensation of employee growth rate by a similar amount. This indicates that the stronger workers' position in wage negotiation, the weaker impact of FD for advancing export performance and the more limited fall of labour costs. It appears however that wage bargaining solutions do not affect at all the magnitude of a shift from direct into indirect taxation for employment or GDP growth rate. It suggests that at least in the analysed sample wage negotiation systems that foster high downward wage rigidity stimulate wage pressure and consequently hamper potentially beneficial impact of a considered tax shift form direct into indirect taxation for export performance.

The results presented in table 21 strongly confirm **Hypothesis 2d** pointing that generous unemployment benefits make unemployed people more reluctant to accept job offers and thus limit beneficial implications of FD for labour market and economic performance. According to the estimates, an increase of net unemployment benefit replacement rate by one standard deviation (approx. 0.16 and 0,12 for single workers and one -earner couple with kids, respectively) limits a positive impact of FD_{it} variable for employment growth by one-fifth for single workers and by one-seventh for one-earner couple with kids. This seems to be a direct result of a reduced wage decrease following FD. The estimates show that a considered rise of replacement rate cause a surge of value added in export due to FD to decline by about 10-13%. Finally, we estimate spatial models based on Eq. 3 in order to verify **Hypothesis 3.**

Unfortunately, we are not able to estimate the models for $WAGE_{it}$, due to frequent gaps in the data[16].

We start with the model describing performance in international trade, namely the models with VAX_{it} and NX_{it} as a dependent variable. The estimates of the spatial autoregressive coefficients of VAX_{it} (ρ) and the spatial lag coefficients (δ and $\boldsymbol{\theta}$) are jointly different from zero in both models, indicating that the non-spatial specification based on Eq. 1 ignores important aspects of spatial impact. The estimates of β are statistically significant (p-value<0.01), however their values: -2.986 and -2.926 respectively, are two to three times lower than in the case of non-spatial specifications. That said, to avoid erroneous conclusions, we focus on the interpretation of *direct* and *indirect impact* (see Table 23) instead of δ and β estimates. The estimates of the *direct impact* of FD_{it} amounts to -4.759 and -2.737 and are statistically significant (z-test p-value<0.01 and <0.1, respectively). Comparison with the estimates of β in a non-spatial model indicates, that ignoring spatial dependence overestimates the local impact of fiscal devaluations. The difference between the *direct impact* and β estimates, which amounts to -1.773 and -2.429 respectively, may be interpreted as the feedback loop effect of **channel C** (see Section 5). The relatively high value of the differences and their statistical significance indicate that reverse inductions from FD in the i-th country to neighboring countries and back are non-negligible. Also, the estimates of the *indirect impact* of FD_{it} variable is significant both statistically (z-test p-value<0.01) and economically. It means that FD in a given country substantially improves international trade performance in neighboring countries through spatially induced effects (**channel B)**. The results point to tight integration among analyzed countries within global value chains and indicates that '*cooperative effect*', understood as described in Hypothesis 3 (see Section 5), strongly dominates '*competitive effect*' as far as international trade outcomes are concerned. The scale of the *indirect impact* may seem surprising (the estimates amount to -22.320 in case of VAX_{it} and -15.746 in case of NX_{it}), but as argued by LeSage and Fischer (2008), it cumulates the effect of changes in a particular explanatory variable in one country on the dependent variable in all neighboring regions. In the analyzed case, it adds up the effect of FD_{it} on all neighboring countries, which explains the relatively high value of the estimates. To

[16] STATA procedure used to estimate the models (xsmle) demands balanced panels and the data gaps in $\Delta wage$ leaves us with too few observations for which all countries are covered.

confirm that the spatially induced effects are driven by spatially lagged variables and not by a spatially autocorrelated error term, the hypothesis $H_0: (\beta + \rho \delta = 0$ and $\boldsymbol{\gamma} = \rho \boldsymbol{\theta})$ has been tested, and it is rejected (chi^2- test *p*-values<0.01) in both models.

Subsequently, we analyze the results for GDP and employment growth. Based on analytical approach used in previous paragraphs, one can see that the outcomes point to important role of spatial impact in both models (ρ, δ and $\boldsymbol{\theta}$ are jointly different from zero). Similarly, in both equations spatial effects are better described by SDM and not SEM specification ($H_0: (\beta + \rho \delta = 0$ and $\boldsymbol{\gamma} = \rho \boldsymbol{\theta}$ rejected for both models). However, analysis of *direct* and *indirect impact* estimates clearly indicates that the source of spatial impact are not changes in tax revenue structure mirrored in FD_{it} variable, but merely co-movements of economic cycles. Indeed, in case of FD_{it} variable *direct impact* estimates in both models are not statistically different from β estimates neither in spatial nor in non-spatial specification and *indirect impact* estimates are not statistically different from zero. On the other hand, *Output gap*$_{it}$ and *Unemp*$_{it}$ changes in a given country exert statistically and economically significant spatial impact on both GDP and employment growth in neighboring countries. The outcomes are in line with our assumptions formulated in description of Hypothesis 3: even if '*competitive channel'* works and causes that FD undertaken in one country decreases GDP and employment growth in other countries, its impact is counterbalanced by '*cooperative channel*' stemming from integration of analyzed countries in global value chains.

In conclusion, the findings from the empirical part of our research prove that FD strengthens economic performance not only through advancing export activity, as it was so far pointed in the empirical literature, but it also boosts GDP momentum and improves labour market performance. Although we found that favourable effects of FD for export performance are stronger in countries with fixed exchange rate than those using a floating rate, the findings show that FD boosts economic performance irrespective of the monetary regime. The findings show also that a magnitude of effects of FD heavily depends on prevailing wage bargaining settings and generosity of unemployment benefits what is of great importance from the policymakers' perspective. Finally, the estimates indicate that ignoring spatial effects in the analysis of the effects of FD can lead to biased conclusions. We show that 'cooperative effect' of unilateral FD, which is beneficial for neighbouring countries, dominates by far 'competitive effect', which

goes at the expense of other countries' competitiveness. Thus, FD is not beggar thy neighbour policy, at least in the EU. FD implemented in one country can benefit other countries, especially through export channel, provided that they are strongly integrated in global value chains.

7. Robustness analysis

In this section, the robustness of the results on various changes in the modeling approach has been examined.

Firstly, we focus on basic non-spatial models (Equation 1). For the sake of brevity, only the FE estimates are presented because the results do not differ substantially when the DK estimator is used.

Part I of the analysis (see Table 26, columns 1- 5[17]) checks whether exclusion of any country from the sample affects main results. This allows to verify whether the results are driven by outliers, i.e. whether the impact of fiscal devaluation in one country is not significantly stronger/weaker than the average in other country thus strongly weighting on the results. The estimates remain highly significant, regardless of which country has been excluded and their dispersion around the full-sample case is reasonably low.

The impact of outliers is analyzed also in part II of robustness check (see Table 25, columns 1-5), as we remove from the sample 5% of observations with the highest change in FD_{it} variable (in absolute terms). The point estimates remain similar to full-sample case and highly significant, with exception of the model with GDP growth as dependent variable, in which case the estimates of FD_{it} is significant only at 10% level.

Subsequently, part III checked whether changing the way fiscal devaluation is measured i.e. replacing FD_{it} variable in Equation 1 with two separate variables of $ESSC_{it}$ and VAT_{it} revenues expressed as a share of GDP, affected obtained results. Using two separate variables instead of one measure has been proposed in de Mooij and Keen (2012). The results presented in Table 25 (columns 6-10) indicates, that the change makes the impact of fiscal devaluation on GDP growth (column 3) statistically insignificant. In case of remaining dependent variable (columns 1, 2, 4 and 5) the results seem unaffected by the change (see estimates in Table 17 to compare the results).

[17] Only the point estimates and the t-statistics of β are presented. The remaining estimates are available upon request.

Next, in part IV and V we enhance the basic specification of Equation 1 with time fixed effects and the financial crisis dummy[18] (and its interaction with FD_{it}). The results presented in Table 24, columns 1-2 show that the impact of fiscal devaluations on VAX_{it} and NX_{it} is significantly lower than without time fixed effects. On the other hand the impact on remaining dependent variables seem unaffected by the change (columns 3-5). The outcomes are more intuitive when interpreted together with the results of introducing crisis dummy into the basic specification (see Table 24, columns 6-10): the estimates indicate that the impact of fiscal devaluation on VAX_{it} and NX_{it} increased significantly after outbreak of the financial crisis.

Secondly, we analyze robustness of the results of spatial models. We focus on specification described in Equations 4.

In part VI, to evaluate the robustness of the estimated spatial effects to the assumed spatial dependence structure, Equation 4 (for each out of five dependent variables) have been estimated using different weight matrix. We replaced driving distance between capital of countries from the sample with driving time[19] in order to capture the quality of infrastructure. The results (see Table 27) seem unaffected by the change: the *direct* and *indirect impact* estimates and their significance are comparable to those from the baseline specification.

Finally, in part VII we added time fixed-effects to the specifications described by Equation 4. As presented in Table 28, the change has no substantial impact neither on point estimates nor on their significance.

In conclusion, the results are robust not only to the choice of different estimators (as shown in the previous section) but also to exclusion of subset of observations form the sample, changes in the set of explanatory variables and alternative specifications of the weight matrix. As indicated in previous sections, the impact of fiscal devaluations on GDP growth seems not robust. Finally, enhancing basic specifications with time-fixed effects and crisis dummy reveals growing impact of fiscal devaluations on VAX and NX after the outbreak of the financial crisis.

[18] The variable equals 1 for the years 2008-2014, and 0 for remaining years.
[19] Again the Google Distance Matrix API has been used, and the data were gathered on April, 2nd 2017

8. Conclusions

Poor economic performance of peripheral countries of Euro area after the outburst of the GFC gave birth to the conviction that a member of a monetary union is unable to replace exchange rate depreciation (devaluation) with other shock absorbers. This conviction is, in light of our research, an overstatement. We find that FD, understood as a shift from ESSC to VAT, works.

Namely, by decelerating growth of labour compensation per employee, it increases value added in exports, improves net exports, and accelerates GDP and employment growth. These effects are both statistically and economically significant.

Importantly, they are stronger in the members of the Euro area than in countries-out. And they can be further enhanced in a given country, if it shifts towards less coordinated or more decentralised wage bargaining process, or reduces generosity of unemployment benefits.

Note also that there are favourable spill-overs of those effects into other EU members. 'Cooperative effect' of unilateral FD, which is beneficial for neighbouring countries, turns out to dominate by far, at least in the EU, 'competitive effect', which goes at the expense of other countries' competitiveness. One can speculate that this dominance can be further increased through widening a trade co-operation, which monetary union encourages.

