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Gulzar Ali[*], Zhaouha Li[♦]

EVALUATING THE IMPORTANCE OF EXPORTS IN FOREIGN TRADE OF PAKISTAN APPLYING ARDL APPROACH

Abstract

A country's economic development and stand in the world economies can be fairly judge by its contribution in international trade, or it is worth saying that contribution in international trade is the indicator of an economy's performance and its level of fabrication. This study attempted to empirically examine the role of exports and its determinants in foreign trade of Pakistan applied Bound testing approach. The study found noteworthy long-term role of exports and its determinants in international trade of Pakistan. It is also observed that the Country could not utilized their resources efficiently which proved to be a key deficiency in economic development throughout its history. This deficiency in exploitation of the resources led to lack of production surplus and thus low exports. This chronic situation leads the economy towards slow economic progression.

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1. Introduction

The word trade is defined as "the process in which people sell and buy or exchange goods and services" by Oxford Advanced Learner's dictionary (Kumar, 2009). International trade is the exchange of goods and services of one country with rest of the world and vice versa. In short it is an arrangement where merchandise and services are marketed, exchanged and sold among the trading partners via the exports and imports. Exchange of goods and services is an old phenomenon initiated from barter system at small level without any limitations, restrictions and boundaries free trade of goods and services was customary. But with the passage of time as fast as communication and transportation improved among nations of the universe trade nourished throughout the globe, whereas the same phenomenon acts in opposite direction when economists observed protectionists policies and applied discrimination of prices, capital, goods and services resulting in constraining trade within boundaries. Aforementioned was the result of government intervention in free economy by restricting supply through quantitative and qualitative measures like export subsidies, controlled prices, tariffs, import taxes and import quotas under protectionist policies to subsidize the domestic industry. Then in mid-20th century nations started efforts to decrease the restrictions on international trade and support free trade zones to tackle down poverty and income discrimination throughout the globe.

Each economy is likely to export commodities that can be produced more efficiently and with relatively lower cost, according to comparative advantage theory. National income or foreign exchange reserves of trading allies which shows their ability to purchase or budget constrain, prices of exportable commodities, prices of substitutes and competing commodities and exchange rate between trading partners can be categorized under demand determinants. While supply side can be constituted from production capacity of economy, exchange rate, relative prices i.e. price of exports comparative to price of competing commodities, import of inputs and wage rate etc. Overall world export performance is greatly influenced by global income and prices while production capability or efficiency and availability of inputs and natural resources have great role in defining supply side of export performance. However besides economic factors, socio-cultural and political circumstances also play key role in determining exports of a nation.

In 2013 Pakistan exports worth 28.2 billion dollars allotting it the 70th

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biggest export economy of the world and 89th more complex economy reported by the Economic Complexity Index (ECI). In the same time period Pakistan imported $44.8billion; follow on an unfavorable trade balance of $16.6billion, while it's GDP was $232billion and GDP per capita was $4.6k.

The major exports of Pakistan includes House Linens ($2.65B), Non-Retail Pure Cotton Yarn ($2.39B), Rice ($2.12B), Heavy Pure Woven Cotton ($1.16B) and Non-Knit Men's Suits ($1.07B), according to the 1992 revision of the HS (Harmonized System) categorization. The major destinations of Pakistan's exports are the United States ($3.59B), China ($3.16B), Afghanistan ($2.32B), the United Arab Emirates ($1.76B) and Germany ($1.42B).

Pakistan attempted to promote exports de-linking of the rupee from US dollar and the introduction of a flexible exchange rate was one of the significant measures in this regard. Trade liberalization policy tend to increased imports, and consequently increased current account deficit by $1.934 billion in 1988-89 from previously $1.037 billion in 1980-81 depicting an increase of about 87% for the period of eight years. Despite of negative export growth –17.2% in 1981-82 and –7.9% in 1984-85, GDP growth rate was 7.56% and 8.71% respectively signifying that economic growth was comparatively less dependent on export growth at that time.

Economy relatively flourished for the duration of 1980s as Naqvi and Sarmad (1994) have observed that the relatively high growth of GDP that averaged 7% among 1978 and 1986 was the result of development of manufacturing sector led by a thriving domestic market due to remittances and the illegal trade that rose after Afghan war. In 1982-83 Workers' remittances approached at record level of $3 billion. The government enabled to finance its expenses and deficits that arose from the deteriorating terms-of-trade (TOT) as well as sustained macroeconomic stability and uphold a high growth rate of GDP, by foreign remittances and inflow of Western official capital such as long-term loans and grants in the direction of Afghan war that is estimated to an annual average of more than one billion US dollars.

This research study will contribute to the literature on analytical associations amid exports and its determinants with foreign trade of Pakistan. Further the role of various trade policies, its tools in different regimes and their role in international trade also to be highlighted. In short the study is focusing on past historical literature as well as present and future analysis of the facts and figures related to foreign trade and exports of

Pakistan. To examine detailed scrutiny of sectoral exports and its importance in international trade each sector o exports is observed with respect to its importance for aforementioned. Furthermore main variables were decomposed in secondary variables to have detailed insightful of possible effect, outcome and nature of variables in more detail. In short the researcher is aiming to have accurate and comprehensive results.

1.1 Objective of the Study

The main objective of this research study is
- − To evaluate the importance of exports and its determinants in foreign trade of Pakistan.
- − To examine the role of world income and trade policy variables in foreign trade of Pakistan.

2. Literature Review

An overview of Pakistan's trade history shows that excluding first decade the exports of Pakistan shows progression but besides increasing exports, imports also increased with a relatively higher rate. Hence forth Pakistan throughout its economic history except for 1950-51 and 1972-73 faced deficit in its trade balance. Yet exports proved to be a backbone of the economy and contribute a great share to Pakistan's economy. Over the years compilation of Pakistan's exports has changed considerably. The major modification is increase in manufactured and semi manufactured exports and decrease in primary exports which was converse in the earlier history. Previously 99% of Pakistani exports used to consists of merely five primary products i.e. hides, tea, raw cotton, raw jute and raw wool. But transformation initiated in the pattern of Pakistan's exports as economic strategies transfer towards industrialization. Consequently the ratio of the aforementioned five primary products in export earnings decline gradually to 93% in 1951-52, then to 75% in 1958-59 and then furthermore to 45% in 1971-1972. The decline persisted and the share of primary products in export earnings was recorded to be 19% in 1991-92, hence forth the share of primary merchandise, semi manufactured and manufactured commodities in 2003-04 was 10%, 12% and 78%, respectively.
Ahmed (2000) investigated the response of Bangladesh's exports towards

its Trade Liberalization and Economic Growth applying Co-Integration and Error Correction Model (ECM). The results of the study found long-run relation among exports of goods, price of exported goods, exchange rate and trade liberalization having significant effect on the economic growth of Bangladesh for the period of 1994-19995. However, the study found short-run relation between supplies of exported goods and Bangladesh's economic growth.

Bahmani-Oskooee (2001) studied the effect of Nominal and Real Exchange Rates on the Trade Performance of Middle Eastern Countries taking quarterly panel data from 1971:I-1994:IV. The results obtained shows long-run favorable effect of nominal and real exchange rates on the trade balance of Middle Eastern Countries applying Johansen co-integration. Bahmani-Oskooee and Niroomand (1999) examined the relation among degree of openness, exports and output, found the long-run relation among these variables. Bahmani-Oskooee, Mohtadi and Shabsigh (1991) re-examined the causality between exports and economic growth taking sample of twenty Less Developed Countries (LDC's). in analytical technique the Granger Causality test was applied to find out the causal relation between exports and economic growth for the selected sample of countries. The results obtained for the regression analysis of the study revealed that export-led-growth (ELG) hypothesis exists in New Industrialized Countries (NIC's), but found weak support in case of Less Developed Countries (LDC's). If their study are critically examine, the result presented are uncertain and indecisive in evaluating the hypothesis tested to show an obvious and understandable outcome of the causal relation between exports and economic growth as well as of export-led-growth (ELG) hypothesis. Bahmani-Oskooee and Alse (1993) investigated the causality between exports and economic growth using co-integration and Error Correction Model (ECM).

Santos-Paulino and Amelia (2002) studied the impact of trade liberalization on export and international trade for twenty-two developing countries taking the time period of data from 1972 to 1998. The model used in the study is the export growth function regressed through Ordinary Least Square (OLS). Export has taken as the dependent variable and world income and flexible exchange rate as independent variable, while dummy was used for adopting trade liberalization policies. The results showed that all these variables are significant have positive expected signs, concluding that export grows faster in open economies.

Martinez-Zarzoso and Nowak-Lehmann (2003) examined the bilateral annual exports among the 19 countries. The study used panel data for the period of analysis from 1975 to 2002. The trade Gravity Model was applied in the methodology to find out the impact of bilateral exports on population growth rate, infrastructures and imports of these 19 countries. The study found the positive and significant effect of exports on both population and infrastructures on the economic growth of these selected samples of study countries. The study also found that bigger population countries have greater imports as compared to small population countries. Further, the study concluded that infrastructure too played a leading role like exports in raising the economic growth of these sample selected countries.

