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Real Effective Exchange Rates determinants and growth: lessons from Italian regions

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Silvia Calò

(Central Bank of Ireland)[2]

Mariarosaria Comunale

(Bank of Lithuania, ECB)[3] [4]

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[2]Economist, International Relations, Central Bank of Ireland, New Wapping Street, North Wall Quay, Dublin, Ireland. Email: silvia.calo@centralbank.ie – Tel. +353 086 461 4289.

[3]Principal Economist, Applied Macroeconomic Research Division, Economics Department, Bank of Lithuania, Totorių g. 4, LT-01121 Vilnius (Lithuania). Email: mariarosaria.comunale@gmail.com ; mcomunale@lb.lt - Tel. +370 5 268 0103.

[4] Economist, Directorate General International & European Relations, External Developments, European Central Bank, Sonnemannstrasse 20, 60314 Frankfurt am Main (Germany).

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Gedimino pr. 6, LT-01103 Vilnius

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ABSTRACT

In this paper we analyse the price competitiveness of the Italian regions by computing the Real Effective Exchange Rate (REER) for each region, deflated by CPI and *vis-à-vis* the main partner countries. We use them to look for the medium-term determinants, finding significant heterogeneities in the role of government consumption and investment expenditure. Government consumption has an extremely negative effect on competitiveness in North-Eastern Italy, Southern Italy and Lazio. Investment plays a negative role especially in the North-West, while it can be positive for competitiveness in Lazio and Southern Italy. We also find that the transfer theory does not necessarily hold and it even behaves in the opposite direction in case of North-Eastern Italy and Lazio. Lastly, we show that an increase in the regional price competitiveness influences regional growth positively only in the long run and spillovers may play a role.

Keywords: Italian regions, government consumption, government investment, Real Effective Exchange Rate, growth.

JEL codes: E62, F31, F41, R11.

1. INTRODUCTION

Following the crisis in the euro area, price competitiveness within a monetary union has become a central point in academic and policy debates. Since the nominal exchange rate is not available to policy makers anymore, price adjustments have to happen through changes in prices and wages, normally via structural reforms, aimed at increasing the competitiveness of the countries that are most severely hit by asymmetric adverse shocks. In this paper, we use the case of the Italian regions to study the behaviour of Real Effective Exchange Rates (REERs) and their determinants within a monetary and fiscal union. We believe that this analysis will be helpful to look at, especially as a case of a union, along these two aspects: monetary and fiscal, not only for other countries with a different level of autonomy at regional level but also for the EU in perspective.

By using a sample of 20 regions over the period 1997-2014, sharing the same institutional characteristics but differing from each other in trade specialisation, income level, and – in the case of autonomous regions – also differing in the degree of fiscal autonomy, we exploit a natural laboratory for studying the effects of government spending on price competitiveness. Moreover, the Italian Constitutional Reform of 2001 has increased the number of expenditure competencies of sub-national governments, spurring decentralisation in fiscal policy decisions, and contributing to a divergence in the spending patterns among regions. By presenting what is to our knowledge a first study on the behaviour of REERs at sub-national level, we contribute to a better understanding of the national-level dynamics.

This paper contributes to the current literature by exploring the behaviour of the REER at sub-national level. The Italian case is used as a laboratory for studying the role of government expenditure in the context of a fiscal union, with heterogeneous level of income, productivity, and export performance. Moreover, we look at how the regional REERs may affect growth in the short and long term and at the role of spillovers and global factors. We find that the REER can influence growth in a different way in the short and long run and spillovers and other global factors can play a role as well.

The rest of the paper is structured along the following lines. Section 2 provides an overview of various aspects of the literature. Section 3 plays out our methodology to calculate the REERs and determinants, while section 4 provides information on the data sources and their description. Section 5 presents the diagnostics and the estimation strategies. The results for the determinants of the REER and the impact of the regional REERs on regional GDP growth are presented in Section 6 and 7, respectively. Section 8 concludes.

2. LITERATURE REVIEW

This paper contributes to the understanding on the determinants of REER, especially at regional level, and to the link between price competitiveness and growth. These strands of literature rely mostly on country-level data and not on regional data.

The literature on the determinants of the REERs at national level is very extensive. In modelling the long-run behaviour of the REER, the focus has been on factors such as productivity, the Balassa-Samuelson effect, and the trade balance (TB) or the net foreign asset (NFA) position. Lane and Milesi-Ferretti (2002, 2004) consider the link between the net foreign asset position, the trade balance and the REER and thereafter the determinants of the latter. The relationship between international payments and the REER is called "the transfer problem".[6] The most comprehensive study on the topic is Ricci, Milesi-Ferretti, and Lee (2013), where the authors study the long-run determinants of the REER including in the data set 48 industrial countries and emerging markets for the period 1980–2004, at annual frequency. The fundamental determinants of REER are: the relative labour productivity of the traded sector relative to the non-traded, as a proxy for the Balassa–Samuelson effect; the (commodities) terms of trade; the NFA over trade; the nominal government consumption to GDP; and an index of trade restrictions and administered prices in consumer prices. The authors find that the REER co-moves positively with the terms of trade for all the groups. The NFA position, the relative productivity and the government consumption are key for the REER in emerging countries only. Galstyan and Lane (2009) show that the composition of government spending influences the long-run behaviour of the real exchange rate, for a panel of 19 advanced economies over 1980-2004. Lastly, Comunale (2017, 2019) finds that in the EU over the last 20 years, coefficients of the determinants are extremely different across groups in magnitude and sometimes in sign as well and the transfer theory does not hold for periphery and the new member states. The relative importance of the transfer variable and the Balassa-Samuelson measure are crucial for the asymmetries.