These findings are robust to changes in the estimation methods, the sample composition, the set of explanatory variables and the selection of a spatial weight matrix.

The last finding adds to some well-known advantages of FD over exchange rate depreciation (devaluation). It is acknowledged that FD has hardly ever been a shock amplifier, which depreciation (devaluation) can be in an economy over-burdened with debt in foreign currency. It is also argued that FD can be growth enhancing in the long term, since it results in less distortionary tax structure, whereas depreciation (devaluation) cannot, as it (at most) masks competitiveness problems of an economy. Now one can safely state that FD, unlike exchange rate devaluation, is not beggar thy neighbour policy, at least in the EU. We leave for future research a problem, whether this applies also to other regions of the global economy.

Obviously, FD has serious shortcomings that we do not challenge. In particular, it requires policy makers able to identify shock on time and act decisively. Besides, there is a limit to use FD. VAT cannot be raised indefinitely – for economic, but also legal reasons. In fact, many EU

members, especially outside Euro area, are quite close to the ceiling set in the European law (and Hungary even breached that ceiling). Thus, FD should be considered only an extraordinary emergency tool, applied exclusively in response to really severe shocks.

References

Abbas S., Bouhga-Hagbe J., Fatás A., Mauro P., and Velloso R.C. (2011), *Fiscal Policy and the Current Account*, IMF Economic Review, Palgrave Macmillan; International Monetary Fund, vol. 59(4), pages 603-629, November.

Annicchiarico B., Di Dio F., and Felici F. (2014), *Fiscal Devaluation Scenarios: a Quantitative Assessment for the Italian Economy,* Ministry of Economy and Finance, Department of the Treasury Working Paper No. 1.

Alla Z. (2015), *Optimal Fiscal Devaluations in a Currency Union,* Working Paper, Sciences Po, Department of Economics. November 11, 2015.

Atkinson, A.B., and J.E. Stiglitz (1976) *The design of tax structure: direct versus indirect taxation*, Journal of Public Economics, 6, 55-75.

Babecký J., P. Du Caju, T. Kosma, M. Lawless, J. Messina, and T. Rõõm (2010), *Downward Nominal And Real Wage Rigidity Survey Evidence From European Firms*, Scandinavian Journal of Economics, Vol. 112, Issue 4, pp. 884-910

Baiardi D., Profeta P., Puglisi R., and Scabrosetti S. (2017), *Tax Policy and Economic Growth: Does It Really Matter?* CESifo Working Paper Series No. 6343.

Bertola G., and R. Rogerson (1997), *Institutions and Labour Reallocation*, European Economic Review, Vol. 41, Issue 6, pp. 1147-1171

Bertola G. (1999), *Macroeconomic Perspectives on Aggregate Labor Markets*, [in:] Ashenfelter O., D. Card (Eds.) Handbook of Labor Economics, Vol. 3, Part C, pp. 2985-3028

Bluedorn J. and Leigh D. (2011), *Revisiting the Twin Deficits Hypothesis: The Effect of Fiscal Consolidation on the Current Account*, IMF Economic Review, 59, issue 4, p. 582-602.

Bosca J., Domenech R., and Ferri J. (2013), *Fiscal Devaluation in EMU* , BBVA Research Working Paper Series, No. 12/11

Calderon C, Chongy A., and Loayza N. (2002), *Determinants of Current Account Deficits in Developing Countries,* Contributions to Macroeconomics, Vol. 2, No. 1,pp. 1-31.

Correia, I. (2011), *Fiscal Devaluation* in Bank of Portugal, Economic Bulletin, pp.27-39,

de Mooij, R. and Keen M. (2012), *Fiscal Devaluation and Fiscal Consolidation: The VAT in Troubled Times,* IMF Working Paper WP/12/85

Driscoll, J. and Kraay, A. (1998), *Consistent Covariance Matrix Estimation With Spatially Dependent Panel Data*, The Review of Economics and Statistics, 80, issue 4, p. 549-560.

Engler P., Ganelli G., Tervala J., and Voights S. (2017), *Fiscal devaluation in a Monetary Union,* IMF Econ Rev (2017) 65: 241. doi:10.1057/s41308-016-0002-4

EC (2013), *Study on the Impacts of Fiscal Devaluation*, Taxation Papers, Working Paper no 36, European Commission

Elhorst J. (2010), *Applied Spatial Econometrics: Raising the Bar,* Spatial Economic Analysis, Taylor & Francis Journals, vol. 5(1), pages 9-28.

Fahri E., Gopinath G., and Itskhoki O. (2014), *Fiscal Devaluation,* Review of Economic Studies, Oxford University Press, vol. 81(2), pages 725-760.

Franco F. (2013), *External rebalancing in the EMU, the case of Portugal, Adjusting to external imbalances within the EMU, the case of Portugal*, mimeo, Universidade Nova de Lisboa.

Friedman M. (1997) *The Euro: Monetary Unity To Political Disunity,* a commentary published on Project Syndicate (August, 28th 1997)

Garnier G., György E., Heineken K., Mathé M., Puglisi L., Ruà S., Skonieczna A., and Van Mierlo A., (2014), *A wind of change? Reforms of Tax Systems since the launch of Europe 2020,* European Commission Taxation papers, Working paper no. 49 - 2014

Gomes S., Jacquinot P., and Pisanie M. (2014), *Fiscal Devaluation in the Euro Area,* Working Paper Series No 1725, European Central Bank

Hohberger S. and Kraus L. (2015), *Is fiscal devaluation welfare enhancing? A modelbased Analysis*_Beiträge zur Jahrestagung des Vereins für Socialpolitik 2015: Ökonomische Entwicklung - Theorie und Politik - Session: Fiscal policy, No. D01-V1

Iosifidi M. and Mylonidis N., (2017) *Relative effective taxation and income inequality: Evidence from OECD countries,* Journal of European Social Policy Vol 27, Issue 1, pp. 57 - 76

Johnson R., and Noguera G. (2012), *Accounting for Intermediates: Production Sharing and Trade in Value added,* Journal of International Economics Volume 86, Issue 2, March 2012, pages 224–236

Keynes, J. M. (1931), *Addendum to: Great Britain. Committee on Finance and Industry Report* [Macmillan Report] (London: His Majesty's Stationery Office, 1931), pages 190-209. Reprinted in Donald Moggridge, *The Collected Writings of John Maynard Keynes*, vol. 20 (London: Macmillan and Cambridge: Cambridge Press for the Royal Economic Society, 1981), pages 283-309.

Koske J., (2013), *Fiscal devaluation – can it help to boost competitiveness?* Economic Department Working Paper, No. 1089, OECD

Langot F., Patureau L., and Sopraseuth T. (2014), *Fiscal Devaluation and Structural Gaps,* Working papers 508, Banque de France.

Langot F., Patureau L., and Sopraseuth T. (2012), *Optimal Fiscal Devaluation,* CEPREMAP Working Papers (Docweb) 1202, CEPREMAP.

LeSage J.P. and Pace R.K. (2009), *Introduction to Spatial Econometrics*, Taylor & Francis Group, LLC

LeSage J.P. and Fischer M.M. (2008), *Spatial Growth Regressions: Model Specification, Estimation and Interpretation*, Spatial Economic Analysis, Taylor & Francis Journals, vol. 3(3), pages 275-304.

LeSage J.P. and Pace R.K. (2014), *The Biggest Myth in Spatial Econometrics,* Econometrics, MDPI, Open Access Journal, vol. 2(4), pages 1-33, December.

Lipinska A., and von Thadden L. (2012), *On the (In)effectiveness of Fiscal Devaluations in a Monetary Union,* Finance and Economics Discussion Series 2012-71, Board of Governors of the Federal Reserve System (U.S.).

Messina J., P. Du Caju, C. F. Duarte, N. L. Hansen, and M. Izquierdo, (2010), *The Incidence Of Nominal And Real Wage Rigidity: An Individual-Based Sectoral Approach*, Journal of European Economic Association, Vol. 8, Issue 2-3, pp. 487-496

OECD (2008), *Do Tax Structures Affect Aggregate Economic Growth?: Empirical Evidence from a Panel of OECD Countries*, OECD Economics Department Working Papers, No. 643

Orsini K., Burgert M., Grevesmuhl O., and Suardi M. (2014), *Assessing the impact of a revenue-neutral tax shift away from labour income in Spain* ECFIN Country Focus, Volume11, Issue 5, April

Pauly C. (2015) *Spain Emerges as Model for Europe*, a commentary published on Der Spiegel online (March, 25th 2015)

Pereira A.M., Pereira R.M., and Rodrigues P.G. (2014), *On the Long-Term Impact of a Fiscal Devaluation: An Application to the Portuguese Case,* Working Papers 116, Department of Economics, College of William and Mary.

Puglisi L. (2014), *Fiscal Devaluations in the Euro Area: What has been done since the crisis?* Taxation Papers, Working Paper N.47-2014, European Commission

Rzońca A. and Ciżkowicz P. (2005), "*Non-keynesian effects of fiscal contraction in new members states"* ECB, Working paper No. 519, 2005.

Tables

Table 1. The impact of a fiscal devaluation (the average results from general equilibrium models)

Variable	Impact	Source
Output	0,46%	Annicchiarico et al. (2014); Bosca et al. 2013; EC (2013); Engler et al. (2017); Hohberger and Kraus (2015); Lipinska and von Thadden (2012); Orsini et al. (2015); Pereira et al. (2014)
Employment	0,39%	Annicchiarico et al. (2014); Bosca et al. (2013); Langot, et al. (2012); Langot, et al. (2014); EC (2013); Bosca et al. (2013); Lipinska and von Thadden (2012); Pereira et al. (2014)
Effective exchange rate	-0,56%	Annicchiarico et al. (2014); Bosca et al. (2013); Engler et al. (2017); Gomes et al. (2013); Hohberger and Kraus (2015); Langot et al. (2014)
Net exports	0,67%	Bosca et al. (2013); Hohberger and Kraus (2015); Gomes et al. (2013); EC (2013); Engler et al. (2017); Orsini et al.(2015)

Source: own elaboration

Table 2. The summary of empirical literature

Model	Sample	Dependent variable	Measurement of FD	Unit	FD impact	Source
SVAR model	Portugal from 1995 to 2010, quarterly data	Net exports	Separate parameters for VAT and ESSC	Effective tax rates	Import decreases by 13,6 % and export increases by 8,4 %	Franco (2013)
Panel data model with fixed effects	OECD countries from 1965 to 2009	Net exports	Separate parameters for VAT and ESSC	Revenues as a % of GDP; statutory tax rates	Net exports improvement by 3,44 % of GDP	de Mooij and Keen (2012)
Pooled, cross sectional data model	EU – 15 countries from 1995 to 2009	Current account	A ratio between *implicit tax rates*[20] of social security contributions and consumption	Implicit tax rates	Current account improvement by between 1,4% and 2,8 % of GDP	Bosca et al. (2013)

Source: Own elaboration

[20] They measure the effective average tax burden on different types of economic income or activities, i.e. on labour, consumption and capital, as the ratio between revenue from the tax type under consideration and its (maximum possible) base.