Akhtar (2003) investigated the seasonal behavior and trade pattern of Pakistan's exports and imports using quarterly data from 1984: 1 to 2002:1. In the methodology several techniques like integrated models, Auto-Regressive Integrated Model Analysis (ARIMA), mixed ARIMA, ARIMA-GARCH and unit root test. Though the study used diverse and varied analytical techniques, found that the deterministic effect of both exports and imports were relatively stronger than stochastic effects. Akhtar and Ghani (2010) studied free trade agreement benefits for SAARC countries applying trade gravity model. The study found constructive and assenting effect of trade agreements on economic growth of SAARC countries for the period of 2003-2008, using cross-sectional.

Jordan and Eita (2005) determined the causal relationship between exports, international trade and economic growth for Namibian Economy. The time series data was used in the study covering the period of analysis from 1995 to 2005. The co-integration method was applied in the methodology of the study. The results obtained found the positive and significant evidence of long run relationship between exports and economic growth of Namibian's economy, exerting that Namibian economic growth was basically an export led growth.

Zada, Muhammad and Bahadur (2011) attempted to explore the determinants of exports in Pakistan. The study was based on the annual time series data for the period of analysis from 1975 to 2008. The Empirical Bayesian Technique and General Model of Movement (GMM) were applied in the methodology for the estimation and regression of the variables. The results obtained from the study revealed that International Price and International Demand were the most impressive and important determinates of the exports of Pakistan. Further, concluded that fluctuation in the

exchange rate also affects the exports of Pakistan in the international markets.

Khiyavi, Moghaddasi and Yazdani (2012) attempted to explore the bilateral trade factors of exports in 14 developing countries.[1] The panel data was used in the study for the period of 1991 to 2009. In the methodology they applied the Trade Gravity Model for the estimation and regression analysis. The results obtained from the study revealed that exports and imports have played positive and significant role in bilateral trade flows between these selected samples of 14 countries.

Tabari and Haghight (2014) attempted to analyze the bilateral trade relationship between Iran and 45 Asian countries. The study was based on the panel data over the period of analysis for 2001 to 2011. In the methodology of the study they used Trade Gravity Model and regressed with the help of Pooled Estimated Generalized Least Square (EGLS) based on Random effect and fixed Model. The results obtained from the regression analysis of the study revealed that bilateral trade flows of Iran have positively correlated with selected sample of 45 Asian countries for the study having positive and significant affect on the economic growth of Iran and also in increasing the Iran's exports and imports. Further, the study found that increase in real exchange rate has negative impact on the exports and positive on the imports of Iran. Due to the fluctuation in the exchange rate the exports of Iran decreases and its imports increases during the selected period of analysis of the study.

Elshehawy, Shen and Ahmed (2014) investigated the bilateral trade flows and exports between Egypt and its trading partners (42 countries). The study was based on the panel data for the period of analysis from 2000 to 2013. In the methodology of the study they used Trade Gravity Model to estimate the impact of exports for Egypt. The results obtained from the study showed that exports of Egypt, regional trade and importer's population have positive and significant effect on the economic growth of Egypt. The study also found the negative impact of transportations cost and geographical distances on the Egypt's economic growth.

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[1] Iran, India, Malaysia, Pakistan, Thailand, Turkey, Brazil, Indonesia, Kenya, Venezuela, Tunisia, Romania, Chile and Mexico.

3. Econometric Model and Description of Data

This research study observing the behavior of embodied exports and its determinants in international (Foreign) trade of Pakistan. For this, the econometric model for the growth of international trade and exports of the country was developed. The basic idea for the development of these theoretical models have been taken from previous models used by Santos-Paulino and Thirlwall (2004), Wacziarg and Welch (2008) and Ju et. el. (2008) extended their work to develop models for this study.

The demand for goods in the international market (international trade) depends on the assessment of the comparative prices of goods, the relative prices of the currencies of both the trading countries and demand for goods in the world countries and in international market. If the world income, the elasticity of world income and the proportional price of the goods in the world countries assume as constant than the international trade equation are expressed as;

$$I.T_t = A(X_t)^{\alpha_1}(M_t)^{\alpha_2}(Y_t)^{\alpha_3}(ER_t)^{\alpha_4} \qquad (3.1)$$

Here, small "t" represents the time period (time series), $I.T_t$ is the international trade, X_t is the exports, M_t is the Imports, Y_t is the World Income take as constant and ER_t is the exchange rate in time period "t".

In equation (3.1) α_1 is the price elasticity of demand for exporting goods , α_2 is the price elasticity of demand for Importing goods, α_3 is the Income elasticity of demand for both exports and imports goods and α_4 is the price elasticity of exports and imports from Country "i" to country "j". In other words α_4 is the price elasticity in relative currencies of both countries.

To formulate the equation (3.1) to linear form, the logarithmic is taken on both side of the equation (6.1).

$$Ln(I.T_t) = Ln(A) + \alpha_1 Ln(X_t) + \alpha_2 Ln(M_t) + \alpha_3 Ln(Y_t) + \alpha_4 Ln(ER_t) \quad (3.2)$$

Now, by taking the derivative on both side of the equation (3.2), with respect to time "t" the growth rate in international trade with respect to exports, imports, world income and exchange rate be determine. The

equation (6.2) will become as follows;

$$(\dot{I.T_t}/I.T_t) = (\dot{A}/A) + \alpha_1(\dot{X_t}/X_t) + \alpha_2(\dot{M_t}/M_t) + \alpha_3(\dot{Y_t}/Y_t) + \alpha_4(\dot{ER_t}/ER_t) \tag{3.3}$$

In the econometric form for the empirical regression the equation (6.3) be articulated as

$$IT_t = \alpha_0 + \alpha_1 x_t + \alpha_2 m_t + \alpha_3 y_t + \alpha_4 er_t + \mu_t \tag{3.4}$$

In the above equation (3.4), IT_t (=$I.T_t^*/I.T_t$), x_t (=X_t^*/X_t), m (M_t^*/M_t), y_t (=Y_t^*/Y_t) and er_t(= ER_t^*/ER_t). α_0 (=A*/A) and taken as constant i.e. technology, shocks etc. α_1 and α_2 are the price elasticity of demand for exports and Imports of goods, α_3 is the Income elasticity of demand for both exports and imports goods and α_4 is the price elasticity of trading goods in relative currencies for both the countries. μt is the error term or the white noise error stochastic term. The random error term is assumed to be normally distributed through the subsequent restrictions,

$$[E(\eta_i) = 0],[E(\eta_i)^2 = \sigma^2],[E(\eta_{i,}\eta_j) = 0]$$

This process is known "White noise process".

Exports play an important role in international trade to raise the national income of the country and achieve stability in the balance of payments of a country. On the foreign trade a country can improve mutual economic and diplomatic relations with other countries and international organizations by increasing trade as well as it can efficiently utilize available resources to optimal level. Trade proceeds export performance of a country relies on domestic production surpluses, attaining international standards, quality assurance, reliable and suitable terms of trade and securing position in international market for exports. Generally these determinants which affect export performance of a nation can be classified in terms of demand and supply side factors.

In order to estimate the role of Pakistan's exports and its determinants in international trade, the regression model consequential of the parent model of international trade derived and illustrated as equation (3.4) be regressed.

The international trade (IT) is elected as dependent variable and the

independent variables are exports (X), exports of primary commodities (XPC), exports of textile manufacturing sector (XTM), exports of other manufacturing sector (XOM), exports of other commodities and goods (XO), world income (Y), exchange rate (ER), tariff imposition on exports (TRF^x), Proxy variable for [2]Trade openness or Liberalization policy (TOP), terms of trade (TOT) and balance of trade (BOT). The theoretical equation to express the relationship between dependent and independent variables is articulated as;

$$IT = f(X, XPC, XTM, XOM, XO, Y, ER, TRF^x, TOP, TOT, BOT) \qquad (3.5)$$

The econometric model of the above equation (3.5) can be formed as follows;

$$
\begin{aligned}
IT_t = \ & \alpha_0 + \alpha_1 X_t + \alpha_2 XPC_t + \alpha_3 XTM_t + \alpha_4 XOM_t + \alpha_5 XO_t \\
& + \alpha_6 Y_t + \alpha_7 ER_t + \alpha_8 TFR_t^x + \alpha_9 TOP_t \\
& + \alpha_{10} BOT_t + \alpha_{11} TOT_t + \mu_t
\end{aligned}
\qquad (3.6)
$$

The sign of the coefficient/estimator are expected as

$$\alpha_1 > 0, \alpha_2 > 0, \alpha_3 > 0, \alpha_4 > 0, \alpha_5 > 0, \alpha_6 > 0, \alpha_7 < 0, \alpha_8 < 0, \alpha_9 > 0, \alpha_{10} > 0, \alpha_{11} < 0$$

3.1 Data Analysis and Sources

The data used in this study are the annual time series data, because quarterly and semi-annual data are not available for most of the variables included in the study in their desired form. The time periods of analysis are from 1972 to 2015. Prior to 1972, due to the conflicts of different policies and separation of East-Pakistan the data for the selected variables in this research study are unavailable in their purified and true form.