On the other hand, also the general literature about the influence of REER on GDP growth on national level is quite extensive. The oldest studies confirm the negative influence of REER instability or distortion on growth (Dollar, 1992 for instance analyzing the 70s and 80s). In the more recent export-led growth literature instead, an undervalued exchange rate is proved as having a positive effect on growth, while overvaluation is linked with low growth episodes, as in Rodrik (2008). However, as stressed in Berg and Miao (2010), the REER is not a policy instrument, but a result of policy actions and externalities, and in any case an undervalued REER could bring a "beggar-thy-neighbour" effect. On the opposite side of the debate, the so-called Washington Consensus view considers both types of REER misalignments to be bad for growth in a long-term perspective. Results of Gala and Lucinda (2006) indicate that a real depreciation, i.e. increase in competitiveness, is associated with higher GDP growth. This paper studies the link between REER and growth by using a dynamic panel data analysis with GMM techniques, for 58 countries in 1960-1999. Lastly, Comunale (2017) argues that the REER misalignments, associated with the inflows, have been a further cause of a decline in GDP, in a long-run perspective, while they do not play a role in the short run.

In a study of four cases of large fiscal contractions, Perotti (2012) finds an improvement in the REER to be central to the success of the second Irish consolidation in the late 80s, due to wage moderation and a wage reduction in the public sector.

At regional level, there are few contributions especially related to the Chinese provinces. Chen (2015) looks at the impact of REERs on growth applying fixed-effect and the system-GMM estimators for a panel of 28 provinces for the years 1992-2008. The author finds find a negative sign for the coefficient of the REER, which implies that an increase in competitiveness has a positive effect on growth. A similar approach has been followed by Yan et al. (2016) still for province-level REERs in China. REER depreciation influences economic

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[6] The wealth effects and international investment income flows associated with non-zero net foreign asset positions require some degree of real-exchange-rate adjustment. A debtor country must run trade surpluses to service its external liabilities, and could require a more depreciated REER in the long run. On the contrary, a creditor country can run persistent trade deficits. In turn, all else equal, the capability to sustain a negative net export balance in equilibrium is associated with an appreciated REER.

growth in inland areas but not in coastal areas. This is due to the fact that the inland areas have more resources to expand their production capacity when REER depreciation leads to increased world demand.

3. EMPIRICAL FRAMEWORK FOR REER DETERMINANTS

For sake of clarity, to identify levels of government we adopt the terminology used in Cottarelli and Guerguil (2014). We refer to the General Government when describing the consolidated accounts of the national and sub-national government; with Sub-National Government we describe every level of government below the central, in the Italian case this includes regions (NUTS2) and provinces (NUTS3). The focus of our analysis is at sub-national level.

Our framework is based on Galstyan and Lane (2009), which comes from an adapted version of the two-sector small open economy model by Obstfeld and Rogoff (1996).Our setup is the following:

(1) $REER_{i,t} = \alpha_i + \beta_{i,t} X_{i,t-1} + \varepsilon_{i,t}$

where $X_{i,t-1}$ are our determinants, namely: trade balance over GDP, relative GDP per capita (Balassa-Samuelson proxy), terms of trade (TOT), government consumption and government investment. Moreover, we run this setup using four sub-samples for the four Italian groups of regions/NUTS 1: North-West; North-East; Centre; Mezzogiorno.[7] Lastly, we show results for "*regioni a statuto speciale*"[8] only, and for Lazio region in a time-series framework.

In this model, an increase in government consumption brings a real appreciation (positive coefficient expected) and an increase in government investment can result in a real depreciation (negative coefficient). Moreover, we expect the relative real GDP per capita to affect positively the REERs in the long run. The sign of the trade balance is expected to be negative. In fact, a creditor region (i.e.: a region in which the trade balance is positive, or more generally the net foreign asset position is positive) is better able to run a negative trade balances as a flow in time t-1. This should cause a decrease in competitiveness (increase in REER in time t in our setup) in order to re-equilibrate the net foreign asset position via the trade balance.[9]

The sing of terms of trade coefficient is a-priori uncertain: an increase in the TOT makes the imports relatively cheaper, but brings also a rise in the purchasing power and in the demand for non-traded goods, which can result in an appreciation of the REER in order to restore the equilibrium.

4. DATA SOURCES AND DESCRIPTION

We use a panel setup of 20 Italian regions, from 1997 to 2014 (annual data) in a static framework. We split the sample into macro-regions, namely: North West, North East, Central Italy, and Mezzogiorno. Moreover we show results for "*regioni a statuto speciale*" only and Lazio in a time-series framework.

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[7] Mezzogiorno, as defined by Istat, consists of two NUTS1 regions, "Sud" (South) and "Isole" (Islands). We choose to adopt this definition for sake of comparability with the extensive research on the economy of Southern Italy.

[8] These are the autonomous regions with special statute. Article 116 of the Italian Constitution grants that right to five regions (namely Sardinia, Sicily, Trentino-Alto Adige/Südtirol, Aosta Valley and Friuli-Venezia Giulia).

[9] This is the idea behind the so-called "transfer theory". See Lane and Milesi-Ferretti (2002, 2004) for greater detail.

The data set used for the analyses combines supranational and national data sources. To compute the REERs we rely on data from the Italian Trade Agency "ICE" for regional exports *vis-à-vis* rest of the world trade flows in order to have the time-varying exports trade weights. [10] The regional REERs are calculated from the regional Nominal Effective Exchange Rates (NEERs) and a measure of the relative price or cost between the country under study and its trading partners, here as consumer price indexes (CPIs). The calculation follows the approach in Darvas (2012):

We first use our data set on regional exports to construct the regional time-varying trade weights between region *i* and partner country *j*, $w_{ij,t}$. Since our sample includes all the destinations of Italian exports, then it holds that for each region *i* at time *t*:

$$(2)\ \sum_{j=1}^{41} w_{ij,t} = 1$$

The $NEER_{i,t}$ is calculated as:

$$(3)\ NEER_{i,t} = \prod_{j=1}^{J} w_{ij,t} * S_{ij,t}$$

where $w_{ij,t}$ are the time-varying trade weights between region i and partner country j; $S_{ij,t}$ is the bilateral nominal exchange rate between the currency of region *i* (i.e. the euro) and the currency of partner *j*.