Table 3. Coefficient of pairwise correlation of key explanatory variables and ESSC/VAT ratio

	ESSC/VAT	Employment	VAX	NX/GDP	GDP	Compensation per employee
ESSC/VAT	1.0000					
Employment	-0.1522***	1.0000				
VAX	-0.2186***	0.1665***	1.0000			
NX/GDP	-0.1171***	0.1640***	0.6544***	1.0000		
GDP	-0.0995**	0.5913***	0.1527***	-0.1256***	1.0000	
Compensation per employee	0.1047**	0.0639*	-0.0110	-0.2243***	0.4097***	1.0000

** and *** denote 5% and 1% significance level, respectively.

Source: Own calculation

Table 4. Impact of 1 p.p. tax shift from ESSC to VAT on dependent variables (point estimates)

	FD	*FD_cyclical*	*ESSC_gdp and VAT_gdp*
	1	***2***	***3***
VAX	2,25***	2,24***	2,91***
NX	1,19***	1,14***	1,19***
ΔGDP	0,69***	0,66***	0,67**
ΔEmployment	0,92***	0,91***	0,98***
ΔWage	-1,71***	-1,69**	-2,31***

Notes: We compute FD ratios after the tax shift (col. 1-2) based on average values of ESSC/GDP and VAT/GDP and the coefficient from Eq. 1. Similarly for col. 3, yet with coefficients from part III of Robustness check analysis (Table 25)

Source: Own calculation

Table 5. Review of the existing literature

	Authors	Model	Countries	Period	Measurements of FD	Units	Impact of FD (change in %)			
							Output	Employment	Effective exchange rate	Net exports
Theoretical / Numerical application	Fahri E.; Gopinath G. and Itskhoki O. (2013)	Theoretical model and DSGE implementation	Spain	2008	Increase of VAT +7,6 p.p.; and reduction of ESSC - 10,7 p.p.	Tax rates	0,02	0,025	not included	0,04
	Langot F., Patureau L., Sopraseuth T. (2012)	DSGE	France	1995-2008	Increase of consumption tax by 5 p.p ; reduction of labour tax by 10 p.p.	Tax rates	not included	0,1	not included	not included
	Gomes S., Jacquinot P., Pisanie M. (2014)	EAGEL (DSGE)	Spain and Portugal	no inf	A shift from ESSC to VAT by 1 percent of GDP	Percent of GDP	not included	not included	-0,7	0,5
	Pereira A.M., Pereira R.M., Rodrigues P.G (2014)	DGE	Portugal	2000 - 2013	Increase of VAT by 2 p.p.; reduction of ESSC of 4 p.p,	Percent of GDP	0,27	0,38	not included	not included
	Engler P., Ganelli G., Tervala J., Voights S. (2017)	DSGE	Eurozone countries	no inf	Increase of VAT bt 1 p.p., reduction of ESSC of 1,7 p.p.	Percent of GDP	0,9-1,4	not included	-0,3	0,2
	Annicchiarico B., Di Dio F., Felici F. (2014)	IGEM (DGE)	Italy	2002 - 2008 (quarterly data)	Increase of VAT by 2 p.p., reduction of ESSC by 3 p.p.	Percent of GDP	0,05 - 0,3	0,16 - 0,34	-0,04 - (-0,25)	not included
	Lipinska A. and von Thadden L.(2012)	DSGE	Eurozone countries	1996 - 2006	Increase of consumption tax by 1 p.p.; reduction of labour tax by 0,76 p.p.	Tax rates	0,18	0,18	not included	not included
	Langot F., Patureau L., Sopraseuth T., (2014),	DGE	France	1995 - 2008	Seeking an optimal relation between consumption and labour tax: Increase of consumption tax by 22 p.p.; reduction of labour tax by 7 p.p.,	Tax rates	not included	0,55	-3	not included
	Pereira A.M., Pereira R.M., Rodrigues P.G. (2014)	DGE	Portugal	2000 - 2013	A shift from labour tax to consumption tax by 1 percent of GDP	Percent of GDP	0,7-1	0,11 - 0,37	not included	not included
	EC (2013)	Econometric (NiGEM) and DGE (NK, AGE)	Selected Eurozone countries: FR, IT, ES, AT	no inf	Reducing the revenue of SSC by a percentage that represents 1% of GDP, and then by searching what is the increase in VAT rates that allows making a revenue neutral reform. Final values depend on the country	Percent of GDP	0,17 - 0,38	0,49-0,94	not included	-0,09 - (-0,54)
	Alla Z. (2015)	Standard NK open economy model with a numerical application	Spain and France	2008 and 2009	Increase of consumption tax by 2,1 p.p.; reduction in labour tax of 2,9 p.p.	Percent of GDP	not included	not included	not included	4,1
	Orsini K. Burgert M., Grevesmuhl O., Suardi M. (2014)	DSGE - QUEST	Spain	no inf	Increase of consumption tax by 4,2 p.p.; reduction in labour tax of 5,7 p.p.	Tax rates	0,7	not included	not included	0,2 - 0,5
	Hohberger S., Kraus L. (2015)	DSGE	Selected Eurozone countries: AT, BE, ES, FI, EL, IE, NL and PT	1999q1 - 2012q4	Increase of consumption tax by 1,0 p.p.; reduction in labour tax of 2,5 p.p.	Tax rates	0,2	not included	-0,1	0,05
Empirical	Franco F. (2013)	SVAR	Portugal	1996q1 - 2010q3.	A shift from labour tax to consumption tax by 1 percent of GDP	Percent of GDP	not included	not included	not included	not included
	De Mooij, R. and M. Keen (2012),	Panel data model	OECD countries	1965 - 2009	A shift from labour tax to consumption tax by 1 percent of GDP	Percent of GDP	insigificant	not included	not included	2,8 - 4
	Bosca, J., Domenech R., and Ferri J. (2013)	DGE - REMS (Rational Expectations Model for the Spanish economy); Panel data model	Spain	1985q3 - 2009 q4; 2007	Panel data model: A ratio between implicit tax rates of social security contributions and consumption, DGE: Increase of effective consumption tax rate by o 2 p.p.; reduction in effective ESSC rate of 3,5 p.p,	Tax rates	0,74	1,3	0,7	0,53

Table 6. Variables definitions

Variable	Name in model	Unit	Definition	Source
Value-added exports	*VAX*	Percentage points	Share of value-added produced in a country but absorbed in another country in overall value-added produced in a country	WIOD
Net exports	*NX*	% GDP	Net exports in percentage of GDP	EC AMECO
Gross domestic product	*GDP*	% change yoy	Real GDP dynamics	EC AMECO
Employment	*EMPL*	% change yoy	Number of workers dynamics	Eurostat
Labour costs	*WAGE*	% change yoy	Total labour costs per employee dynamics (gross wage + social security contributions paid by employer)	OECD
Fiscal devaluation	*FD*	% GDP	Ratio between social security contributions paid by employer and value added taxes	Authors' computation based on Eurostat data
Fiscal devaluation (cyclically adjusted)	*Cyclical_FD*	% GDP	Ratio between social security contributions paid by employer and value added taxes - cyclically adjusted	Authors' computation based on Eurostat data
Output gap	*Output gap*	% potential GDP	Gap between actual GDP and potential GDP	EC AMECO
Nominal effective exchange rate	*NEER*	2005 = 100	Value of a currency of a given country against a weighted basket of currencies of its trading partners. An increase of the index means an appreciation of the currency.	Eurostat
Unemployment rate	*Unemp*	%	Unemployment rate	Eurostat
Employer social security contributions	*ESSC*	% GDP	Receipts collected by governments from Employers' actual social contributions	Eurostat
Value added tax	*VAT*	%GDP	Receipts collected by governments from Value added taxes (VAT)	Eurostat
Cyclically adjusted primary balance (potential GDP)	*CAPB*	% GDP	Cyclically adjusted primary balance based on potential GDP	EC AMECO
Eurozone membership	*EURO*	0-1	Binary variables: a time of the membership in the Eurozone (1)	
Openness of the economy	*OPEN*	% GDP	Sum of exports and imports in relation to GDP	Eurostat
Centralisation of wage bargaining	*CWB*	1-5	Index: values from 1 for decentralized wage bargaining to 5 for strongly centralized wage bargaining	ICTWSS
The predominant level at which wage bargaining takes place	*LEVEL*	1-6	Index: values from 1 for negotiations on local level to 6 for negotiations on central or cross-sectional level	ICTWSS
Net replacement rate of unemployment benefits (single person)	*NRR_single*	Percentage points	Ratio between unemployment benefits in the first period of unemployment and net income earned before a job loss – single worker without children earning 100% of average wage in the economy	Vliet, Caminada (2012), OECD
Net replacement rate of unemployment benefits (family)	*NRR_couple*	Percentage points	Ratio between unemployment benefits in the first period of unemployment and net income earned before a job loss – worker with two children and not working spouse earning 100% of average wage in the economy	Vliet, Caminada (2012), OECD

Source: Own elaboration

Table 7. Descriptive statistics

Variables	No obs.	Mean	Std. Dev.	Minimum	Maximum
Value added in export	517	29,61	12,12	0,18	65,80
Net exports	507	0,06	8,25	-21,60	32,70
Gross domestic product	512	2,56	3,57	-14,80	11,90
Employment	526	0,55	2,49	-14,30	9,70
Labour costs	374	4,01	3,95	-7,66	27,49
Fiscal devaluation	529	0,92	0,37	0,23	2,18
Fiscal devaluation (cyclically adjusted)	516	0,93	0,37	0,23	2,13
Output gap	517	-0,17	3,26	-14,69	14,45
Nominal effective exchange rate	540	111,15	114,11	63,03	2132,31
Unemployment rate	496	9,11	4,24	1,90	27,50
Cyclically adjusted primary balance	514	0,04	2,42	-18,74	20,01
Eurozone membership	540	0,41	0,49	0,00	1,00
Openness of the economy	540	108,14	60,22	37,10	385,40
Centralisation of wage bargaining	488	2,47	1,37	1,00	5,75
The predominant level at which wage bargaining takes place	528	2,46	1,29	1,00	5,00
Net replacement rate of unemployment benefits (single person)	512	0,54	0,17	0,17	0,85
Net replacement rate of unemployment benefits (family)	512	0,61	0,14	0,25	0,92

Source: Own elaboration

Table 8. Episodes of major fiscal devaluation (a fall of ESSC/VAT ratio) accompanied by economic expansion.