The data used in this study are obtained from Economic Surveys, Federal Bureau of Statistics, State Bank of Pakistan, Agriculture Development Bank

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[2] Proxy Variable for Trade Openness as Trade to GDP Ratio calculated as {(X+M)/GDP}

of Pakistan (ZTBL), Cooperatives and Commercial Banks, International Financial Statistics (IFS), Pakistan Institute of Development Economics (PIDE), World Development Report (WDR), National Accounts of Pakistan, Federal Board of Revenue (FBR) Pakistan, Custom House (Islamabad) Pakistan, World Development Index, World Bank, Trading Economics, World Economic data Indicator, Global Economy, Ministry of Finance Pakistan, Economic Affairs Division Pakistan, World Trade Organization (WTO) Statistics Database, from different surveys and reports.

4. Methodology, Results and Discussion (Regression Analysis of Model)

In time series analysis there is always a suspicious about spurious relation in the data. As this research study too consist on time series data, therefore before doing the regression analysis the data were tested for unit root through Augmented-Dicky Fuller (ADF) test. The result of ADF test is incorporated in table (6.1), results showing that some variables are stationary at I(0) and some are at I(1). As none of the variables at I(2), that confirms that there is not any spurious relation in the data. The situation when some variables are stationary at I(0) and some variables at I(1), the recommended method for applying analytical technique suggested by economist and researchers is Auto-Regressive Distributed Lag (ARDL) model.

In order to analyze the impact of exports on International trade of Pakistan the Auto-Regressive Distributed Lag (ARDL) model is applied as an analytical technique. The dependent variable is international trade (IT) and the independent variables are exports (X), exports of primary commodities (XPC), exports of textile manufacturing sector (XTM), exports of other manufacturing sector (XOM), exports of other commodities and goods (XO), world income (Y), exchange rate (ER), tariff imposition on exports (TRF^x), Proxy variable for Trade openness or Liberalization policy (TOP), terms of trade (TOT) and balance of trade (BOT). The theoretical equation to express the relationship between dependent and independent variables is articulated as;

IT = f (X, XPC, XTM, XOM, XO, Y, ER, TRFx, TOP, TOT, BOT)   (4.1)

The econometric model of the above theoretical model (7.1) can be formed as follows;

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$$IT_t = \alpha_0 + \alpha_1 X_t + \alpha_2 XPC_t + \alpha_3 XTM_t + \alpha_4 XOM_t + \alpha_5 XO_t +$$
$$\alpha_6 Y_t + \alpha_7 ER_t + \alpha_8 TFR_t^x + \alpha_9 TOP_t + \alpha_{10} BOT_t + \alpha_{11} TOT_t + \qquad (4.2)$$
$$\mu_t$$

The ARDL model to be regressed can be written as;

$$IT_t = \alpha_0 + \alpha_1 X_t + \alpha_2 XPC_t + \alpha_3 XTM_t + \alpha_4 XOM_t + \alpha_5 XO_t +$$
$$\alpha_6 Y_t + \alpha_7 ER_t + \alpha_8 TFR_t^x + \alpha_9 TOP_t + \alpha_{10} BOT_t + \alpha_{11} TOT_t +$$
$$\sum_{t-1}^{t=n} \beta_0 \Delta IT_{t-1} +$$
$$\sum_{t-1}^{t=n} \alpha_1 \Delta X_{t-1} + \sum_{t-1}^{t=n} \alpha_2 \Delta XPC_{t-1} + \sum_{t-1}^{t=n} \alpha_3 \Delta XTM_{t-1} + \qquad (4.3)$$
$$\sum_{t-1}^{t=n} \alpha_4 \Delta XOM_{t-1} + \sum_{t-1}^{t=n} \alpha_5 \Delta XO_{t-1} + \sum_{t-1}^{t=n} \alpha_6 \Delta Y_{t-1} +$$
$$\sum_{t-1}^{t=n} \alpha_7 \Delta ER_{t-1} + \sum_{t-1}^{t=n} \alpha_8 \Delta TRF_{t-1}^X + \sum_{t-1}^{t=n} \alpha_9 \Delta TOP_{t-1} +$$
$$\sum_{t-1}^{t=n} \alpha_{10} \Delta BOT_{t-1} + \sum_{t-1}^{t=n} \alpha_{11} \Delta TOT_{t-1} + \mu_T$$

The model (4.3) is regressed with the help of E-Views version 9 applying ARDL approach and the important results are incorporated in table (6.2).

To evaluate the importance of exports in international trade of Pakistan, the Auto-Regressive model has been applied in the analytical techniques firstly, to find the effect of exports and its determinant in the foreign trade of Pakistan empirically. The overall results of the variables are good obtained from the regression analysis of ARDL approach via confirmed from Prob. F-stat value (0.0000), Durbin-Watson Stat (2.053) and R-Squared value (0.9261) explaining 92% variation between dependent and explanatory variables also showing goodness fit of the model. The DW value is greater than the R-Squared value showing that there is not any sign of spurious relation in the data.

The result of the effect of exports and its determinants on the international trade of Pakistan is shown in table (6.2). The lag-length criterion of the

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model is selected from Akaike and Schwarz criteria following the regression lag analysis of the ARDL model and takes the lag regression form as (1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, and 0).

The exports is highly significant with positive coefficient value as expected showing that exports plays an important role in foreign trade and the theoretical literature strongly supports the empirical results of this study. The estimated value of the estimator of exports is (0.713821), means that one percent increase in the total exports of Pakistan can convey seventy-one percent increases in the foreign trade of Pakistan to its major trading partners countries. The results are consistent with the studies of Aurangzeb (2006), Nadeem (2007), Hossain and Karunaratne (2004), Mohammad (2010), Zakariya (2014) and Saleem and Sial (2015).

Exports of primary goods and commodities have vital and imperative role in the foreign trade of developing and under-developed countries and considered as engine of growth for these countries. It also has an influential role in development process. Pakistan too is a developing country having lack of capital, technology and industrial structure. Therefore, mostly exports primary goods to its trading partner's countries. The results incorporated in table (6.2) showing that the co-efficient value of Exports of primary goods and commodities estimator in case of Pakistan is positive and (0.130488) as expected means that one percent increase primary and agriculture goods may increase thirteen percent increase in foreign trade of Pakistan. the results of the study is consistent with the past studies of Bahmani-Oskooee and Alse (1993), Dutt and Ghosh (1996), Ghatak et al. (1997), Levin and Raut (1997), Rahman and Mustafa (1998), Islam (1998), Ekanayake (1999), Dawson (2005), Kwa and Bassoume (2007), Sanjuan-Lopez and Dawson (2010) and Faridi (2012).

The textile sector plays a major and important role in the exports of Pakistan since independence. The empirical results of this research study showing that exports of textile sector have a momentous role in foreign trade of Pakistan as well as the theoretical analysis and the data supports the results of the this study. The coefficient value of exports of manufacturing sector is (0.648157) shows that one percent increase in the textile sector bring sixty-four percent increase in the exports and international trade of Pakistan of this sector. The results are consistent with some recent past studies done by Hanif and Jafri (2006), Subhani (2010), Zulfiqar and Kauser (2012), Ahmad and Kalim (2013), Afia Malik (2000) and Xinxin Wang (2014).

Export of manufacturing sector plays an important role in the economic growth and development of the country. Majority of the empirical as well as theoretical studies supports the importance and contribution of manufacturing exports in raising the economic growth of the countries. The empirical results of this study also supports the importance of manufacturing sector, as the co-efficient of export of manufacturing sector is positive and significant as expected. The co-efficient value is (0.439073) demonstrating that one percent improvement in the manufacturing sector exports transmits forty-three percent increases in the international trade of Pakistan. The results of this research study is consistent with the past studies of Lardy (2003), Kilavuz and Topcu (2012), Akbar and Fatima (2013).

The exports of other goods and items as well as sub-groups of manufacturing like jewelry, cements etc observe encouraging growth from last few decades as shown by statistical analysis, while the results of this study proved empirically. The results given in table (6.2) revealed that exports of other goods and items have significant positive value (0.273501) as expected showing that one percent increase in the exports of other items may brings an amplify of twenty-Seven percent in overall foreign trade of Pakistan.