The relative cost of region *i* vis-à-vis its trading partners, $CPI_{i,t}^{f}$ is measured as the following:

$$(4)\ CPI_{i,t}^{f} = \prod_{j}^{J} w_{ij,t} * CPI_{j,t}$$

It then enters into the Real Effective Exchange Rate calculations as follows:

$$(5)\ REER_{i,t} = \frac{NEER_{i,t} * CPI_{i,t}}{CPI_{i,t}^{f}}$$

where $REER_{i,t}$ is the Real Effective Exchange Rate at time t for region i; $CPI_{i,t}$ is the Consumer Price Index at time t for region i; $NEER_{i,t}$ is the Nominal Effective Exchange Rate at time t for region i; $CPI_{i,t}^{f}$ is the geometrically weighted average of CPI indices of trading partners at time t for region i.

The time-varying trade weights $w_{ij,t}$ have been used to compute the relative GDP per capita and government consumption vis-à-vis trading partners. For government investment, we only have 28 trading partners 28 because of data availability (also in this case the weights sum up to 1).

The data for the real GDP per capita and GDP growth of the Italian regions are from ISTAT; while for the partners are taken from WB WDI. We took nominal total GDP for each region and made it real by using the deflator (=nominal*100/deflator) from WB WDI, then we calculated per capita real GDP in euros (total real GDP/population). At the end we use the bilateral exchange rates EURUSD (from Eurostat) to have it in constant 2005 USD as the partners.

The data on the General Government comes from the OECD National Accounts Statistics database. We integrate this dataset with data from the World Bank for the government consumption of the partners. Data on government expenditure at central, regional, and local level in Italy is provided by the Italian "*Dipartimento per lo sviluppo e la coesione territoriale*", through the Regional Public Accounts (RPA) dataset.[11] The data provided by the RPA is consolidated through levels of government, so transfers between different government

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[10] ICE kindly provided the data and they can be obtained at http://actea.ice.it/.

[11] Please see: http://www.dps.gov.it/it/cpt.

levels are taken into account, allowing us to sum together the expenditure imputed to different level of government without double-counting transfers.

Lastly, the terms of trade data are from ISTAT: the international trade statistical warehouse Coeweb provides data on values and volumes at regional level.

Figure 1 shows some descriptive statistics for the average REER at regional level over the entire sample, while Figure 2 reports its standard deviation over the period. The figures show how heterogeneous the REER is across Italian regions and how differences in the REER do not necessarily persist over time. In Figures 3 and 4 we split the sample in two, before and after the global financial crisis of 2008. Quite remarkably, some regions seem to have gone from the upper to the lower end of the scale (e.g. Trentino Alto-Adige and Basilicata).

Table 1. Exports of goods by region and destination (as % total goods exports)

Region	**Macro-region**	**EU27**	**EA19**	**UK**	**Switzer-land**	**US**	**Russia**	**China**	**Japan**	**Hong Kong**
Abruzzo	South	63	33	8	2	6	2	1	1	0
Basilicata	South	57	33	16	3	3	0	0	1	0
Calabria	South	44	23	6	6	7	1	1	2	1
Campania	South	42	25	9	6	10	1	2	2	1
Emilia-Romagna	North-East	49	29	6	3	9	3	2	2	1
Friuli-Venezia Giulia	North-East	53	28	7	2	5	2	2	1	0
Lazio	Centre	49	30	7	4	9	1	1	2	1
Liguria	North-West	42	27	4	2	7	1	1	1	1
Lombardy	North-West	50	28	5	5	7	2	2	2	1
Marche	Centre	54	32	7	2	6	6	1	1	1
Molise	Centre	48	30	8	3	8	3	1	4	2
Piedmont	North-West	56	33	7	5	6	1	2	1	1
Puglia	South	50	31	7	6	10	1	1	1	0
Sardinia	Islands	51	45	2	0	7	0	1	0	0
Sicilia	Islands	42	33	4	1	8	0	0	1	0
Toscana	Centre	42	25	6	6	11	1	2	2	3
Trentino-Alto Adige	North-East	64	27	6	4	8	1	1	1	0
Umbria	Centre	50	24	6	2	10	2	3	1	1

Valle d'A-osta	North-West	50	28	5	21	4	1	2	0	1
Veneto	North-East	52	28	6	3	9	2	2	1	1

Note: Data source: ICE, author's calculations. The analysis in the paper groups South and Islands together, into Mezzogiorno.

5. ESTIMATION STRATEGY AND DIAGNOSTICS FOR REER DETERMINANTS

We test for the presence of unit roots, cointegration and cross-sectional dependence (CSD) in our static panel setups in order to select the most appropriate estimator. First of all, we check for cross-sectional independence, in order to use the proper test for unit roots, by using Pesaran's test (2004). This method provides a general diagnostic test for cross section independence in panels and allows for unbalanced datasets. We reject cross-sectional independence in all our setups but the one on "*regioni a statuto speciale*", in which we cannot reject cross-sectional independence at 1% and 5%, but only at 10% (Table 2).

[Insert Table 2 around here]

Then we apply the so-called Cross-sectionally augmented Im, Pesaran and Shin test (CIPS) or "second-generation" test (Pesaran, 2007), which is built for analysis of unit roots in heterogeneous panels setups with cross-section dependence. The test assesses the non-stationarity of our panel setups (Table 2).[12] For government investment only we can reject the null hypothesis at 10% and 5% but not at 1%.

[Insert Table 3 around here]

The test provided for cointegration in our panel, is known as "Pedroni test"[13] (Table 3). This is a procedure for heterogeneous panels, which allows for more regressors.[14] As reported by Wagner and Hlouskova (2009), the test of Pedroni applying the Augmented Dickey-Fuller (ADF) principle performs best; on the contrary, all other tests (Westerlund's included) have very low power in many circumstances (and virtually none for $T \leq 25$, which is our case). The authors conclude that in a situation where the null hypothesis of no cointegration is crucial, the Pedroni's test is the first choice. In case of Mezzogiorno only, we reject the null hypothesis of no cointegration between 5% and 1%.