	ESSC			VAT			ESSC/VAT			GDP			VAX			EMPL			NX			WAGE		
	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ
Italy (1998-2000)	9,9	8,3	-1,6	5,4	6,0	0,6	1,8	1,4	-0,4	1,8	2,3	0,5	19,2	19,3	0,1	0,3	1,5	1,2	3,9	2,0	-1,9	4,6	2,8	-1,8
Bulgaria (2003-2006)	7,1	6,9	-0,2	7,2	9,6	2,4	1,0	0,7	-0,3	5,9	6,4	0,5	31,7	31,1	-0,6	0,2	2,9	2,7	-8,1	-13,6	-5,5	.	.	
Hungary (1998-2000)	11,2	10,6	-0,6	7,5	8,1	0,6	1,5	1,3	-0,2	3,3	3,9	0,6	29,4	31,9	2,5	0,2	1,8	1,6	1,2	-2,4	-3,6	20,6	13,1	-7,6
Finland (1996-1997)	9,8	9,3	-0,6	7,7	8,1	0,4	1,3	1,2	-0,1	4,2	5,0	0,8	30,3	29,2	-1,1	1,8	2,4	0,6	7,5	7,2	-0,3	4,4	2,7	-1,7
Estonia (2006)	9,8	9,7	-0,1	8,1	9,0	0,9	1,2	1,1	-0,1	9,4	10,3	0,9	37,4	35,6	-1,8	2,3	4,8	2,5	-6,5	-10,2	-3,7	.	.	
Italy (2006)	8,3	8,1	-0,2	5,7	6,0	0,3	1,5	1,4	-0,1	0,9	2,0	1,1	18,9	19,6	0,7	0,6	2,0	1,4	-0,1	-0,8	-0,7	3,3	3,3	0,0
Lithuania (2005)	7,5	7,2	-0,3	6,4	7,1	0,7	1,2	1,0	-0,2	6,6	7,7	1,1	28,5	31,3	2,8	-1,1	0,8	1,9	-7,1	-7,1	0,0	.	.	
Czech Republic (2004)	9,7	9,5	-0,2	5,9	6,7	0,8	1,6	1,4	-0,2	3,6	4,9	1,3	34,7	38,3	3,6	-0,8	-0,2	0,6	-1,2	0,9	2,1	7,7	8,2	0,5
Latvia (2003)	6,7	6,1	-0,6	6,5	6,9	0,4	1,0	0,9	-0,2	7,1	8,4	1,3	29,2	28,5	-0,7	1,5	0,6	-0,9	-9,8	-12,6	-2,8	.	.	
Czech Republic (1999)	9,3	9,2	-0,1	5,7	6,1	0,4	1,6	1,5	-0,1	-0,3	1,4	1,7	33,4	34,4	1,0	-1,8	-2,2	-0,4	-0,5	-0,6	-0,1	7,9	5,9	-2,0
Slovakia (2003-2006)	8,8	7,2	-1,6	6,9	7,5	0,6	1,3	1,0	-0,3	4,5	6,5	2,0	36,3	38,8	2,5	0,1	1,2	1,1	-7,3	-3,4	4,0	8,4	8,9	0,6
Latvia (2005)	6,0	5,7	-0,3	6,7	7,4	0,7	0,9	0,8	-0,1	8,3	10,7	2,4	27,4	29,9	2,5	0,2	0,9	0,7	-15,6	-14,5	1,1	.	.	
Germany (2006-2007)	6,8	6,5	-0,4	6,1	6,5	0,4	1,1	1,0	-0,1	0,7	3,5	2,8	29,1	31,7	2,6	0,0	1,3	1,3	5,2	6,3	1,1	1,4	1,3	-0,1
Lithuania (1997)	7,4	8,0	0,6	6,8	8,3	1,5	1,1	1,0	-0,1	5,1	8,3	3,2	29,3	30,4	1,2	0,9	0,6	-0,3	-9,2	-10,1	-0,9	.	.	
Romania (1998-1999)	6,9	7,4	0,4	4,5	6,1	1,6	1,5	1,2	-0,3	-4,8	-1,3	3,6	.	.		.	.		-6,8	-6,2	0,6	.	.	
Estonia (2011-2012)	11,8	10,5	-1,3	8,5	8,3	-0,2	1,4	1,3	-0,1	2,3	6,0	3,7	37,0	39,0	2,1	-5,0	4,1	9,1	6,5	0,7	-5,8	.	.	
Romania (2000-2003)	7,8	7,0	-0,9	6,0	6,7	0,7	1,3	1,0	-0,3	-0,4	4,7	5,1	.	.		.	-3,0		-4,5	-6,5	-2,0	.	.	
United Kingdom (2010)	4,2	4,2	0,0	5,3	6,1	0,8	0,8	0,7	-0,1	-4,3	1,9	6,2	21,4	22,0	0,5	-1,6	0,2	1,8	-1,6	-2,2	-0,6	2,6	1,9	-0,7
Latvia (1997)	9,4	7,7	-1,7	7,9	7,7	-0,2	1,2	1,0	-0,2	2,4	9,0	6,6	31,3	31,6	0,3	-1,9	4,4	6,3	-7,2	-7,4	-0,2	.	.	
Italy (2010)	9,1	9,0	-0,1	5,5	6,1	0,6	1,7	1,5	-0,2	-5,5	1,7	7,2	17,6	18,8	1,2	-1,7	-0,6	1,1	-0,5	-1,9	-1,4	0,1	2,4	2,3
Bulgaria (2000-2001)	8,5	8,1	-0,4	7,6	8,3	0,7	1,1	1,0	-0,1	-6,0	4,4	10,4	34,9	32,0	-2,8	-4,3	-1,6	2,7	-4,6	-7,4	-2,8	.	.	
Estonia (2000)	10,9	10,7	-0,2	7,7	8,4	0,7	1,4	1,3	-0,2	-0,9	10,6	11,5	36,0	38,9	3,0	-4,4	0,8	5,2	-4,9	-3,6	1,3	.	.	
Latvia (2010-2012)	6,7	6,2	-0,5	5,9	6,9	1,0	1,1	0,9	-0,2	-14,3	2,1	16,4	29,1	31,1	2,0	-14,3	-1,3	13,0	-1,5	-3,4	-1,9	.	.	
Lithuania (2010-2011)	8,5	7,4	-1,2	7,3	7,8	0,5	1,2	0,9	-0,2	-14,8	3,8	18,6	33,3	33,3	0,0	-7,7	-2,4	5,3	-1,8	-2,3	-0,5	.	.	
Average	**8,4**	**7,9**	**-0,5**	**6,6**	**7,3**	**0,7**	**1,3**	**1,1**	**-0,2**	**0,6**	**5,2**	**4,6**	**29,8**	**30,8**	**1,0**	**-1,7**	**0,8**	**2,7**	**-3,1**	**-4,1**	**-1,0**	**6,1**	**5,1**	**-1,0**

Source: Own elaboration

Table 9. Episodes of major fiscal devaluation (a fall of ESSC/VAT ratio) accompanied by economic contraction.

	ESSC			VAT			ESSC/VAT			GDP			VAX			EMPL			NX			WAGE		
	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ
Czech Republic (2008-2009)	9,5	9,2	-0,3	6,1	6,6	0,5	1,6	1,4	-0,2	5,5	-1,1	-6,6	40,8	38,3	-2,5	2,1	0,2	-1,9	2,7	3,2	0,5	6,0	2,7	-3,3
Romania (2005)	5,9	6,4	0,5	6,6	8,0	1,4	0,9	0,8	-0,1	8,4	4,2	-4,2	.	.		-1,7	-1,5	0,2	-9,0	-10,2	-1,2	.	.	
Hungary (2009-2010)	9,6	8,4	-1,3	7,6	8,5	0,9	1,3	1,0	-0,3	0,9	-3,0	-3,9	39,4	40,7	1,3	-2,0	-1,4	0,6	0,5	5,3	4,8	7,0	1,7	-5,2
Hungary (2012)	7,8	7,5	-0,3	8,4	9,2	0,8	0,9	0,8	-0,1	1,7	-1,6	-3,3	44,8	42,0	-2,8	0,0	0,1	0,1	6,5	7,3	0,8	3,4	2,9	-0,5
Slovakia (2011)	6,8	6,6	-0,2	6,2	6,7	0,5	1,1	1,0	-0,1	5,0	2,8	-2,2	36,6	36,6	-0,1	-1,5	1,8	3,3	-0,2	0,5	0,7	5,5	3,0	-2,5
Cyprus (2000-2003)	4,2	4,2	0,0	4,1	5,9	1,8	1,0	0,7	-0,3	4,8	3,8	-1,0	16,7	16,5	-0,1	1,8	2,4	0,6	1,8	0,1	-1,7	.	.	
Hungary (2003-2004)	9,9	9,5	-0,4	7,7	8,4	0,7	1,3	1,1	-0,2	4,5	4,4	-0,1	31,8	31,9	0,1	-0,1	-0,5	-0,4	-1,9	-3,7	-1,8	11,5	12,1	0,6
Spain (2012-2014)	8,4	8,2	-0,2	5,3	6,0	0,7	1,6	1,4	-0,2	-1,0	-1,1	-0,1	18,0	19,4	1,5	-2,7	-2,0	0,7	-1,1	1,6	2,7	1,0	0,1	-0,9
Spain (2004)	8,7	8,6	-0,1	5,8	6,1	0,3	1,5	1,4	-0,1	3,2	3,2	0,0	16,8	16,3	-0,5	3,3	3,8	0,5	-2,4	-4,0	-1,6	2,9	2,6	-0,3
Czech Republic (2008-2009)	9,5	9,2	-0,3	6,1	6,6	0,5	1,6	1,4	-0,2	5,5	-1,1	-6,6	40,8	38,3	-2,5	2,1	0,2	-1,9	2,7	3,2	0,5	6,0	2,7	-3,3
Average	**7,9**	**7,6**	**-0,3**	**6,4**	**7,3**	**0,8**	**1,2**	**1,1**	**-0,2**	**3,7**	**1,3**	**-2,4**	**30,6**	**30,2**	**-0,4**	**-0,1**	**0,3**	**0,4**	**-0,3**	**0,0**	**0,3**	**5,3**	**3,6**	**-1,7**

Source: Own elaboration

Table 10. Episodes of major fiscal revaluation (a rise of ESSC/VAT ratio) accompanied by economic expansion.