The impact and role of world economies and their income distribution has gain a considerable importance for the policy maker and became a debating issue. Some countries have taking a considerable advantage by attracting the world income and entering to world market through their exports. On the other hand, it also suffers some countries especially developing countries and increases the competitive environment for these countries. In this research study, the world income is taken to test empirically that either the world income has any impact on the international trade of Pakistan. The results obtained from the regression analysis of the ARDL model proved that world income has significant positive effect on the foreign trade of Pakistan. The estimator value of world trade is positive and (0.172513), explaining that one percent increase in the world may attract the exports of Pakistan that will leads to an increase of about seventeen percent in the foreign trade towards the world countries. The same results are also found in the earlier studies of Acemoglu and Ventura (2002), Hanson et. al. (2005), Baldwin (2012) and Antras (2014).

The exchange rate is also an important variable that affect the exports as well as imports of the country ultimately leads to international trade of that country. Many countries devalue their currency to gain much fruit from

foreign trade via increasing their exports through devaluating of their currency. Pakistan too, devalues their currency in 1972 that brought an increase of an about forty percent in that time. In this study, the variable exchange rate is included to empirically examine the effect it on the international trade of Pakistan. the co-efficient value (-0.264171) of exchange rate is negative and significant indicates that one percent decrease in the exchange rate may bring an increase of twenty-six percent in the foreign trade of Pakistan. The empirical results of this study for exchange rate are consistent with the studies Bahmani-Oskooee (2001), Liew et. al. (2003), Kemal (2005), Xafa (2007), Wai-mum, Yuen-ling and Tan (2008) and Shahbaz et. al. (2011).

The tariffs and exports duties play an imperative role in international trade of the country. Low tariffs rate boom the exports that increases the foreign trade of that country. Like other countries Pakistan too has adopted different tariffs policies throughout the history in order to increase the foreign trade to achieve maximum output from exports and international trade. To empirically examine the impact of exports tariffs on the international trade of Pakistan, this study uses tariffs duties as an explanatory variable. The co-efficient value (0.293213) of exports tariffs is negative and significant showing the regression results incorporated in table (6.2), means that one percent decrease in the exports duties can cause an increase of about thirty percent in the foreign trade of Pakistan. the empirical results of this research study is consistent with the past studies of Bertola and Faini (1991), Shun-Fa (2011), Kahnamoui (2013) and Isakova et. al. (2013).

Generally perceived that trade liberalization or trade openness have noteworthy effect on the international trade as well as generate a competitive environment for the countries to improve the quality and quantity of the products to enhance increase in their exports and foreign trade (Ravallion, 2004). Mixed literature been exists regarding to trade openness and its possible effect. Some empirical studies support positive effect, some negative while some studies didn't found any significant effect of trade openness or liberalization policies. Some of the economist suggests that developing countries can gain much from international trade, while other have doubtful believe on the gain from foreign trade. This study attempted to empirically observe the connotation of trade openness in international trade of Pakistan. The result given in table (6.2) reveals that trade openness has insignificant co-efficient value doesn't shows any considerable influence in the foreign trade of Pakistan. Some earlier studies also found the related

results include the studies of Dollar and Kraay (2003), Rigobon and Rodrik (2005), Yucel (2009), Siddiqui and Iqbal (2010).

Trade balance is an important factor that clearly shows the volume of trade (exports and imports) of the country. If a country exports is larger than imports, trade balance be in surplus. If trade volume of exports is smaller than exports, trade balance is in deficit or in negative. If volume of exports and imports are equal, trade is called balance. Most of the developing countries are suffering from trade balance. Pakistan too except few years continuously facing trade deficit. This research study includes trade balance (X-M) as one of the explanatory variables to assess their role in foreign trade of Pakistan. The co-efficient value of trade balance is positive and significant as expected, showing that one percent increase in the exports brings surplus in the trade balance that leads to an increase of approximately thirty-six percent in the overall international trade of Pakistan. The empirical result of this research study supports the theoretical theory of trade balance and consistent with the studies of Khan and Hossain (2010), Waliullah et. al. (2010), Mohammad (2010), Ju, et. al. (2010) and Abbas (2013).

Terms of trade has gained keen interest in foreign trade among the countries, especially in case of developing countries. Huge fluctuation and instability in the price level in developing countries create worsening in the terms of trade that leads to fall in the foreign trade of developing countries. This research study attempted to explore the effect of terms of trade on the international trade of Pakistan. The result for terms of trade obtained from the regression analysis shows the true sign as expected and supports by the theoretical model, but find insignificant that shows that terms of trade hasn't any effect on the foreign trade of Pakistan. Though some studies of Mendoza (1997), Ghirmay, Sharma, and Grabowski (1999), Bleaney and Greenaway (2001), Blattman et. al. (2003) and Fatima (2010) find the significant negative effect of terms of trade. The reason of finding insignificant results may be that exports of Pakistan are less than the imports. Moreover, the economy as well as price level and political system also facing instability that may leads to decrease in the foreign trade of Pakistan.

This research study also assessed the behavior of Error Correction Term (ECT)[3]. ECT estimates the speed at which the model will return back to its original position after subsequent an external shock or from disequilibrium. The value of ECT (-0.440785) is negative and significant, that means that

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[3] *Also known as "Speed of Adjustment".*

this model can turn back at a speed of forty-four percent to its original if suffer from any external shock.

The constant term has negative and insignificant; while lag of international trade has found significant positive delivering that previous year foreign trade of Pakistan have optimistic impact on the current year international trade.

4.1 Diagnostic and Stability Analysis of Export and Foreign Trade Model

To check the sensitivity, steadiness and goodness of fit of Export and Foreign Trade model, the diagnostic and stability test are applied to check the Auto-correlation, Hetro- skedasticity, Stability, Long-run relation and co-integration among the variables as well as of the model.

The Breusch-Godfrey Serial Correlation LM Test and Breusch-Pagan-Godfrey Heteroskedasticity Test are applied to test the serial correlation and Heteroskedasticity in the model. The results integrated in table (6.3) shows rejection of the null hypothesis proving that the model is free from problem of serial correlation and Heteroskedasticity.

For the stability of the model, the Ramsey RESET[4] Test and the results shown in table (6.4) demonstrating the stability and normality of the model and acceptance of null hypothesis, that the model is stable and steer to goodness of fit.

The long-run relation of variables included in the model and their co-integration vector are also checked applying the Bound Testing Approach and ARDL long-run and co-integration technique. The Null Hypothesis is $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = \alpha_9 = \alpha_{10} = \alpha_{11} = 0$, assuming that there hasn't exists any long-run relation among the variables. In contrast the Alternative Hypothesis showing the existence of long run relation, that is $\alpha_1 \neq 0$, $\alpha_2 \neq 0$, $\alpha_3 \neq 0$, $\alpha_4 \neq 0$, $\alpha_5 \neq 0$, $\alpha_6 \neq 0$, $\alpha_7 \neq 0$, $\alpha_8 \neq 0$, $\alpha_9 \neq 0$, $\alpha_{10} \neq 0$, $\alpha_{11} \neq 0$. The hypothesis is tested through bound testing approach comparing the F-stat value with Pesaran test values. If the F-statistics value is greater than critical value of upper bound assume by Pesaran test, showing rejection of the null hypothesis.

The results of bound test given in table (6.5), illustrate the rejection of null hypothesis and indicating the long-run relation among exports, its determinants and foreign trade of Pakistan. The ARDL co-integration test

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[4] Regression Specification error term

also confirms co-integrating vectors among the variables as shown in table (6.6).

5. Conclusion

Besides resource scarcity Pakistan has also been lacking bargaining power in trade transactions with developed economies due to non-membership of any significant free trading zone or trading block. Exports to individual economies are constrained under bilateral trade agreement and are subject to several of quota and tariff restrictions. Pakistan's exports are greatly contributed by cotton and textile which was adversely affected by [5]DCs protectionism and MFA (Multifibre Arrangements), if not so Pakistan would have wider options to export textiles and clothing and would have superior situation to market these. Furthermore, DCs have augmented several obstacles by the label of environmental protection, child labor and human rights against Pakistan's exports, in addition to dumping in the LDCs markets.

Apart from the key crops export, Pakistan has to utilize its comparative advantage in the production and exports of dairy products, meat, fruits, vegetables, horticulture, etc to grasp benefit from trade liberalization to full extent. Pakistan also has comparative advantage in the production of many primary products. However in order to exploit its comparative advantage, Pakistan has to concentrate on import bills and resolve the tribulations in supply side i.e. domestic demand. Pakistan along other developing countries demands for fair global trading system considering WTO negotiations on agricultural. With regard to the Agreement on trade related features of intellectual property rights (TRIPS), Pakistan oblige to guarantee that the industry is encouraged to give intellectual property protection for its goods and also make sure that there is effectual protection of the intellectual property rights connected to imported goods.