[Insert Table 4 around here]

We can conclude that we are mainly in a case of non-stationarity and cointegration in a static framework in each of our specifications. Given that, it is preferred a Group Mean (GM)-Fully Modifed OLS (FMOLS) estimator proposed by Pedroni (2000) and used for instance by Carrera and Restout (2008). The simple panel OLS estimator for the static setup cannot be used because it would be biased. The GM-FMOLS is indeed an estimator that eliminates this endogeneity bias between dependent variable and regressors. In addition, it

[12] Null hypothesis assumes that all series are non-stationary. This t-test is also based on Augmented Dickey-Fuller statistics as IPS (2003) but it is augmented with the cross section averages of lagged levels and first-differences of the individual series (CADF statistics).

[13] The test has been conducted by using the RATS command @pancoint. The test is described in Pedroni (1999) and Pedroni (2004).

[14] The maximum amount of regressors in case of Pedroni's test is eight.

allows for heterogeneity of both the long-run cointegrating vector and short-run dynamics; it performs better than the (simple) within FMOLS in case of panel data and it behaves well even in relatively small samples under a variety of scenarios (Pedroni, 2000).

The GM-FMOLS estimator is built as the average of the within FMOLS estimator over the cross-sectional dimension, as in Equation 8.

$$(6)\quad \hat{\beta}_{fmols} = \left(\frac{1}{N}\right) * \sum_{i=1}^{N} \hat{\beta}_{fmols,i}$$

A conventional FMOLS estimator, as in Philips and Hansen (1990), can be obtained by transforming the regress and then applying the OLS procedure, as explained in Wang and Wu (2012). The FMOLS estimator is used when we estimate the setup for Lazio region only.

The GM-FMOLS estimator can be obtained also through the following cointegrated system as explained by Carrera and Restout (2008) and Pedroni (2000, 2001):

$$(7)\quad y_{it} = \alpha_i + x'_{it}\beta + u_{it}$$
$$(8)\quad x_{it} = x_{i,t-1} + \varepsilon_{it}$$

where α_i are the fixed effects, x_{it} is a k x 1 vector of integrated regressors (in our case the determinants of the REER), β is a k x 1 vector of slope parameters and the vector error process $(u_{it}, \varepsilon'_{it})$' is stationary. Its asymptotic covariance matrix Ω_i can be further decomposed:

$$(9)\quad \Omega_I \equiv \begin{bmatrix} \Omega_{u_i} & \Omega_{u\varepsilon_i} \\ \Omega_{\varepsilon u_i} & \Omega_{\varepsilon_i} \end{bmatrix} = \Omega_i^0 + \Gamma_i + \Gamma'_i$$

where Ω_{u_i} and Ω_{ε_i} are the long-run covariance of u_{it} and ε_{it}; $\Omega_{\varepsilon u_i}$ gives the covariance between u_{it} and ε_{it} and captures the endogenous feedback effect between the dependent variable y_{it} of which u_{it} is the error term and the regressors x_{it}, whose error term is represented by vector ε_{it}. At the end, Ω_i^0 is the covariance matrix in contemporaneous and $\Gamma_i = \begin{bmatrix} \Gamma_{u_i} & \Gamma_{u\varepsilon_i} \\ \Gamma_{\varepsilon u_i} & \Gamma_{\varepsilon_i} \end{bmatrix}$ is a weighted sum of auto-covariances. Given that, the GM-FMOLS is an estimator that eliminates this endogeneity bias between dependent variable and regressors in this way:

$$(10)\quad \hat{\beta}_{fmols} = \left(\frac{1}{N}\right) \sum_{i=1}^{N} \left[\sum_{t=1}^{T} (x_{it} - \bar{x}_i)(x_{it} - \bar{x}_i)'\right]^{-1} \left(\sum_{t=1}^{T} (x_{it} - \bar{x}_i) y_{it}^* - T\hat{\gamma}_i\right)$$

where $y_{it}^* = (y_{it} - \bar{y}_i) - {}^{\hat{\Omega}_{\varepsilon u_i}}\!/_{\hat{\Omega}_{\varepsilon_i}}\, \Delta x_{it}$ and $\hat{\gamma}_i = \hat{\Gamma}_{\varepsilon u_i} + \hat{\Omega}^0_{\varepsilon u_i} - {}^{\hat{\Omega}_{\varepsilon u_i}}\!/_{\hat{\Omega}_{\varepsilon_i}} \left(\hat{\Gamma}_{\varepsilon_i} + \hat{\Omega}^0_{\varepsilon_i}\right)$ and $\bar{x}_i$ and $\bar{y}_i$ are the cross sectional simple average. Therefore y_{it}^* are the y_{it} adjusted for the covariance between error terms and x_{it} ; T $\hat{\gamma}_i$ is the adjustment for the constant (Roudet et al., 2007).

6. RESULTS ON REER DETERMINANTS

In the full sample of 20 regions, the results are in line with the model but for the transfer variable (trade balance over GDP), which has the right sign but it is not significant (Table 5, Column 1). The effect on the REER of government consumption is significantly larger than the one of government investment, i.e. an increase in government consumption can affect negatively the price competitiveness of the Italian regions in the medium run, while investment has only a minor negative impact. A decrease in the terms of trade (imports value > exports value) increases the REER (i.e. decreases price competitiveness). Lastly, GDP per capita here is a proxy of Balassa-Samuelson effect, i.e. we have an increase in non-tradable prices, without a comparable increase in productivity relative to the tradable sectors.

[Insert Table 5 around here]

By using the GM-FMOLS estimator for our four sub-samples, we can also check for the asymmetries in determinants of REERs across the different regional groups (Table 5, Columns 2-5).