	ESSC			VAT			ESSC/VAT			GDP			VAX			EMPL			NX			WAGE		
	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ	T-1	FD	Δ
Czech Republic (2006)	9,5	9,5	0,0	6,6	6,1	-0,5	1,4	1,6	0,1	6,4	6,9	0,5	38,7	39,3	0,5	1,9	1,3	-0,6	2,7	3,0	0,3	4,1	5,9	1,7
Estonia (1998-1999)	11,1	11,0	-0,2	9,6	7,9	-1,7	1,2	1,4	0,2	11,8	1,6	-10,2	37,4	36,8	-0,5	0,0	-3,2	-3,2	-10,9	-7,5	3,5	.	.	
Estonia (2008)	10,1	11,1	1,0	8,8	7,8	-1,0	1,2	1,4	0,3	7,7	-5,4	-13,1	34,8	36,4	1,7	0,2	-0,2	-0,4	-9,2	-4,0	5,2	.	.	
Hungary (2005-2006)	9,3	9,4	0,1	8,7	7,9	-0,8	1,1	1,2	0,1	5,0	4,2	-0,9	32,5	36,1	3,6	-1,0	0,1	1,1	-3,6	-1,5	2,1	10,4	6,3	-4,1
Latvia (2008-2009)	5,7	6,3	0,6	7,6	6,1	-1,5	0,8	1,0	0,3	9,9	-9,0	-18,9	25,3	27,7	2,4	3,8	-7,6	-11,4	-20,1	-7,6	12,5	.	.	
Lithuania (1998)	8,0	8,6	0,6	8,3	8,0	-0,3	1,0	1,1	0,1	8,3	7,5	-0,8	30,4	26,3	-4,2	0,6	-0,8	-1,4	-10,1	-11,4	-1,3	.	.	
Poland (2012)	4,9	5,3	0,4	7,8	7,1	-0,7	0,6	0,8	0,1	5,0	2,1	-2,9	29,4	32,5	3,1	0,6	0,6	0,0	-1,2	1,4	2,6	4,9	1,9	-3,0
Slovakia (2012-2013)	6,7	7,1	0,4	6,0	6,2	0,2	1,0	1,2	0,2	1,7	1,6	-0,1	40,9	41,7	0,8	0,1	-0,4	-0,5	5,2	5,8	0,6	2,3	2,2	-0,1
Spain (2007-2009)	8,6	8,6	0,0	6,3	4,9	-1,4	1,4	1,8	0,4	4,2	0,4	-3,8	16,0	15,8	-0,2	4,2	-0,9	-5,1	-6,4	-4,8	1,6	3,2	6,1	2,9
Sweden (2000-2001)	1,9	3,3	1,4	8,4	8,3	-0,2	0,2	0,4	0,2	4,5	3,2	-1,4	30,8	32,1	1,3	2,1	2,3	0,2	6,5	6,6	0,0	4,1	3,2	-0,9
Italy (2007-2008)	8,1	8,6	0,5	6,0	5,8	-0,2	1,4	1,5	0,1	2,0	0,2	-1,8	19,6	20,3	0,7	2,0	0,7	-1,3	-0,8	-0,6	0,3	3,3	2,7	-0,6
Portugal (2009)	4,6	5,0	0,4	8,1	7,9	-0,2	0,6	0,7	0,1	0,2	-1,2	-1,4	19,5	20,3	0,8	0,4	-1,9	-2,3	-10,1	-3,8	6,3	2,5	0,4	-2,1
Average	**7,4**	**7,8**	**0,4**	**7,7**	**7,0**	**-0,7**	**1,0**	**1,2**	**0,2**	**5,6**	**1,0**	**-4,6**	**29,6**	**30,4**	**0,8**	**1,2**	**-0,8**	**-2,1**	**-4,8**	**-2,0**	**2,8**	**4,4**	**3,6**	**7,4**

Source: Own elaboration.

Table 11. Correlation coefficients of ESSC/VAT ratio and key dependent variables by quartiles of a degree of centralisation of wage negotiation (*cwb*).

	Degree of centralisation of wage negotiation (cwb)					
	Q1	Q2	Q3	Q4	Wald test	p_value
GDP	-0,0181	-0,0737	-0,2029	-0,2812	5,00	0,17
EMPL	-0,2151***	-0,0151	-0,1104	-0,3316***	4,89	0,18
VAX	**0,0769**	**-0,5749*** **	**-0,7555*** **	**-0,1245**	**74,51**	**0,00**
NX	**-0,0814**	**-0,1325**	**-0,4138*** **	**-0,2117**	**9,56**	**0,02**
WAGE	**0,4181*** **	**0,0086**	**-0,0523**	**-0,1439**	**15,78**	**0,00**

Source: Own calculation.

Table 12. Correlation coefficients of ESSC/VAT ratio and key dependent variables by quantiles ofa level at which wage bargaining takes place (*level*).

	The predominant level at which wage bargaining takes place (level)						
	level=1	level=2	level=3	level=4	level=5	Wald test	p_value
GDP	-0,0181	0,0723	-0,1303*	0,113	-0,3978***	9,40	0,05
EMPL	-0,2151***	-0,0953	-0,0193	0,4974**	-0,4600*	19,15	0,00
VAX	**0,0769**	**0,4075*** **	**-0,6511*** **	**0,6378*** **	**-0,1752**	**89,70**	**0,00**
NX	**-0,0814**	**0,4358*** **	**-0,2518*** **	**0,4005***	**-0,2614***	**26,65**	**0,00**
WAGE	**0,4181*** **	**0,6677*** **	**0,0147**	**-0,4479** **	**-0,4769*** **	**38,34**	**0,00**

Source: Own calculation.

Table 13. Correlation coefficients of ESSC/VAT ratio and key dependent variables by quantiles of benefit net replacement rate for single workers (*nrr_single*).

	Net replacement rate for single workers					
	Q1	Q2	Q3	Q4	Wald test	p_value
GDP	-0,1055	-0,1187	-0,2381***	-0,1088	1,55	0,67
EMPL	**-0,3753*** **	**-0,0337**	**-0,3091*** **	**-0,0272**	**12,39**	**0,01**
VAX	**-0,2773*** **	**-0,3235*** **	**0,1043**	**-0,5115*** **	**17,39**	**0,00**
NX	**-0,2561*** **	**0,1352**	**0,3010*** **	**-0,2581*** **	**26,32**	**0,00**
WAGE	**0,1143**	**0,2842** **	**-0,3269*** **	**-0,1043**	**18,91**	**0,00**

Source: Own calculation.

Table 14. Correlation coefficients of ESSC/VAT ratio and key dependent variables by quantiles of benefit net replacement rate for married couples with children (*nrr_couple*).

	Net replacement rate for couples					
	Q1	Q2	Q3	Q4	Wald test	p_value
GDP	0,0979	-0,3230***	-0,0897	-0,2212**	11,53	0,01
EMPL	**-0,2487*** **	**-0,2888*** **	**0,0194**	**-0,0886**	**8,76**	**0,03**
VAX	**0,108**	**-0,2809*** **	**-0,8386*** **	**-0,2289** **	**71,45**	**0,00**
NX	0,0773	-0,2259**	-0,1351	-0,1556	5,84	0,12
WAGE	**0,1583**	**0,2085** **	**-0,1021**	**-0,2215** *	**11,07**	**0,01**

Source: Own calculation.

Table 15. Correlation coefficients of ESSC/VAT ratio and key dependent variables by quantiles of trade openness (*openness*).

	Degree of openness to international trade					
	Q1	Q2	Q3	Q4	Wald test	p_value
GDP	-0,1371	-0,0711	0,0927	-0,1879*	5,294	0,15
EMPL	0,0944	-0,1969**	-0,2101**	-0,3455***	13,334	0,00
VAX	**0,1261**	**0,1642** *	**0,3136*** **	**-0,3399*** **	**27,906**	**0,00**
NX	**0,4935*** **	**-0,1417**	**-0,0159**	**-0,3477*** **	**39,289**	**0,00**
WAGE	**-0,2077** **	**0,4051*** **	**0,4141*** **	**-0,0823**	**29,888**	**0,00**

Source: Own calculation

Table 16. Correlation coefficients of ESSC/VAT ratio and key dependent variables by eurozone membership.

	Eurozone membership			
	Euro	Non - Euro	Wald test	p_value
GDP	-0,1202**	-0,0468	0,57	0,45
EMPL	-0,1812***	-0,1484*	0,12	0,73
VAX	**-0,3475*** **	**0,3726*** **	**50,13**	**0,00**
NX	-0,1635***	-0,0564	1,21	0,27
WAGE	**-0,0285**	**0,4139*** **	**14,23**	**0,00**

Source: Own calculation

Table 17. Estimation results: Panel data fixed effects models

	Fiscal devaluation (FE model)					Fiscal devaluation cyclically adjusted (FE model)				
	`(1)	`(2)	`(3)	`(4)	`(5)	`(6)	`(7)	`(8)	`(9)	`(10)
	Value added in export (VAX)	**NX**	**GDP**	**EMPL**	**WAGE**	**Value added in export (VAX)**	**NX**	**GDP**	**EMPL**	**WAGE**
FD	-9.707***	-5.166***	-2.986***	-3.980***	7.391***					
	(-7.66)	(-3.92)	(-2.80)	(-5.19)	(6.54)					
Cyclical_FD						-9.461***	-4.824***	-2.771***	-3.852***	7.145***
						(-7.49)	(-3.65)	(-2.61)	(-5.17)	(6.27)
Output gap	-0.103	-0.408***	0.980***	0.417***	0.412***	-0.0848	-0.386***	0.974***	0.403***	0.387***
	(-1.60)	(-6.33)	(18.53)	(10.86)	(6.47)	(-1.31)	(-5.90)	(18.21)	(10.65)	(6.04)
NEER	0.0233**	0.0157**	-0.00514	-0.00210	-0.0388**	0.0231**	0.0153**	-0.00558	-0.00202	-0.0386**
	(2.39)	(2.17)	(-0.86)	(-0.19)	(-2.06)	(2.37)	(2.10)	(-0.93)	(-0.19)	(-2.04)
CAPB	-0.0213	0.0875	-0.0765	0.0235	-0.0273	-0.0187	0.0805	-0.0641	0.0292	-0.0288
	(-0.37)	(1.46)	(-1.57)	(0.68)	(-0.56)	(-0.32)	(1.33)	(-1.32)	(0.86)	(-0.59)
Unemp	0.177**	0.266***	0.504***	-0.00234	-0.109*	0.167**	0.276***	0.480***	-0.0193	-0.105
	(2.49)	(3.61)	(8.54)	(-0.06)	(-1.71)	(2.36)	(3.70)	(8.06)	(-0.46)	(-1.63)
N	473	457	478	484	362	473	446	465	471	362
r2	0.149	0.313	0.501	0.412	0.346	0.145	0.309	0.499	0.412	0.340

Notes: Panel data models with 5 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$, $WAGE_t$. Models 1-5 use raw data on fiscal devaluation , while models 6-7 use cyclically adjusted data on fiscal devaluation. All models are discussed in section 5. Variables definitions are reported in Table 6. Presented regressions were carried out using fixed effects (FE) estimators for each model. The estimation has been carried out on a sample of 27 countries over 1995-2014. Numbers in parenthesis are t-statistics, stars denote coefficient estimates significance at 1%(***), 5%(**) and 10%(*) levels.