The main failure of export growth in Pakistan depends on certain sociopolitical and economic factors e.g. advanced infrastructure, encouraging geo-political and world condition, nonviolent law and order situation, political stability, competitiveness, efficient manpower, price and bargaining power in trade negotiations, and considerable research and development expenditure, etc. The possibility of improving exports growth

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[5] *Developed Countries*

by handling aforementioned determinants and situation efficiently in a developing economy like Pakistan is almost unattainable.

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Regression Results of Exports and its Determinates as Independent variables and Foreign Trade as Dependent Variable are

Table: 6.1. *Augmented Dickey–Fuller Unit Root Test Results*

Variables	Acronyms	ADF Values		ADF Critical Values
		At Level	At 1st Difference	
INTERNATIONAL TRADE	IT	-2.445816**	-4.222351*	-2.9339
EXPORTS	X	-3.087215*	-5.351679*	-2.9339
EXPORTS OF PRIMARY COMMODITIES	XPC	-2.528486**	-4.301104*	-2.9339
EXPORTS OF TEXTILE MANUFACTURING SECTOR	XTM	-1.441125	-4.396435*	-2.9339
EXPORTS OF OTHER MANUFACTURING SECTOR	XOM	-0.959122	-4.928020*	-2.9339
EXPORTS OF OTHER GOODS	XO	-2.935485*	-4.609289*	-2.9339
WORLD INCOME	Y	-2.698155**	-3.795314*	-2.9339
EXCHANGE RATE	ER	-1.488565	-3.647880*	-2.9339
EXPORT TARIFFS	TRF[x]	-3.580181*	-4.989223*	-2.9339
TRADE OPENNESS	TOP	-0.820238	-5.071277*	-2.9339
TERMS OF TRADE	TOT	-1.936422	-5.784582*	-2.9339
BALANCE OF TRADE	BOT	-4.858152*	-6.485582*	-2.9339

Critical Value of ADF is selected at 5% significance level. (*) & (**) shows rejection of Null Hypothesis at 5% & 10%.

Table: 6.2. Regression Results of ARDL Approach (For Exports and Foreign Trade of Pakistan Model)

Variables	Acronyms	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	C	-0.276365	0.324298	-0.852193	0.4067
EXPORTS	X	0.713821	0.186394	3.829632*	0.0000
EXPORTS OF PRIMARY COMMODITIES	XPC	0.130488	0.062482	2.088422**	0.0498
EXPORTS OF TEXTILE MANUFACTURING SECTOR	XTM	0.648157	0.143385	4.521477*	0.0000
EXPORTS OF OTHER MANUFACTURING SECTOR	XOM	0.439073	0.252909	1.736084***	0.0979
EXPORTS OF OTHER GOODS	XO	0.273501	0.128118	2.134758**	0.0482
WORLD INCOME	Y	0.172513	0.054032	3.192736*	0.0057
EXCHANGE RATE	ER	-0.264171	0.080492	-3.281937*	0.0047
EXPORT TARIFFS	TRF^x	-0.293213	0.150659	-1.946192***	0.0694
TRADE OPENNESS	TOP	0.575233	0.623446	0.922667	0.3672
TERMS OF TRADE	TOT	-0.395426	0.286379	-1.380778	0.1587
BALANCE OF TRADE	BOT	0.363891	0.092147	3.949003*	0.0011
ERROR CORRECTION TERM	ECT	-0.440785	0.116534	-3.782429*	0.0000
R-SQUARED		0.926183	Durbin-Watson stat		2.053114
ADJUSTED R-SQUARED		0.917258	Prob(F-statistic)		0.000000

(*), (**), (***) showing significance at 1%, 5% & 10% respectively.

Table: 6.3. Breusch-Godfrey Serial Correlation LM & Breusch-Pagan-Godfrey Heteroskedasticity Tests

Results of Serial Correlation LM Test				Results of Heteroskedasticity			
F-STATISTIC	0.452	Prob. F(2,22)	0.6416	F-statistic	2.08	Prob. F(19,19)	0.0595
OBS*R-QUARED	1.502	Prob. Chi-Square (2)	0.4717	Obs*R-squared	26.33	Prob. Chi-Square(19)	0.1210

Table: 6.4. Ramsey RESET Stability Test

	Value	df	Probability
T-STATISTIC	0.485019	19	0.6332
F-STATISTIC	0.235244	(1, 19)	0.6332

Table:6.5. ARDL Bounds Test *(Null Hypothesis: No long-run relationships exist)*

BOUNDS TEST VALUE		Critical Value Bounds	
TEST STATISTIC	Value	I0 Bound	I1 Bound
F-STATISTIC	17.25619*****	2.45	3.61

Critical Value is selected at 5% significance level. (*****) Shows rejection of null hypothesis

Table:6.6. ARDL Co-integrating Test

Cointegrating Form				
VARIABLE	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ(-1)	-0.965684	0.019553	-49.388077	0.0000

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LOCAL CREDIT MARKETS IN THE ITALIAN REGIONS: AN

ANALYSIS FROM THE INTRODUCTION OF THE EURO TO THE

GREAT RECESSION

Abstract

The efficiency of local financial systems strongly affects the success of the related socio-economic contexts. The aim of this work is to represent the situation of the Italian regions and macro areas in light of the events induced by the international economic crisis. The analysis focuses on local systems for the efficient reorganization of national and European financial markets. We also discuss the essential reminders in the economics literature on local banks and credit markets, related to the concept of manufacturing districts. We focus on the role of credit in the Italian regions, including policy suggestions on the reorganization of credit markets.

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1. Introduction

Many would agree that credit represents a key variable in explaining the processes of economic development and that the efficiency of local financial systems affects the success of the related socio-economic contexts. In some countries, such as Italy, there is an industrial organization based on small and medium-sized enterprises, often characterized by scarce resources and always linked to their territory. In this perspective, local banks, by playing the role of the main financial intermediary by proximity, often offer support similar to financial consulting for small-scale producers, who characterize the Italian economic system.

The direct and detailed knowledge of the two interlocutors, businesses and banks, and the local reference environment claims a widespread point of view, decision-making and an operational core that only *ad hoc* models of governance could guarantee. In this view, on the one hand, the risk of loan disbursements in favor of undeserving borrowers could be minimized; on the other hand, and as a result, the funding of purely speculative activities would prove more limited.

However, in pursuing sector and geographical diversification of risks, the historical Italian point of view agrees with the idea that just models of governance larger in scale could facilitate reaching the right target. The result somewhat obliterated the subject of the existence and the efficiency of local credit markets, accompanied by simplification and impoverishment of the financial firms' system that operates there.

The unexpected and prolonged effects of the crisis in Italy that originated in the financial markets in 2007, nevertheless, require reflection on the topic of local credit markets, given that the recent facts show that the possibility of really grasping all the opportunities offered by the so-called "local economy" is compromised, without their revitalization. The main reason lies in the fact that the non-recovery of satisfactory rates of growth requires a reexamination of the "fundamentals" of Italian economic system, starting with its market layers. In fact, in reality, we observe that the perverse effects, as well, resulting from the existence of asymmetric information and agency problems, persist and increase in the case of limited territorial dimensions, although in this case the local credit markets and their links with the economic districts of reference could play a relevant role. This is what the physical closeness and trust between businesses and banks should eliminate.

Usually, however, the monetary and supervisory authorities, scholars, policy makers and economic agents tend to neglect these dynamics that define the existence and the time evolution of local credit markets and, as their irrepressible functions, for good or evil, produce inevitable and characteristic effects in geographical areas, especially on the investment levels and the specific volume of production and trade achievable in each local context.

The aim of this work is to represent, in an exhaustive and original manner, the situation of the Italian regions and macro areas in light of the events induced by the international economic crisis in financial and credit markets, highlighting the period of the failed economic recovery and of the so-called *Great Recession*. The analysis focuses on local systems, seen as the indispensable basis for the efficient reorganization of national and European financial markets. In the next section, we discuss the essential reminders in the economics literature on the issues of local banks and credit markets that are related to the concept of manufacturing districts: an essential characterization of the entrepreneurial system in Italy. In the subsequent sections, the work focuses on the roles of supply and demand of credit with reference to the Italian macro geographical areas, first individually and then compared together. Bank loans will be then analyzed, taking into consideration the duration, and placing emphasis on the funding of productive activities and investments, deepening the loan addressed to the consumer to observe the peculiarities of credit to households. The period examined overlaps the monetary regime of the Euro, even if, to note the continuity with the previous monetary system, the main time series start in 1998, that is the last year of validity of the Lira. The basic performances are reconstructed at the Italian macro areas level. A picture of the evolution of the "fundamentals" well differentiated for the various defined areas emerges, with reference to the first virtuous phase that followed the introduction of the Euro. The final section considers several credit variables jointly for a careful analysis of the Italian region, with the aim of showing the actual structural differences in terms of availability of credit in its various forms.

2. Theoretical background

The general organization of banks considers the close relationship between banks, investors and consumers, in order to define the policy on the

credit market. The focus point of this configuration is strongly based on the mutual knowledge between all kinds of economic agents.