The results for the North-West macro-region (Column 2) are in line with the full sample for the transfer variable. However we cannot see any effect on the REER by government consumption; the negative effect of government investments on price competitiveness is larger than in the full sample; and the terms of trade is positive and significant. The latter signals that an increase in exports value might augment the demand of non-tradable goods. An improvement in the terms of trade can increase the amount of imports for any given level of exports. This can bring two different effects: an income effect and a substitution one (Carrera and Restout, 2008). The increase in the terms of trade makes the imports relatively cheaper (through a positive substitution effect), but brings also a rise in the purchasing power and in the demand for non-traded goods.

The case of North-Eastern Italy is instead quite interesting (Column 3). The transfer variable, i.e. the trade balance over GDP, works in the opposite direction: having a positive trade balance brings a decrease in competitiveness. Moreover, the magnitude of the positive effect of government consumption (which means a negative influence on competitiveness) is much higher than in the full sample case.

The public consumption in North-East seems to influence more intensively non-tradable goods via a possible increase in demand. In central regions (Column 4) it is worth stressing that the transfer theory seems to work, while there is no significant effect for government expenditure on REER. The latter is quite an unexpected result, given that the presence of all the Ministries and other national-level agencies in Rome. Moreover, Lazio is the region with the highest value added share produced in the service sector (85% in 2013, according to ISTAT).

We therefore decided to estimate our setup for Lazio only by using a simple FMOLS estimator (Table 6, Column 3). As expected, the government consumption plays a negative role in price competitiveness in this region. It is worth stressing that government investment is positive for competitiveness (negative effect on REER). At the end, we see that the transfer variable is extremely high and positive, i.e. in case of an increase in the trade balance by 1% the REER seems to increase by more than 2.5%. This is in sheer contrast to the predictions of the transfer theory. Lastly, we analyse the case of Mezzogiorno (Column 5). The trade balance does not play any role in determining the REER in the long run. The magnitude of the effect of government consumption is also quite high as it is the relative GDP per capita. As in the case of Lazio, government investment can play a positive role on competitiveness in the area, most likely because of a lack of private investments.

[Insert Table 6 around here]

Finally, we decided to isolate the "*regioni a statuto speciale*" (Table 6, Column 4), since they are granted more power and autonomy in terms of legislation, administration and finance. Surprisingly government expenditure does not affect the REER in the medium run. The most relevant effect is for the trade balance; moreover, the transfer theory does not hold in this case either.

In conclusion, we find strong asymmetries in the determinants of REERs across Italian macro-regions. The negative effect on price competitiveness of government consumption is extremely relevant for North-East, Mezzogiorno and Lazio. Government investment plays a negative role especially in North-West, while can be positive for competitiveness in Lazio and Mezzogiorno. We also find that the transfer theory does not necessarily hold and regression results even point to the opposite in case of North-Eastern Italy and Lazio.

7. THE IMPACT OF REGIONAL REERS ON REGIONAL GDP GROWTH

7.1 EMPIRICAL SETUP FOR REGIONAL GROWTH

Following Chen (2015), we look at the impact of the REERs to the (regional) GDP growth. The structure is as Equation 10. We estimate the coefficient for the whole panel of regions. In addition to the abovementioned Chen (2015), in our dynamic set-up we look at both short and long-term coefficients in an Error Correction Model and we correct for cross-sectional dependence by applying a dynamic factor model *á la* Pesaran and Tosetti (2011).[15] This is justified by rejecting both cross-sectional independence and stationarity for GDP growth.[16]

In both cases we keep the heterogeneity of the coefficients for each region. In the Error Correction Model we apply the Mean Group estimator.

We only take one lag to preserve degrees of freedom when working with annual data.

(11) $y_{i,t} = \beta_{1i} + \beta_{2i} y_{i,t-1} + \beta_{3i} REER_{i,t-1} + \varepsilon_{i,t}$

where $y_{i,t}$ is the regional GDP growth, $y_{i,t-1}$ its first lag (one year) and $REER_{i,t-1}$ is the first lag of the REER as previously computed. We apply the lag of the REER because we believe that price competitiveness does not have a contemporaneous impact on growth at time t.

The correspondent Error Correction model structure is the following:

(12) $\Delta GDPG_{i,t} = \phi_i \left(GDPG_{i,t-1} - \theta'_{0i} - \theta'_{1i} REER_{i,t-1} \right) + \delta'^{*}_{11i} \Delta REER_{i,t-1} + \mu_i + \varepsilon_{i,t}$

7.2. RESULTS FOR REGIONAL GROWTH

As reported in Table 7 we can see the REER's impact on growth by using an Error Correction model. We firstly used the dynamic fixed effect estimator for homogeneous coefficients, and then we used the Mean Group estimator to take into account the heterogeneity across regions. Price competitiveness in the short-run seems to have a negative effect on growth, while an increase in competitiveness (negative change in REER) has a positive and significantly bigger effect.

[Insert Table 7 around here]

If we look at the dynamic factor model we do not see any impact on price competitiveness. We can attribute this result to method's inability to disentangle between short and long-term dynamics and to the

[15] For more details on the estimators, see Comunale (2017, appendix available on JIMF).
[16] Tests are available upon request.

addition of cross-sectional means to correct for cross-sectional dependence. However, unobserved common factors, i.e. regional spillovers and global factors do play a significant role. This is especially true for GDP spillovers from other regions which can play as a proxy for inter-regional trade as well (Table 8).

[Insert Table 8 around here]

8. CONCLUSIONS AND POLICY IMPLICATIONS

These preliminary findings show how a high level of government expenditure influences the capacity of the regions with the highest government wage expenditure to be price-competitive. This effect, felt in the areas already characterised by a low GDP per capita before the onset of the crisis, has strong implications in terms of the ability of fiscal policy in helping these regions to recover successfully.