Table 18. Estimation results: Panel data fixed effects models with Discroll-Kraay and GMM estimators

	Discroll-Kraay estimator					GMM estimator				
	`(1)	`(2)	`(3)	`(4)	`(5)	`(6)	`(7)	`(8)	`(9)	`(10)
	Value added in export (VAX)	**NX**	**GDP**	**EMPL**	**WAGE**	**Value added in export (VAX)**	**NX**	**GDP**	**EMPL**	**WAGE**
FD	-9.707***	-5.166**	-2.986*	-3.980***	7.391***	-12.20***	-8.974***	-4.214**	-5.878***	6.754***
	(-6.24)	(-2.37)	(-1.90)	(-3.31)	(6.02)	(-7.34)	(-3.42)	(-1.97)	(-5.06)	(3.96)
Output gap	-0.103	-0.408***	0.980***	0.417***	0.412***	-0.0722	-0.294*	0.124	0.442***	0.229**
	(-0.87)	(-5.29)	(3.96)	(4.79)	(3.47)	(-0.64)	(-1.69)	(0.81)	(5.80)	(1.99)
NEER	0.0233***	0.0157***	-0.00514	-0.00210	-0.0388**	0.0332***	0.0352**	-0.0148	0.0125	-0.100***
	(3.60)	(3.29)	(-0.63)	(-0.15)	(-2.57)	(3.38)	(2.23)	(-1.42)	(0.59)	(-3.60)
CAPB	-0.0213	0.0875	-0.0765	0.0235	-0.0273	-1.402***	-1.807***	0.952**	-0.00948	0.434
	(-0.28)	(1.54)	(-1.24)	(0.48)	(-0.59)	(-4.02)	(-3.13)	(1.98)	(-0.05)	(1.25)
Unemp	0.177*	0.266*	0.504**	-0.00234	-0.109	0.461***	0.663***	0.0234	0.243***	-0.330**
	(1.99)	(2.15)	(2.55)	(-0.04)	(-1.16)	(3.45)	(2.89)	(0.14)	(2.91)	(-2.36)
N	473	457	478	484	362	448	431	460	458	344
F (p value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000

Notes: Panel data models with 5 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$, $WAGE_t$. Models 1-5 use Driscoll-Kraay estimator and Models 6-10 GMM estimators.
All models are discussed in section 5. Variables definitions are reported in Table 6. The estimation has been carried out on a sample of 27 countries over 1995-2014. Numbers in parenthesis are t-statistics, stars denote coefficient estimates significance at 1%(***), 5%(**) and 10%(*) levels.

Table 19. Estimation results: Analysis of non-linear implications: Eurozone membership and openness of the economy

	Eurozone membership					Openness of the economy				
	`(1)	`(2)	`(3)	`(4)	`(5)	`(6)	`(7)	`(8)	`(9)	`(10)
	Value added in export (VAX)	NX	GDP	EMPL	WAGE	Value added in export (VAX)	NX	GDP	EMPL	WAGE
FD	-8.232***	-4.298***	-3.534***	-4.157***	7.226***	-3.269**	0.901	-3.916**	-5.257***	11.35***
	(1.21)	(1.31)	(1.07)	(0.78)	(1.14)	(1.57)	(1.95)	(1.86)	(1.36)	(1.75)
FD*EURO	-2.864***	-2.393**	0.197	-0.234	-0.398					
	(0.95)	(1.02)	(0.87)	(0.61)	(0.88)					
EURO	5.501***	3.860***	-1.760**	-0.479	-0.780					
	(0.95)	(1.03)	(0.88)	(0.61)	(0.92)					
FD*OPEN						0.0162	0.00289	0.00244	0.0194	-0.0786***
						(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
OPEN						0.105***	0.101***	-0.0150	-0.0121	0.0154
						(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
N	473	457	478	484	362	458	443	464	469	362
r2	0.260	0.345	0.523	0.423	0.368	0.553	0.534	0.508	0.422	0.439
F	22.14	31.89	69.48	47.05	27.93	75.16	67.08	63.59	45.43	37.49

Notes: Panel data models with 5 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$, $WAGE_{it}$. Models 1-5 analyzes Eurozone membership, while Models 6-10 trade openness. Control variables used in the models remain unchanged: *Output gap*$_{it}$, $NEER_{it}$, $CAPB_{it}$ and $Unemp_{it}$
All models are discussed in section 5. Variables definitions are reported in Table 6. The estimation has been carried out on a sample of 27 countries over 1995-2014. Numbers in parenthesis are standard errors, stars denote coefficient estimates significance at 1%(***), 5%(**) and 10%(*) levels.

Table 20. Estimation results: Analysis of non-linear (labour market) implications: Centralisation of wage bargaining and level at which wage bargaining takes place

	Centralisation of wage bargaining					The predominant level at which wage bargaining takes place				
	`(1)	`(2)	`(3)	`(4)	`(5)	`(6)	`(7)	`(8)	`(9)	`(10)
	Value added in export (VAX)	NX	GDP	EMPL	WAGE	Value added in export (VAX)	NX	GDP	EMPL	WAGE
FD	-17.25***	-10.61***	-2.617	-4.549***	14.95***	-17.70***	-8.420***	-1.698	-3.522***	15.11***
	(2.22)	(2.34)	(1.88)	(1.31)	(1.84)	(2.22)	(2.36)	(1.91)	(1.36)	(1.88)
FD*CWB	3.090***	2.224***	-0.326	-0.00698	-2.819***					
	(0.69)	(0.73)	(0.59)	(0.41)	(0.55)					
CWB	-2.757***	-1.970***	0.475	0.270	2.897***					
	(0.55)	(0.58)	(0.46)	(0.32)	(0.44)					
FD*LEVEL						3.344***	1.492*	-0.733	-0.386	-2.931***
						(0.74)	(0.78)	(0.63)	(0.45)	(0.60)
LEVEL						-2.887***	-1.590***	0.815*	0.556*	2.890***
						(0.55)	(0.58)	(0.47)	(0.33)	(0.44)
N	450	423	442	450	343	470	453	474	483	362
r2	0.202	0.336	0.506	0.430	0.422	0.209	0.344	0.504	0.431	0.427
F	15.15	28.26	60.11	45.05	33.18	16.48	31.42	64.00	48.60	35.74

Notes: Panel data models with 5 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$, $WAGE_{it}$. Models 1-5 analyzes Centralization of wage bargaining , while Models 6-10 the predominant level at which wage bargaining takes place. Control variables used in the models remain unchanged: $Output\ gap_{it}$, $NEER_{it}$, $CAPB_{it}$ and $Unemp_{it}$
All models are discussed in section 5. Variables definitions are reported in Table 6. The estimation has been carried out on a sample of 27 countries over 1995-2014. Numbers in parenthesis are standard errors, stars denote coefficient estimates significance at 1%(***), 5%(**) and 10%(*) levels.

Table 21. Estimation results: Analysis of non-linear (labour market) implications: Unemployment benefits: single person and family

	Net replacement rate of unemployment benefits (single person)					Net replacement rate of unemployment benefits (family)				
	`(1)	`(2)	`(3)	`(4)	`(5)	`(6)	`(7)	`(8)	`(9)	`(10)
	Value added in export (VAX)	**NX**	**GDP**	**EMPL**	**WAGE**	**Value added in export (VAX)**	**NX**	**GDP**	**EMPL**	**WAGE**
FD	-16.18***	-1.976	-7.228***	-10.97***	15.88***	-18.49***	-0.743	-5.357	-10.44***	19.53***
	(3.04)	(3.32)	(2.71)	(1.84)	(2.59)	(4.06)	(4.33)	(3.70)	(2.44)	(3.39)
FD*NRR_Single	12.72**	-6.850	7.927*	13.04***	-16.43***					
	(5.29)	(5.77)	(4.76)	(3.21)	(4.55)					
NRR_Single	-23.23***	5.695	-4.977	-15.89***	18.99***					
	(6.08)	(6.69)	(5.36)	(3.65)	(5.51)					
FD*NRR_couple						15.01**	-7.412	3.398	10.29***	-19.81***
						(6.18)	(6.58)	(5.66)	(3.72)	(5.13)
NRR_Couple						-20.42***	3.450	-0.778	-11.65***	24.51***
						(6.87)	(7.30)	(6.04)	(4.14)	(6.03)
N	466	440	458	464	362	466	440	458	464	362
r2	0.172	0.324	0.502	0.427	0.371	0.153	0.326	0.499	0.413	0.378
F	12.85	27.93	61.28	45.96	28.33	11.17	28.15	60.40	43.36	29.11

Notes: Panel data models with 5 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$, $WAGE_{it}$. Models 1-5 analyzes net replacement rate of unemployment benefits for a single worker, while Models 6-10 for a family (a worker with two children and not working spouse) Control variables used in the models remain unchanged: *Output gap*$_{it}$, $NEER_{it}$, $CAPB_{it}$ and $Unemp_{it}$
All models are discussed in section 5. Variables definitions are reported in Table 6. The estimation has been carried out on a sample of 27 countries over 1995-2014. Numbers in parenthesis are standard errors, stars denote coefficient estimates significance at 1%(***), 5%(**) and 10%(*) levels.