If properly exploited, the integration of the local financial system with the entrepreneurial activity is an element of local development. The connections between the financial market, in particular the flows in the granting of credit, and the economic growth and development, are multiple and in both directions (Fry 1988; Levine 1997). The financial market redirects resources towards the production sector with the contribution of the financial institutions that possess the information (and have economies of scale) to do so efficiently (among others Stiglitz and Weiss 1981), *i.e.* moves from areas or sectors in surplus to those in deficit. At the same time, the evolution of the economic environment needs and promotes a stronger and more secure financial market.

As a consequence of the above mentioned, the level of efficiency of financial intermediation affects the degree and the rapidity of development of the economic context (Schumpeter 1934). At the local level, an efficient financial system should consider banks that provide the appropriate tools for business and, in the case of small and medium enterprises (SMEs), supporting the decision-making processes of production and investment, while at the same time disfavouring speculative behaviours contrary to the general welfare. In Italy, the characterization of small-scale producers directly claims complicity among small businesses and local banks. In this context, we must consider a relevant difference in the process of obtaining resources, which is the role of the capital market: in the US, this market replaces in part the role of banks, while this is not frequent in Europe. The role of the capital market is, however, weak everywhere for small businesses. Furthermore, we must consider that the same legislation is applied differently in Europe and in the US, considering how to respect the evolution of the rules of Basel I, II, and III. In particular, we refer to relative higher costs to respect the rules that small banks may sustain in Europe, not being differentiated from large banking groups and this induces a detriment of efficiency.

In Italy, the difficulties described above in obtaining resources forces a large number of small businesses to integrate their needs with local banks activities, as it should be in industrial districts. In particular, *mutual* and *cooperative* banks are more related to organized local areas (*e.g.* the regions in this paper) or proper industrial districts (for the creation and evolution of the districts see, among many contributions, Marshall 1920; Porter 1998;

Becattini 1987 and 1989 for the Italian case). Obviously, the roles and prerogatives of the industrial districts have changed over time, as well as their needs in terms of financial requests to the local banks. Of course, the degree of efficiency is due to the level of integration between banks and the socioeconomic system of each district as a whole (Harrison 1992). Baffigi, Pagnini and Quintiliani (1999) propose an indicator of integration that assumes two conditions: the concentration of lending in the context of reference and holding of a large share of the local credit market, also considering the importance of mutual benefit between the bank and the district, and the cooperative legal form of the same credit institution. Obviously, these conditions allow the local banks to obtain benefits from the cooperative behaviour of firms, and, at the same time, to know and control the businesses and the relationships among them. The negatives effects are the costs of monitoring and the lack of diversification, due to the concentration of resources in the same area, and the risk of poor control in the vast mutual dilution of the voting members typical of cooperative banks.

We must refer to the "theory of the local bank" (see Becattini 1990 and 1992) originated from the Italian case and then verified at the international level. In this sense, trust is the assumption for the existence of local banks and the reason that should allow overcoming the difficulties imposed by asymmetric information. At the same time, trust represents a precondition for the existence of a local community (sharing social, political and economic institutions).

Furthermore, we must consider that, as the districts are evolving into business networks without geographical boundaries, even local banks are entering into networks. Modina and Formisano (2009) demonstrate the positive effects of the Italian networks of local banks using network theory, with the result of improving economic performances, quality and innovation of banks' products and services. This is obviously due to mutual support and the possibility of reaching economies of scale, otherwise impossible for small banks. This is a precondition for economic growth: Guiso *et al.* (2004) have demonstrated how the development of the local financial system is a determinant of the economic growth of the entire area of influence. The described "organized system" works by encouraging new entrepreneurial activities of local economic agents, attracting businesses and increasing competition. The authors have also tested a significant increase in the ability to create business and do so at a young age, moving from areas less financially efficient to areas where small entrepreneurial activities have

easier access to credit. The authors found that the ratio of new firms to population is 25 percent higher in the most financially developed Italian provinces, with direct positive effects on the local GDP. Banks should demonstrate usefulness by financing small enterprises and encouraging the creation of new businesses especially in backwards areas (Cesarini, Ferri and Giardino 1997).

However, as anticipated, the several negative effects caused by the international crisis have affected the flow of credit granted. As shown in this work, the reduction in the flow of credit happened immediately after the outbreak of the international crisis, to worsen in the years of the missed economic recovery (after 2010), at least for certain types of borrowers. Obviously, we must consider the final destination of the credit: the financial system should be able to direct it to the most efficient agents, in times of scarcity. In theory, the ideal market prices reflect knowledge and information held by businesses and investors, and thus the prices should ensure the best allocation of resources (Fama 1970). However, the recent credit crunch in Italy did not come for the price, *i.e.* the interest rate, because occurred in a context of good liquidity and low interest rates. The restriction is therefore due to the fear of banks to offer loans, due to low capitalization, to indicate a *capital crunch*, *i.e.* a credit crunch due to poor banking capitalization. The occurred difficulties have affected the general trust, principally because a sort of "distance" between the large banking groups (increasingly present in the country) and the small businesses, obviously in view of a lack of reciprocal awareness. We do therefore reference to the theory of efficient financial markets, so the efficiency is achieved when all agents know all the information, and this influences the price of financial securities. Only the information should affect the value of the securities, so making impossible the speculative behaviour.

Briefly, in Italy banks have had the need to limit the exposure risk. Furthermore, the reduction of credit flows occurred because of both supply and demand of credit. The worsening of the credit quality increased risks for banks, reducing their operation. At the same time, the reduction in some types of indebtedness is due to the reduction of consumption and investment, also caused by a general weakness and turbulence in the capital market and in important markets, such as real estate. This decrease in lending, as mentioned, was even more severe for SMEs that rely almost exclusively on banks funds, due to the low access to capital market.

3. Bank deposits

The management of the collection of banks introduces the role of the local credit markets with regard to the dynamics of growth and development at regional level. This section focuses on bank deposits, intended as a prelude to the use activities through the disbursement of loans.

The deposit collection is one of the most representative bank activities since their ancient organizations. This activity meets the needs of both individuals and legal persons to avoid the physical ownership of a large amount of money that would remain fruitless and put the owner potentially at risk. Of course, the increasing customer need complexity and the greatest opportunities for savings allocation allowed an increase in services related to deposits, which are seen from a different point of view than as a simple contract in which the receiving bank is required to refund the amounts temporarily entrusted to it and, if provided, to pay interest. The deposits are, as noted, the sources of funds necessary for banks to make lending, *i.e.* to feed the supply side of the credit to borrowers. In addition, as it is widely known, the deposits also affect the overall size of the so-called "money supply" in a macroeconomic system. This influence is manifested through the money multiplier that exploits the ability of banks to receive deposits and make loans as a result by maintaining as a reserve a portion of the values originally received. Then, a currency of banking origin will be created and added to that normally considered and established in the amount by the Central Bank.

As is evident, the aggregate "money supply" of bank origin would have a meaning even in the territorial jurisdictions, as these are all characterized by the presence and functions of financial intermediaries, although not always from their effective and independent governance levels. For this reason, we assume such dimensions of analysis, although it is difficult to measure the share of banking origin "money supply" for each field.

Figures 1 and 2 show the trend of bank deposits, according to the definition of the Bank of Italy, *i.e.* the total amount of the deposits properly defined (with agreed maturity, on demand, overnight and redeemable at notice), savings bonds, certificates of deposit and current accounts.

Figure 1. Bank deposits per geographical Italian macro area, 1998-2013 (Millions of Euros)
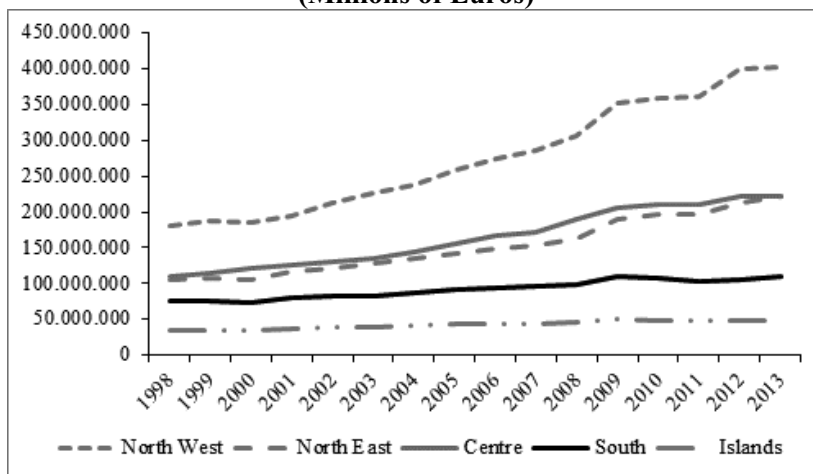
Source: Own elaboration on Bank of Italy database

The dynamics of the credit markets' most strategic variable show structural heterogeneity among the regions of North and South of Italy, especially in the years of the prolonged economic downturn. Since 2008, when the crisis began, the negative expectations have led to greater attention paid to the choices in current consumption and purchase of durable goods, with a relative increase in savings. However, the absolute values of the deposits decreased in the following years in the South, in particular due to the increasing levels of unemployment. This was also a result of the feedback linked to increasing difficulties of borrowers in having access to credit. Nevertheless, a more robust response to the problems of the real economy in the same period in the Centre-North did not allow to reduce the levels of deposits, which then started to grow again in 2011.The information on the flows of deposits, at a first glance, emphasizes an asymmetry in local formation and collection of the resources useful to the banking system to power its capacity for financial support of the investment, production and consumption activities. This generates strong differences in the potential configurations of different local credit markets.