The heterogeneity in the results for government investment and for the transfer theory, confirm as well the necessity of a careful competitiveness analysis carried out at the regional level. Lastly, we show that an increase in the regional price competitiveness influences regional growth positively only in the long run and spillovers may play a role.

A better understanding of the behaviour of REERs and their determinants is then fundamental to trying to achieve the objective of reducing regional disparities as stated in the Treaty on the Functioning of the European Union, as it will help facing symmetric and asymmetric shocks that might occur in the future. We believe that this analysis can inform policy-makers and researchers on the dynamics occurring within a union based on two dimensions: monetary and fiscal. These dynamics apply not only to nations with different degrees of autonomy at regional level, but also from an EU and EMU perspective. This work hence offers a new point of view to the debate on the deepening of the EMU and the architecture of the euro area budget within the EU one, where different proposals for fiscal stabilisation mechanisms at the euro area level have been put forward by stressing the importance of regional dynamics within the country.

Finally, in order to better explore the effects of these shocks in the EMU, we aim at expanding our data set in a further study to include other European countries with similar characteristics and a level of autonomy across regions (e.g. Spain, France and Germany). This will provide the policy-makers with a granular insight into the internal dynamics of the EMU and help develop better convergence and stabilisation policies.

REFERENCES

Berg, A. and Y. Miao (2010), The Real Exchange Rate and Growth Revisited: The Washington Consensus Strikes Back? IMF Working Paper 10/58.

Bussière M., Ca' Zorzi M., Chudik A. and Dieppe A. (2010) 'Methodological advances in the assessment of equilibrium exchange rates', ECB Working Paper 1151.

Carrera, J. E., and Restout, R. (2008). Long Run Determinants of Real Exchange Rates in Latin America. No.0811.Groupe d'Analyse et de Théorie Economique (GATE), Centre national de la recherché scientifique (CNRS), Université Lyon 2, Ecole Normale Supérieure.

Chen, J., (2015). Interprovincial Competitiveness and Economic Growth: Evidence from Chinese Provincial Data (1992–2008) (August 2015). *Pacific Economic Review*, Vol. 20, Issue 3, pp. 388-414, 2015.

Clark, P. B., & MacDonald, R. (1999).Exchange Rates and Economic Fundamentals: a Methodological Comparison of BEERS and FEERS. In *Equilibrium Real Exchange Rates*, ed. by R. MacDonald and J.L.Stein (Massachusetts: Kluwer Academic Publishers), pp. 209-40.

Clostermann, J. & Friedmann W. (1998). What drives the real effective D-Mark exchange rate? *Konjunkturpolitik, Applied Economics Quarterly*, 44, 207-230.

Comunale, M. (2019). Long-Run Determinants and Misalignments of the Real Effective Exchange Rate in the EU. *Scottish Journal of Political Economy, forthcoming.*

Comunale, M. (2017). Dutch Disease, Real Effective Exchange Rate Misalignments and their effect on GDP Growth in the EU, *Journal of International Money and Finance*, Volume 73, Part B, May 2017, Pages 350–370.

Cottarelli, C., Guerguil, M. (Eds.).(2014). *Designing a European Fiscal Union: Lessons from the Experience of Fiscal Federations* (Vol. 34).Routledge.

Coudert, V., Couharde, C., & Mignon, V. (2013).On currency misalignments within the euro area. *Review of International Economics*, 21(1), 35-48.

Darvas, Z. (2012). Real effective exchange rates for 178 countries: a new database. Working Paper 2012/06, Bruegel, 15 March 2012.

Dollar, D. (1992), Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985, *Economic Development and Cultural Change*, vol. 40, No. 3 (April), 523–544.

Gala, P.; Lucinda, C. R. (2006), Exchange Rate Misalignment and Growth: Old and New Econometric Evidence. *Revista Economia*, p.165-87.

Galstyan, V., & Lane, P. R. (2009).The composition of government spending and the real exchange rate. *Journal of Money, Credit and Banking*, 41(6), pp. 1233–1249.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003).Testing for unit roots in heterogeneous panels.*Journal of econometrics*, 115(1), 53-74.

Lane, P. R., & Milesi-Ferretti, G. M. (2002). External wealth, the trade balance, and the real exchange rate. *European Economic Review*, *46*(6), 1049-1071.

Lane, P. R., & Milesi-Ferretti, G. M. (2004). The transfer problem revisited: Net foreign assets and real exchange rates. *Review of Economics and Statistics*,*86*(4), 841-857.

Obstfeld, M., and K.Rogoff.(1996) *Foundations of International Macroeconomics*. Cambridge, MA: MIT Press.

Pedroni, P. (2000). Fully modified OLS for heterogeneous Cointegrated panels, in B.H. Baltagi, eds., Nonstationary panels, panel cointegration, and dynamic panels*, Advances in Econometrics*, Vol. 15, (JAI) 93-130.

Pedroni, P. (2001). Purchasing power parity tests in cointegrated panels. *Review of Economics and Statistics*, 83(4), pp. 727–731.

Perotti, R. (2012). The" austerity myth": gain without pain?. In *Fiscal policy after the financial crisis* (pp. 307-354). University of Chicago Press.

Pesaran, M. H., (2004) General Diagnostic Tests for Cross Section Dependence in Panels. CESifo Working Paper Series No. 1229; IZA Discussion Paper No. 1240.

Pesaran, M. H., (2007) A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics* 22: 265-312.

Pesaran M.H., Tosetti E. (2011) Large panels with common factors and spatial correlation. *Journal of Econometrics* 161 (2011) 182—202.

Pesaran, M.H. and Chudik, A. (2015) Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors, *Journal of Econometrics*, 188(2), p.393-420

Phillips, P., & Hansen, B. (1990). Statistical Inference in Instrumental Variables Regression with I(1) Processes. *Review of Economic Studies*, 57, 99–125.

Rodrik, D. (2008), The Real Exchange Rate and Economic Growth, *Brookings Papers on Economic Activity*, Fall 2008.