Table 22. Estimation results: Spatial panel data models: All variables spatially lagged

	Dependent variable:							
	VAX		NX		GDP		EMPL	
Specification	Non spatial model	SDM panel with all variables spatially-lagged	Non spatial model	SDM panel with all variables spatially-lagged	Non spatial model	SDM panel with all variables spatially-lagged	Non spatial model	SDM panel with all variables spatially-lagged
	(1)	`(2)	(3)	`(4)	(5)	`(6)	(7)	`(8)
FD	-9.707***	-2.986***	-5.166***	-2.926**	-2.986***	-2.926**	-3.980***	-4.073***
	(-7.66)	(-2.80)	(-3.92)	(-2.92)	(-2.80)	(-2.92)	(-5.19)	(0.83))
Output gap	-0.103	0.980***	-0.408***	0.225***	0.980***	0.225***	0.417***	0.238***
	(-1.60)	(18.53)	(-6.33)	(0.08)	(18.53)	(0.08)	(10.86)	(0.05)
NEER	0.0233**	-0.00514	0.0157**	0.032***	-0.00514	0.032***	-0.00210	0.010*
	(2.39)	(-0.86)	(2.17)	(0.00)	(-0.86)	(0.00)	(-0.19)	(0.00)
ΔCAPB	-0.0213	-0.0765	0.0875	0.085	-0.0765	0.085	0.0235	-0.006
	(-0.37)	(-1.57)	(1.46)	(0.06)	(-1.57)	(0.06)	(0.68)	(0.03)
Unemp	0.177**	0.504***	0.266***	0.303***	0.504***	0.303***	-0.00234	-0.193***
	(2.49)	(8.54)	(3.61)	(0.07)	(8.54)	(0.07)	(-0.06)	(0.05)
W FD	NA	-10.256***	NA	-19.217***	NA	-3.368***	NA	2.611
		(2.98)		(3.64)		(0.89)		(1.85)
W Output gap	NA	-0.099	NA	-0.367**	NA	0.627**	NA	0.313***
		(0.10)		(0.15)		(0.05)		(0.15)
W NEER	NA	0.092**	NA	0.236***	NA	-0.008***	NA	0.052*
		(0.37)		(0.05)		(0.00)		(0.03)
W CAPB	NA	0.127	NA	-0.193	NA	-0.185	NA	0.099
		(0.176)		(0.227)		(0.037)		(0.13)
W Unemp	NA	-0.161	NA	0.194	NA	0.084	NA	0.578***
		(0.19)		(0.25)		(0.05)		(0.15)
W VAX	NA	0.0487***	NA	NA	NA	NA	NA	NA
		(0.74)						
W NX	NA	NA	NA	-0.197	NA	NA	NA	NA
				(0.12)				
W GDP	NA	NA	NA	NA	NA	0.522***	NA	NA
						(0.07)		
W EMPL	NA	NA	NA	NA	NA	NA	NA	0.230**
								(0.11)
N	473	416	457	416	478	416	484	416
r2	0.149	0.338	0.313	0.342	0.501	0.741	0.412	0.507
SDM vs Non-spatial FE	NA	157.9	NA	57.82	NA	442.36	NA	52.05
		(0.000)		(0.000)		(0.000)		(0.000)
SDM vs SEM	NA	28.77	NA	51.94	NA	45.10	NA	21.82
		(0.000)		(0.000)		(0.000)		(0.000)

Notes: The estimated models are: Columns: 1, 3, 5, 7 – panel data models, with no spatially lagged variables, Columns: 2, 4, 6, 8– spatial Durbin models (SDM), with all variables spatially lagged. Each pair of model estimates 4 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$. All models are discussed in Section 5. Variables definitions are reported in Table 6. Presented regressions were carried out using fixed effects (FE) estimators. The estimation has been carried out on a sample of 27 countries over 1995-2014. Numbers in parentheses are t-statistics in case of non-spatial models and z-statistics for spatial models. Two bottom rows contain test statistics and p-values for testing the validity of SDM vs. SEM (Spatial Error Model) and SDM vs. non-spatial model specification. The tests are presented in Section 5. Stars denote coefficient estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 23. Estimation results: Direct, indirect and total effects of spatial estimates

Specification	SDM panel with all variables spatially-lagged					
	Dependent variable:					
	VAX			NX		
	Direct	Indirect	Total	Direct	Indirect	Total
	(1)	(2)	`(3)	(4)	(5)	`(6)
FD	-4.759***	-23.078***	-27.837***	-2.737*	-15.746***	-18.483***
	(1.17)	(4.60)	(4.59)	(1.58)	(2.92)	(2.47)
Output gap	0.016	-0.165	-0.149	-0.215***	-0.271**	-0.486***
	(0.06)	(0.17)	0.18	(0.081)	(0.11)	(0.09)
NEER	0.0294***	0.190**	0.220***	0.029***	0.192***	0.222***
	(0.01)	(0.08)	(0.08)	(0.01)	(0.04)	.0450739
CAPB	0.006	0.222	0.228	0.084	-0.187	-0.103
	(0.047)	(0.34)	(0.35)	(0.06)	(0.19)	(0.19)
Unemp	0.208***	-0.099	0.119	0.311***	0.120	0.431**
	(0.07)	(0.34)	0.36	(0.08)	(0.20)	(0.20)
	GDP			EMPL		
	Direct	Indirect	Total	Direct	Indirect	Total
	(7)	(8)	`(9)	(10)	(11)	`(12)
FD	-3.356***	1.735	-1.620	-4.078***	2.208	-1.870
	(0.95)	(3.72)	(3.75)	(0.90)	(2.29)	(2.17)
Output gap	0.673***	1.411***	2.083***	0.248	0.467***	0.715***
	(0.05)	(0.15)	(0.15)	(0.05)	(0.09)	(0.09)
NEER	-0.007	0.056	0.049	0.012**	0.066*	0.078**
	(0.01)	(0.06)	(0.07)	(0.01)	(0.037)	(0.04)
CAPB	-0.195***	-0.252	-0.447	-0.006	0.118	0.112
	(0.04)	(0.29)	(0.30)	(0.03)	(0.17)	(0.17)
Unemp	0.175***	2.811***	2.987***	-0.177***	0.684***	0.507***
	(0.05)	(0.29)	(0.31)	(0.05)	(0.17)	(0.18)

Notes: The estimated models are spatial Durbin models (SDM), with all variables spatially lagged and they estimate 4 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$**.** All models are discussed in section 5. Variables definitions are reported in Table 6. Presented regressions were carried out using fixed effects (FE) estimators for each model. The estimation has been carried out on a sample of 27 countries over 1995-2014. *Direct*, *indirect* and *total impact* are calculated according to the method proposed by LeSage and Pace (2009) detailed in section 5. Z-statistics for coefficient estimates are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 24. Robustness check: Time Fixed effects and crisis dummy

	Time Fixed Effects					Crisis dummy				
	`(1)	`(2)	`(3)	`(4)	`(5)	`(6)	`(7)	`(8)	`(9)	`(10)
	Value added in export (VAX)	NX	GDP	EMPL	WAGE	Value added in export (VAX)	NX	GDP	EMPL	WAGE
FD	-4.724***	-2.931**	-3.055***	-3.902***	6.045***	-6.171***	-3.103**	-5.126***	-4.469***	6.504***
	(-4.24)	(-2.14)	(-3.58)	(-5.01)	(5.54)	(-5.19)	(-2.33)	(-4.97)	(-5.62)	(6.03)
FD*Crisis						-2.232***	-2.192***	0.332	-0.272	0.962
						(-3.19)	(-2.83)	(0.56)	(-0.58)	(1.50)
Crisis						5.063***	3.563***	-2.583***	-0.442	-2.803***
						(7.22)	(4.62)	(-4.38)	(-0.97)	(-4.32)
N	473	457	478	484	362	473	457	478	484	362
r2	0.463	0.386	0.740	0.505	0.468	0.327	0.360	0.580	0.428	0.432
F	15.19	11.13	50.74	18.37	11.71	30.59	34.06	87.47	48.09	36.45

Notes: Panel data models with 5 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$, $WAGE_{it}$. Models 1-5 check time fixed effects, while Models 6-10 the impact of crisis variables. Control variables used in the models remain unchanged: $Output\ gap_{it}$, $NEER_{it}$, $CAPB_{it}$ and $Unemp_{it}$
All models are discussed in section 5. Variables definitions are reported in Table 6. Presented regressions were carried out using fixed effects (FE) estimators for each model. The estimation has been carried out on a sample of 27 countries over 1995-2014. Numbers in parenthesis are t-statistics, stars denote coefficient estimates significance at 1%(***), 5%(**) and 10%(*) levels.

Table 25. Robustness check: removed 5% of highest changes in FD and change in FD specification

	Removed 5% of highest changes in FD					Separate ESSC and VAT				
	`(1)	`(2)	`(3)	`(4)	`(5)	`(6)	`(7)	`(8)	`(9)	`(10)
	Value added in export (VAX)	NX	GDP	EMPL	WAGE	Value added in export (VAX)	NX	GDP	EMPL	WAGE
FD	-11.36***	-6.988***	-2.122*	-3.396***	7.605***					
	(-8.11)	(-4.66)	(-1.85)	(-4.58)	(5.68)					
ESSC						-1.640***	-1.775***	-0.256	-0.340**	1.668***
						(-6.39)	(-6.95)	(-1.18)	(-2.16)	(6.40)
VAT						1.274***	-0.586**	0.409*	0.635***	-0.645**
						(5.02)	(-2.28)	(1.90)	(4.12)	(-2.47)
N	444	427	456	468	340	473	457	478	484	362
r2	0.180	0.331	0.506	0.403	0.350	0.167	0.366	0.498	0.407	0.360
F	18.13	39.00	86.82	73.79	33.99	14.77	40.78	73.50	51.53	31.58

Notes: Panel data models with 5 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL$, $WAGE_{it}$. In Models 1-5 5% of highest changes in FD were removed from the sample , while in Models 6-10 the FD was estimated as a separate variables for: ESSC and VAT. Control variables used in the models remain unchanged: $Output\ gap_{it}$, $NEER_{it}$, $CAPB_{it}$ and $Unemp_{it}$
All models are discussed in section 5. Variables definitions are reported in Table 6. Presented regressions were carried out using fixed effects (FE) estimators for each model. The estimation has been carried out on a sample of 27 countries over 1995-2014. Numbers in parenthesis are t-statistics, stars denote coefficient estimates significance at 1%(***), 5%(**) and 10%(*) levels.