Figure 2. Bank deposit variations, Italy and its geographical macro areas (1998-2013, base value 1998=100)
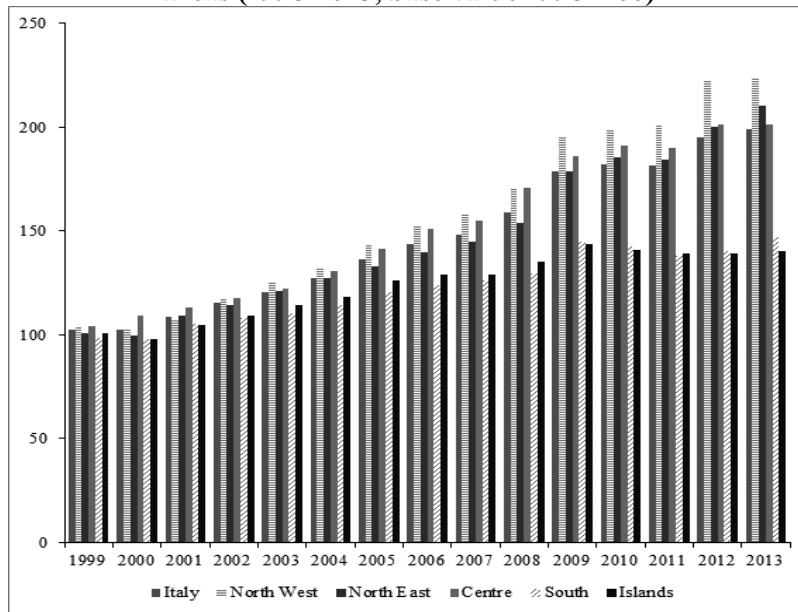
Source: Own elaboration on Bank of Italy database

4. Loans

As mentioned, deposits are the main source of collection for banks, to be exploited later in different types of uses. With reference to borrowers, the first distinction is made between businesses and households. Businesses are characterized by productive purposes and investment, while the latter borrow funds for consumption activities. Another crucial element to take into account is the loan duration: considered as short term if less than or equal to 18 months and as medium or long term in the case of an extended deadline. Figure 3 highlights the main components of bank loans in the Italian macro areas.

**Figure 3. Bank loans 1998-2013, total amounts and different type of uses
(quarterly average values, Millions of Euros,
components are represented on the left vertical axis, total amounts on
the right vertical axis)**
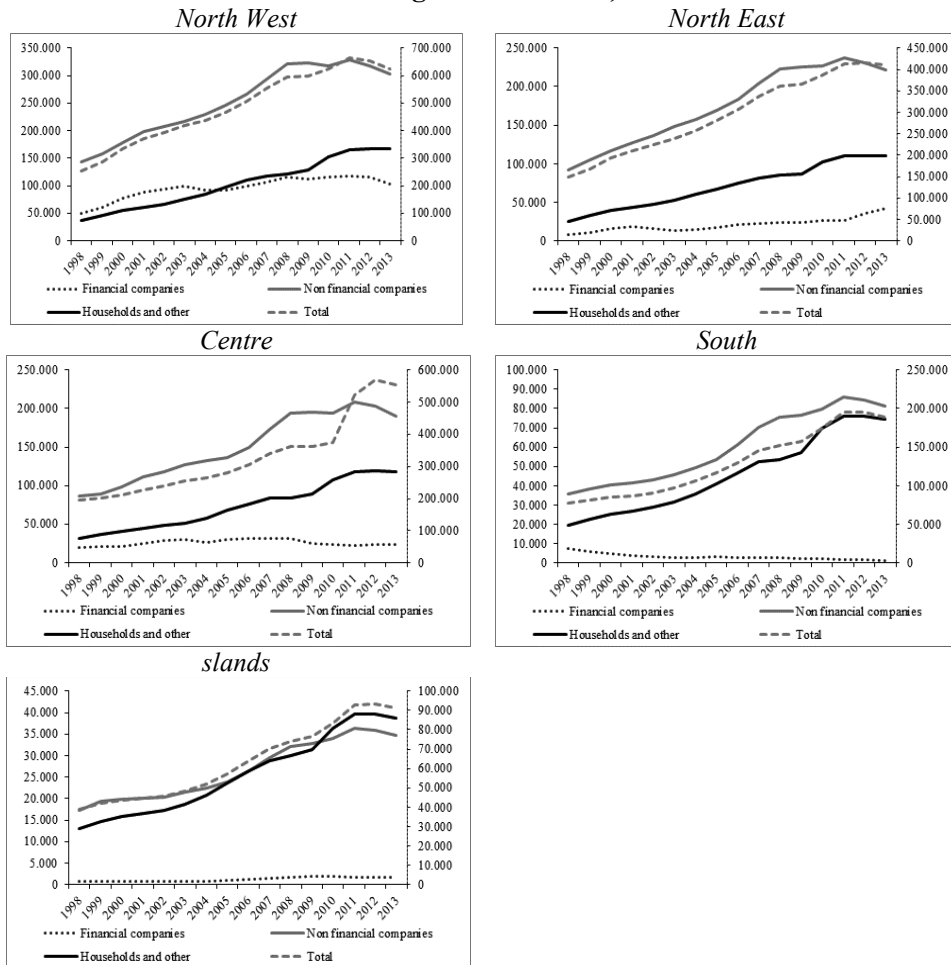
Source: Own elaboration on Bank of Italy database

It is possible to notice that there is an increasing trend with respect to all macro areas, during the period of investigation. It is evident that only because of the effects of the financial crisis, which occurred in 2007, the values begin to suffer from the general slowdown in the international economy. The clearly upward trend is dampened down for loans to enterprises as early as 2008, while in the following year there is a marked increase in loans to households. This change is certainly due to the risk of insolvency in a number of industries, as well as problems of financial statements of companies that could not easily repay debts at maturity, leading to delayed investments.

At the same time, the control requirements in the credit market are tightened by the supervisory authorities, in addition to a more stringent constraints imposed on the balance sheets of the banks themselves. Several regulatory acts were made on the banks' behalf by the BCE, but these acts were often thwarted by the structure of the domestic financial system and by alternative uses of the new liquidity provided by the central authority. In addition, the policy of austerity at EU level has slowed possible support interventions in several countries, with the effect of discriminating the economic domestic context of production, particularly in many countries of the Mediterranean area.

In all the Italian regions, the rapid increase in the rate of unemployment fostered the growth of household borrowing in an attempt to preserve previous levels of consumption as much as possible. Nevertheless, the increase in loans to households was interrupted, particularly during 2011, when the lack of economic recovery and the new problems of the international financial market, emphasized by some of the sovereign debt crisis, made the lending activity more difficult or less attractive (see Section 2).

Looking at the differences between the various macro areas, it is still possible to see the large structural distances in the degree of activity in each defined field. Loans to financial companies, in Fig. 3, reveal that this activity is quite marginal in the South. In this area, the "closeness" between the values of the loans, in some ways, more directly "productive" and those addressed to households induces more critical reflections on the local economy, considering the efficiency and the productivity specification.

As well known, loans and credits useful to investments contribute significantly to the increase in long-term stable production of new wealth, while the uneven increase in credit to households may produce, in extreme

cases, the formation of speculative financial bubbles, as demonstrated by the American subprime mortgages at the beginning of the recent *Great Recession*. In fact, a strong expansion of private credit to households (as that for the purchase of real estate) compared to that for businesses can be a predictor of crises of banking origin, because of the increasing vulnerability, while is less for businesses credit. The credit to businesses is moderated by the expected and associated increase in income through investment (Büyükkarabacak and Valev 2010). In fact, prior to the '90s, the credit to households had a limited impact on the total amount of private credit.

In the Centre-North, loans to the non-financial companies play a much important role than those to households, and this differentiation is maintained during the years of the crisis, only decreasing in 2013. In the South, the values and trend of the productive loans and those for consumption are very close, becoming equal in 2009. Figure 4 shows the aggregate amounts of loans and deposits and the trends (dashed lines) at the national level.