Schmitz, M., De Clercq, M., Fidora, M., Lauro, B., & Pinheiro, C. (2011). Revisting the Effective Exchange Rates of the Euro. ECB Occasional Paper, (134).

Wagner, M., & Hlouskova, J. (2009). The performance of panel cointegration methods: results from a large scale simulation study. *Econometric Reviews*, 29(2), 182-223.

Wang, Q., & Wu, N. (2012). Long-run covariance and its applications in cointegration regression. *Stata Journal*, 12(3), pp. 525–542.

Yan, G. and Li, Sheng and Lin, Yaqi and Jie, Li, (2016) Real Effective Exchange Rate and Regional Economic Growth in China: Evidence from Provincial Data (November–December 2016). *China & World Economy*, Vol. 24, Issue 6, pp. 43-63, 2016.

APPENDIX: TABLES AND FIGURES

Table 2. Pesaran's test for the presence of cross-sectional independence

Setup	Test	Probability
Full sample	21.594	0.0000
North-West	4.243	0.0000
North-East	6.654	0.0000
Central	2.831	0.0046
Mezzogiorno	5.783	0.0000
Statuto speciale (*)	1.832	0.0670

Note: Pesaran's test for cross-sectional independence follows the methods shown in Pesaran (2004). Pesaran's statistic follows a standard normal distribution and it is able to handle balanced and unbalanced panels. It tests the hypothesis of cross-sectional independence in panel data models. Here we apply the test with one lag. In case of "regioni a statuto speciale" we cannot reject cross-sectional independence at 1% and 5%, but only at 10% (*).

Table 3. Stationarity test: second generation t-test by Pesaran (2007) for unit roots in heterogeneous panels with cross-section dependence (CIPS)

Variable	Z-Test	P-value
Log (reer)	-1.232	0.109
Trade balance/GDP	1.648	0.950
Log (relative GDP per capita)	3.224	0.999
Log (terms of trade)	-0.058	0.477
Relative government consumption	-0.519	0.302
Relative government investment (*)	-2.170	0.015

Note: Null hypothesis assumes that all series are non-stationary. One lag has been imposed. This t-test is also based on Augmented Dickey-Fuller statistics as IPS (2003) but it is augmented with the cross section averages of lagged levels and first-differences of the individual series (CADF statistics). For government investment we reject the null at 10% and 5% but not at 1%. (*) means stationarity for all series (i.e. we reject the null of non-stationarity).

Table 4. Pedroni's test for cointegration

Setup	Panel group RHO-stat
Full sample	3.08
North-West	3.84
North-East	3.84
Central	3.84

Mezzogiorno (*)	2.24
Statuto speciale	4.30

Note: This is a revised procedure for cointegration tests in heterogeneous panels with multiple regressors ("Pedroni tests"). We applied 1 lag (no trend). All reported values are distributed N (0,1) under null of no cointegration. In case of very small panel (as it is here) in Pedroni (2004) is explained that group RHO-stat is better because less distortive and more conservative. If group RHO-stat Panel = -2.336 then p-value = 0.010 (Source: Maeso-Fernandez et al., 2004) with N=25. In my case N = 20, we can apply 2-tails t-stat (Rho-stat is distributed approximately as Student's t distribution with distribution with n - 2 = 18 degrees of freedom under the null hypothesis): 10% with rejection of the null if it is higher than 1.7341; 5% rejection if higher than 2.1009; 1% rejection if higher than 2.8784. In case of Mezzogiorno, we reject the null of no cointegration between 5% and 1% (*).

Table 5. Main results with GM-FMOLS: Real Effective Exchange Rate Determinants

Variables	**(1) Full Sample**	**(2) North-West**	**(3) North-East**	**(4) Centre**	**(5) Mezzogiorno**
Trade Balance/GDP	-0.20	-0.22	1.4**	-0.19**	1.01
	(0.747)	(0.304)	(0.428)	(0.394)	(1.839)
Log (GDP per capita)*	0.74***	0.63***	0.89***	0.75***	0.71***
	(0.03)	(0.07)	(0.05)	(0.05)	(0.04)
Log (terms of trade)	-0.18***	0.42***	-0.26***	-0.19***	-0.03**
	(0.03)	(0.05)	(0.08)	(0.03)	(0.05)
Government consumption*	0.39***	0.24	1.19***	-0.08	0.55***
	(0.07)	(0.16)	(0.24)	(0.11)	(0.10)
Government investment*	0.03***	0.24***	0.07***	0.00	-0.07***
	(0.02)	(0.04)	(0.03)	(0.05)	(0.04)
Constant	4.27***	4.58***	3.55***	4.58***	4.31***
	(0.07)	(0.12)	(0.20)	(0.11)	(0.11)
Observations	**260**	**52**	**52**	**52**	**104**

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.
The variables with * are in relative terms.
North West: Piedmont, Aosta Valley, Liguria, Lombardy; North-East: Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Emilia-Romagna; Centre: Tuscany, Umbria, Marche, Lazio; Mezzogiorno: Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicily, Sardinia.

Table 6. Real Effective Exchange Rate determinants: Lazio and Regioni a Statuto Speciale

Variables	**(1)** **Full Sample**	**(2)** **Centre**	**(3)** **Lazio**	**(4)** **STSP**
Trade Balance/GDP	-0.20	-0.19**	2.55***	1.53***
	(0.747)	(0.394)	(0.146)	(0.453)
Log (GDP per capita)*	0.74***	0.75***	0.50***	0.66***
	(0.03)	(0.05)	(0.06)	(0.07)
Log (terms of trade)	-0.18***	-0.19***	-0.22	0.13
	(0.03)	(0.03)	(0.07)	(0.08)
Government consumption*	0.39***	-0.08	0.72***	0.16
	(0.07)	(0.11)	(0.23)	(0.20)
Government investment*	0.03***	0.00	-0.05***	0.00
	(0.02)	(0.05)	(0.02)	(0.03)
Constant	4.27***	4.58***	3.85***	4.65***
	(0.07)	(0.11)	(0.19)	(0.18)
Observations	**260**	**52**	**13**	**65**

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.
The variables with * are in relative terms.
Centre: Tuscany, Umbria, Marche, Lazio; STSP (Regioni a Statuto Speciale): Sardinia, Sicily, Trentino-Alto Adige, Aosta Valley and Friuli-Venezia Giulia.