Table 26. Robustness check: excluding countries (one by one)

	Dependent variable:				
	Value added in export (VAX)	**NX**	**GDP**	**EMPL**	**WAGE**
	`(1)	**`(2)**	**`(3)**	**`(4)**	**`(5)**
All countries included	-9.707***	-5.166***	-2.986***	-3.980***	7.391***
	(-7.66)	(-3.92)	(-2.80)	(-5.19)	(6.54)
Excluded countries:					
Austria	-9.568***	-5.016***	-3.019***	-3.975***	7.439***
	(-7.52)	(-3.77)	(-2.78)	(-5.07)	(6.42)
Belgium	-9.787***	-5.071***	-3.007***	-4.016***	7.477***
	(-7.57)	(-3.77)	(-2.76)	(-5.12)	(6.44)
Bulgaria	-10.00***	-5.073***	-3.729***	-4.812***	7.391***
	(-7.43)	(-3.83)	(-3.32)	(-6.03)	(6.54)
Croatia	-9.707***	-5.263***	-2.857***	-3.985***	7.391***
	(-7.66)	(-3.98)	(-2.67)	(-5.32)	(6.54)
Cyprus	-9.582***	-5.895***	-3.408***	-4.124***	7.391***
	(-7.65)	(-4.46)	(-3.16)	(-5.31)	(6.54)
Czech Republic	-9.707***	-5.166***	-2.986***	-3.980***	7.391***
	(-7.66)	(-3.92)	(-2.80)	(-5.19)	(6.54)
Estonia	-9.799***	-5.620***	-2.523**	-3.885***	7.391***
	(-7.61)	(-4.25)	(-2.46)	(-5.18)	(6.54)
Finland	-10.15***	-5.799***	-3.085***	-4.199***	7.333***
	(-7.89)	(-4.45)	(-2.84)	(-5.36)	(6.25)
France	-9.869***	-4.852***	-2.900***	-3.961***	7.587***
	(-7.58)	(-3.60)	(-2.65)	(-5.02)	(6.45)
Germany	-8.775***	-4.647***	-2.921***	-4.019***	7.863***
	(-6.86)	(-3.42)	(-2.65)	(-5.05)	(6.64)
Greece	-9.740***	-5.522***	-2.816***	-3.838***	7.346***
	(-7.50)	(-4.11)	(-2.62)	(-4.95)	(6.56)
Hungary	-8.545***	-4.230***	-3.596***	-4.019***	5.262***
	(-6.39)	(-3.02)	(-3.19)	(-4.93)	(4.61)
Ireland	-10.21***	-5.488***	-2.707***	-3.764***	7.759***
	(-8.31)	(-4.18)	(-2.59)	(-5.07)	(6.88)
Italy	-10.25***	-5.845***	-3.111***	-4.109***	7.707***
	(-7.66)	(-4.23)	(-2.76)	(-5.06)	(6.33)
Latvia	-9.641***	-5.543***	-2.661**	-3.617***	7.391***
	(-7.46)	(-4.22)	(-2.55)	(-4.81)	(6.54)
Lithuania	-8.888***	-4.816***	-2.676**	-3.775***	7.391***
	(-7.37)	(-3.61)	(-2.54)	(-4.94)	(6.54)
Luxembourg	-8.767***	-4.101***	-3.000***	-4.030***	7.841***
	(-6.88)	(-3.20)	(-2.81)	(-5.10)	(6.73)
Malta	-9.384***	-5.057***	-2.879***	-3.838***	7.391***
	(-7.53)	(-3.85)	(-2.68)	(-4.97)	(6.54)
Netherlands	-11.21***	-6.232***	-2.882**	-4.001***	8.263***
	(-8.50)	(-4.48)	(-2.57)	(-4.89)	(6.79)
Poland	-9.433***	-5.118***	-2.935***	-3.711***	6.052***
	(-7.56)	(-3.83)	(-2.67)	(-4.79)	(5.87)
Portugal	-9.658***	-5.151***	-3.052***	-4.006***	7.400***
	(-7.46)	(-3.84)	(-2.84)	(-5.16)	(6.46)
Romania	-9.985***	-4.735***	-3.453***	-4.304***	7.391***
	(-7.50)	(-3.48)	(-3.16)	(-5.64)	(6.54)
Slovakia	-9.774***	-4.370***	-2.861**	-4.076***	7.688***
	(-7.39)	(-3.27)	(-2.58)	(-5.08)	(6.64)
Slovenia	-9.985***	-4.735***	-3.453***	-4.304***	7.391***
	(-7.50)	(-3.48)	(-3.16)	(-5.64)	(6.54)
Spain	-10.56***	-5.758***	-2.611**	-3.331***	7.650***
	(-7.71)	(-4.07)	(-2.26)	(-4.10)	(6.16)
Sweden	-9.793***	-5.227***	-2.926***	-3.934***	7.356***
	(-7.57)	(-3.88)	(-2.70)	(-5.02)	(6.33)
United Kingdom	-9.707***	-5.166***	-2.986***	-3.980***	7.391***
	(-7.66)	(-3.92)	(-2.80)	(-5.19)	(6.54)

Notes: Panel data models with 5 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$, $WAGE_{it}$. Subsequent rows present estimation results obtained by excluding given country (one by one) from the sample. Control variables used in the models remain unchanged: *Output gap*$_{it}$, $NEER_{it}$, $CAPB_{it}$ and $Unemp_{it}$
All models are discussed in section 5. Variables definitions are reported in Table 6. Presented regressions were carried out using fixed effects (FE) estimators for each model. The estimation has been carried out on a sample of 27 countries over 1995-2014
Numbers in parenthesis are t-statistics , stars denote coefficient estimates significance at 1%(***), 5%(**) and 10%(*) levels.

Table 27. Robustness check: SDM with change of weight matrix

Specification	SDM panel with all variables spatially-lagged (a change of a weight matrix from distance to travel time)											
	Dependent variable:											
	VAX			NX			GDP			EMPL		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
	(1)	(2)	`(3)	(4)	(5)	`(6)	(7)	(8)	`(9)	(10)	(11)	`(12)
FD	-4.722***	-21.572***	-26.295***	-2.476	-15.614***	-18.090***	-3.320***	0.720	-2.600	-3.967***	1.946	-2.021
	(1.15)	(5.00)	(5.01)	(1.55)	(3.29)	(2.93)	(0.93)	(3.98)	(4.01)	(0.88)	(2.50)	(2.41)
Output gap	0.021	-0.126	-0.105	-0.194**	-0.238*	-0.432***	0.676***	1.645***	2.321***	0.244***	0.544***	0.787***
	(0.06)	(0.20)	(0.21)	(0.083)	(0.13)	(0.12)	(0.05)	(0.17)	(0.18)	(0.05)	(0.10)	(0.11)
NEER	0.029***	0.240**	0.268**	0.028***	0.231***	0.259***	*-0.005	0.112	0.108	0.012**	0.093*	0.106**
	(0.01)	(0.10)	(0.11)	(0.01)	(0.06)	(0.06)	(0.01)	(0.08)	(0.08)	(0.01)	(0.05)	(0.05)
CAPB	0.005	0.212	0.217	0.0774642	-0.207	-0.130	-0.207***	-0.532	-0.739**	-0.011	0.079	0.067
	(0.05)	(0.40)	(0.41)	(0.06)	(0.24)	(0.24)	(0.04)	(0.34)	(0.35)	0.034	(0.20)	(0.21)
Unemp	0.214***	-0.059	0.156	0.315***	0.250	0.566**	0.178***	3.404***	3.583***	-0.182***	0.844***	0.662***
	(0.06)	(0.41)	(0.43)	(0.082)	(0.26)	(0.26)	(0.052)	(0.36)	(0.38)	(0.05)	(0.204)	(0.21)
N		416			416			416			416	
R2		0.336			0.383			0.741			0.513	
SDM vs SEM		164.93			50.70			474.17			59.41	
		(0.00)			(0.00)			(0.00)			(0.00)	
SDM vs Non-spatial FE		21.77			36.15			46.21			20.57	
		(0.00)			(0.00)			(0.00)			(0.00)	

Notes: The estimated models are spatial Durbin models (SDM), with all variables spatially lagged and they estimate 4 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$. All models are discussed in section 5 and 7. Variables definitions are reported in Table 6. Presented regressions were carried out using fixed effects (FE) estimators for each model. The estimation has been carried out on a sample of 27 countries over 1995-2014. *Direct*, *indirect* and *total impact* are calculated according to the method proposed by LeSage and Pace (2009) detailed in section 5. Z-statistics for coefficient estimates are given in parentheses. Two bottom rows contain test statistics and p-values for testing the validity of SDM vs. SEM (Spatial Error Model) and SDM vs. non-spatial model specification. Stars denote coefficient estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 28. Robustness check: SDM with time variables

Specification	SDM panel with all variables spatially-lagged and time variables											
	Dependent variable:											
	VAX			NX			GDP			EMPL		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
	(1)	(2)	`(3)	(4)	(5)	`(6)	(7)	(8)	`(9)	(10)	(11)	`(12)
FD	`-4.143***	`-12.846***	`-16.989***	`-3.060**	`-15.842***	`-18.902***	`-3.174***	6.593	3.420	`-3.915***	1.380	`-2.535
	(1.18)	(4.63)	(4.50)	(1.57)	(4.48)	(4.02)	(0.97)	(5.33)	(5.39)	(0.91)	(3.53)	(3.43)
Output gap	0.051	0.201	0.252	`-0.246***	`-0.481**	`-0.737***	0.688***	1.427***	2.115***	0.241***	0.269	0.510***
	(0.06)	(0.23)	(0.24)	(0.08)	(0.24)	(0.24)	.0524341	(0.32)	(0.34)	(0.05)	(0.18)	(0.18)
NEER	0.025***	0.102***	0.127***	0.031***	0.231***	0.262***	`-0.008	0.052	0.043	0.010*	0.032	0.041
	(0.01)	(0.04)	(0.04)	(0.01)	(0.04)	(0.038)	(0.01)	(0.04)	(0.04)	(0.01)	(0.03)	(0.03)
CAPB	0.018	0.311	0.328	0.091	`-0.000	0.091	`-0.188***	`-0.108	`-0.296	`-0.027	`-0.193	`-0.219
	(0.05)	(0.22)	(0.22)	(0.06)	(0.22)	(0.21)	(0.04)	(0.26)	(0.27)	(0.03)	(0.18)	(0.18)
Unemp	0.210***	0.205	0.415	0.271***	0.028	0.300	0.142***	1.928***	2.070***	`-0.194***	0.145	`-0.049
	(0.06)	(0.26)	(0.26)	(0.08)	(0.27)	(0.26)	(0.05)	(0.36)	(0.38)	(0.05)	(0.20)	(0.20)
N		416			416			416			416	
R2		0.336			0.383			0.741			0.513	
SDM vs SEM		164.93			50.70			474.17			59.41	
		(0.00)			(0.00)			(0.00)			(0.00)	
SDM vs Non-spatial FE		21.77			36.15			46.21			20.57	
		(0.00)			(0.00)			(0.00)			(0.00)	

Notes: The estimated models are spatial Durbin models (SDM), with all variables spatially lagged and they estimate 4 dependent variables: VAX_{it}, NX_{it}, GDP_{it}, $EMPL_{it}$. All models are discussed in section 5 and 7. Variables definitions are reported in Table 6. Presented regressions were carried out using fixed effects (FE) estimators for each model. The estimation has been carried out on a sample of 27 countries over 1995-2014. *Direct*, *indirect* and *total impact* are calculated according to the method proposed by LeSage and Pace (2009) detailed in section 5. Z-statistics for coefficient estimates are given in parentheses. Two bottom rows contain test statistics and p-values for testing the validity of SDM vs. SEM (Spatial Error Model) and SDM vs. non-spatial model specification. Stars denote coefficient estimates significance at 1% (***), 5% (**), 10% (*) levels.

www.nbp.pl