Table 7. REER and GDP growth (Error Correction Model)

Variables	**(1)** **long term**	**(2)** **short term**	**(3)** **long term**	**(4)** **short term**
Error Correction		-0.748***		-0.690***
		(0.0624)		(0.0458)
ΔREER		3.955***		7.927***
		(1.120)		(1.738)
REER	-8.506***		-10.48***	
	(1.459)		(1.282)	
Constant		30.19***		34.33***
		(5.326)		(5.086)

Observations	**240**	**240**	**240**	**240**

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is the variation of GDP growth. The REER is always lagged as for Equation 11. Column (1) and (2) is with homogeneous coefficients. Column (3) and (4) are with heterogeneous coefficients.

Table 8. REER and GDP growth (dynamic factor model)

Variables	**GDP growth**	
	(1)	(2)
GDP growth(t-1)	-0.155**	-0.193***
	(0.0632)	(0.0648)
ln(REER)	1.075	
	(1.800)	
ln(REER)(t-1)		-2.445
		(3.429)
Unobserved common factors related to:		
GDP growth	0.971***	1.025***
	(0.0578)	(0.0633)
GDP growth(t-1)	0.165**	0.207***
	(0.0812)	(0.0794)
ln(REER)	-0.367	
	(1.672)	
ln(REER)(t-1)		2.936
		(3.756)
Constant	-3.320	-2.184
	(3.843)	(4.120)
Observations	280	260
Number of regions	**20**	**20**

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.
The dependent variable is GDP growth. Unobserved (common) factors related to the regressors are reported in italics.

Fig. 1. Average REERs deflated by CPI vis-à-vis 41 partners (1997-2014)

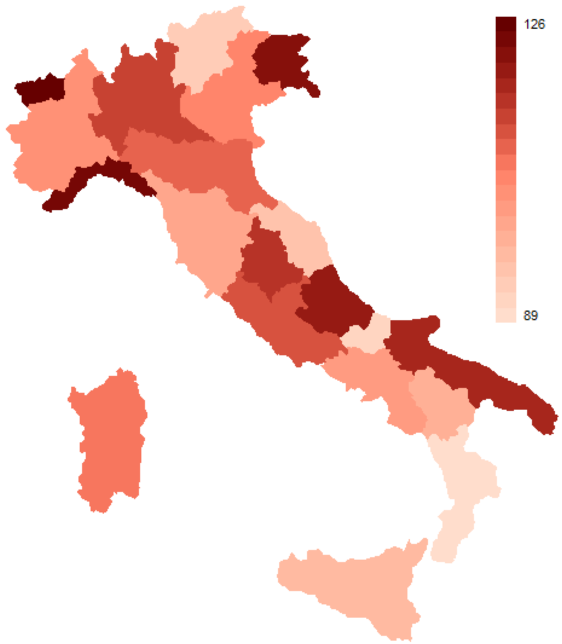

Fig. 2. Standard deviation of REERs deflated by CPI vis-à-vis 41 partners (1998-2014)

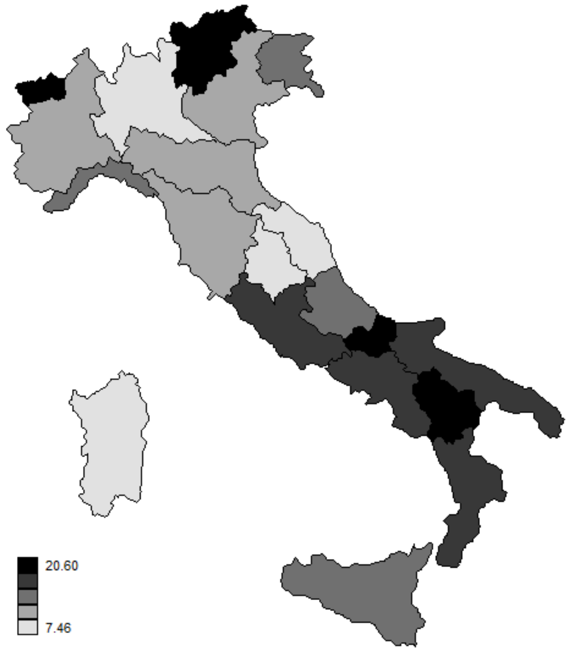

Fig. 3. Average REERs deflated by CPI vis-à-vis 41 partners 1997-2008

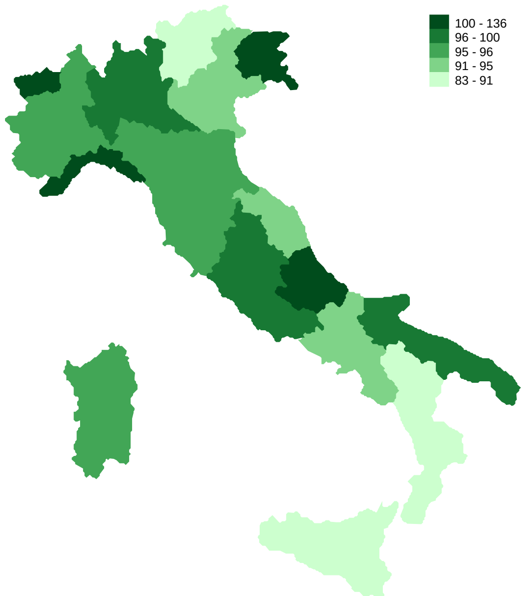

Fig. 4. Average REERs deflated by CPI vis-à-vis 41 partners 2009-2014