Figure 4. Loans and deposits, total amount and trend, Italy 1998-2013 (Millions of Euros, trend in dashed lines)
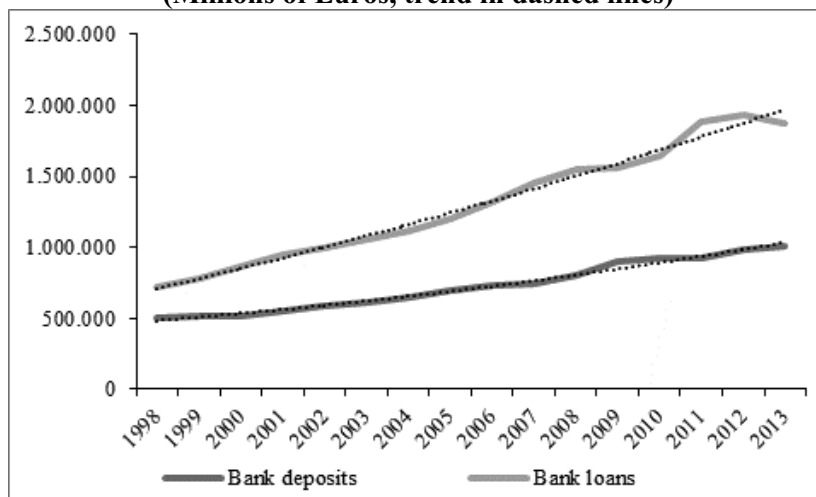
Source: Own elaboration on Bank of Italy database

We can clearly see a scissors dynamic of the two series of measured values, even if lending is characterized by a slight recent reversal caused by

the economic downturn. This means that despite an upward trend in aggregate variables, the collected savings tend to increase by a minor proportional rate with respect to those in lending. In this connection, however, the effectiveness of the so-called system-level credit multiplier should not be overlooked.

These trends are strongly influenced by older data of the observed period. From 1998 to 2007, *i.e.* before the crisis, bank deposits have increased annually by an average of approximately 4,5% and loans by over 8%. From 2008 to 2013, however, deposits increased by an average of 5,13% and loans by just 4,52% (this is also due to the sharp drop of more than 3% between 2012 and 2013).

The distribution of loans by major categories of beneficiaries qualifies local credit markets in a clearly differentiated manner in the described national context that, with the exception of the last two years, registers a stable "core" trend. As we have seen, the jurisdictions in the Centre-North are much more oriented to financing business than those in the South.

5. Loan distributions over time

Many types of loans are not directly comparable because of the legal nature, the guarantees required, the timing of disbursement and the total duration, in addition to considering the different standards of the various lenders. As a result, with all the limitations, it is possible to distinguish between bank loans based on length of time to investigate potential sources that, in a climate of austerity taken by the policy makers, could finance the long-term growth of a country's income, *i.e.* the investment in support of production in the long run. In contrast, the access to short-term loans by businesses is usually aimed at supporting current production, or the so-called working capital. In fact, the main problem for businesses in the 2007-09 credit crunch was related to the short-term financing channels (Akbar *et al.* 2013).

Figure 5 shows the evolution of the timeline composition of loans in the short and medium/long term for the main Italian macro areas.

Figure 5. Loans timeline composition 1998-2013

North West

North East

Centre

South

Islands
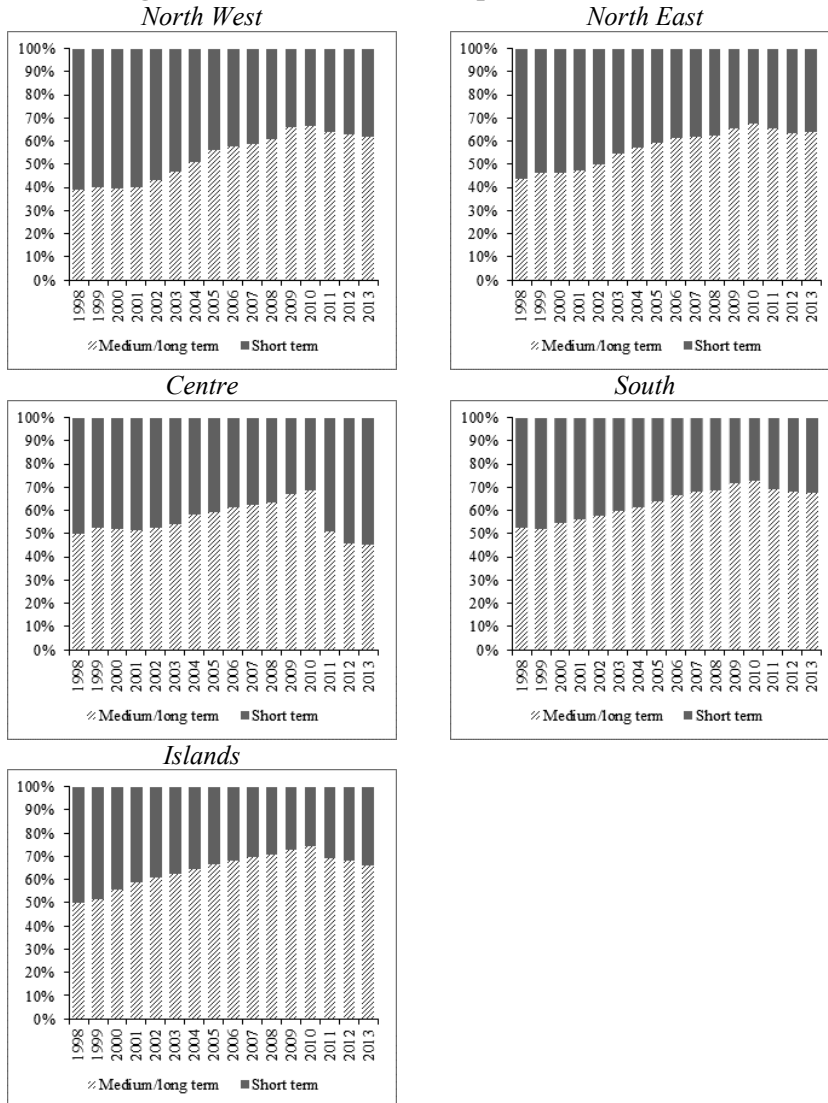
Source: Own elaboration on Bank of Italy database

In all of the areas, it is possible to highlight the time trend to concentrate on the longer-term loans, gradually reducing the share of short-term ones, while in the last three years these trends are reversed, due to the growing needs of businesses and in the absence of an economic recovery.

The overall performances demonstrate the occurrence of excessive stickiness in the adjustment processes in the temporal types of loans, which has exacerbated the negative effects on the real economy in the prolonged economic downturn. Given that the flow of the total investment in the country has neither had uniform growth over time nor adequate spatial distribution, the observed dynamics let us imagine even excessive borrowing for their financing. Namely, entrepreneurs have made their own resources less available to finance company's fixed capital, with the inevitable shift of the adverse effects of the crisis in the real economy almost entirely on the banking system.

In local credit markets, the long crisis highlights all of the fragility that the so-called "relational capitalism", which has long dominated the Italian economic system, assumes in its reference territory. This means that in the mechanisms of access to credit, self-reports often prevail over the principles of a properly regulated competitive market. In sum, we will be seeking the whole theme of the effective functioning of economic democracy even in these areas.

6. The consumer credit

The credit to households is a crucial aspect of the economic financing activity and the qualifications of its structural profiles. In most advanced economies, the consumer credit takes an increasing importance and is awarded to individuals to defer a payment or pay in instalments or just support consumption activities. It is not a coincidence that the institution is governed not only by the Banking Act (art. 121) but also by the Consumer Code (Legislative Decree no. 2005/206). The consumer credit refers to a variety of different contracts such as credit cards, deferred or instalments payment, sales of salary, personal loans, consolidation loans, etc. The payment in instalments for certain goods (*e.g.* vehicles) or payment for them by credit card characterize the so-called "special-purpose loans" to clearly distinguish them from others that are not specifically aimed. The great importance of consumer credit is explained by the characteristic of

increasing funding for consumption opportunities typical of modern economies. These economies need intensive interventions by supervisory authorities to protect consumers, who are deemed to be the "weakest link" of these widespread and refined practices. The rapid growth of the use of these payment facilities, sometimes unfamiliar and unclear, made it necessary to require various types of information that the Contracting Parties must provide. A variety of flexible legal relations is necessarily reflected on the progress of the total consumption expenditure, with specific regional influences in its manifestations. Prior to the crisis that began in 2007, annual increases in several regions were close to 20%, higher than the country average increase of 13% (Fig. 6). These positive changes gradually and annually decreased over the next three years, and due to the continuing *Great Recession*, they became negative (from 1% to approximately 4%, depending on the area) starting in 2011.

Figure 6. Consumer credit 2003-2013 (Millions of Euros, components are represented on the left vertical axis, total amounts on the right vertical axis)

North West

North East

Centre

South

Islands

45
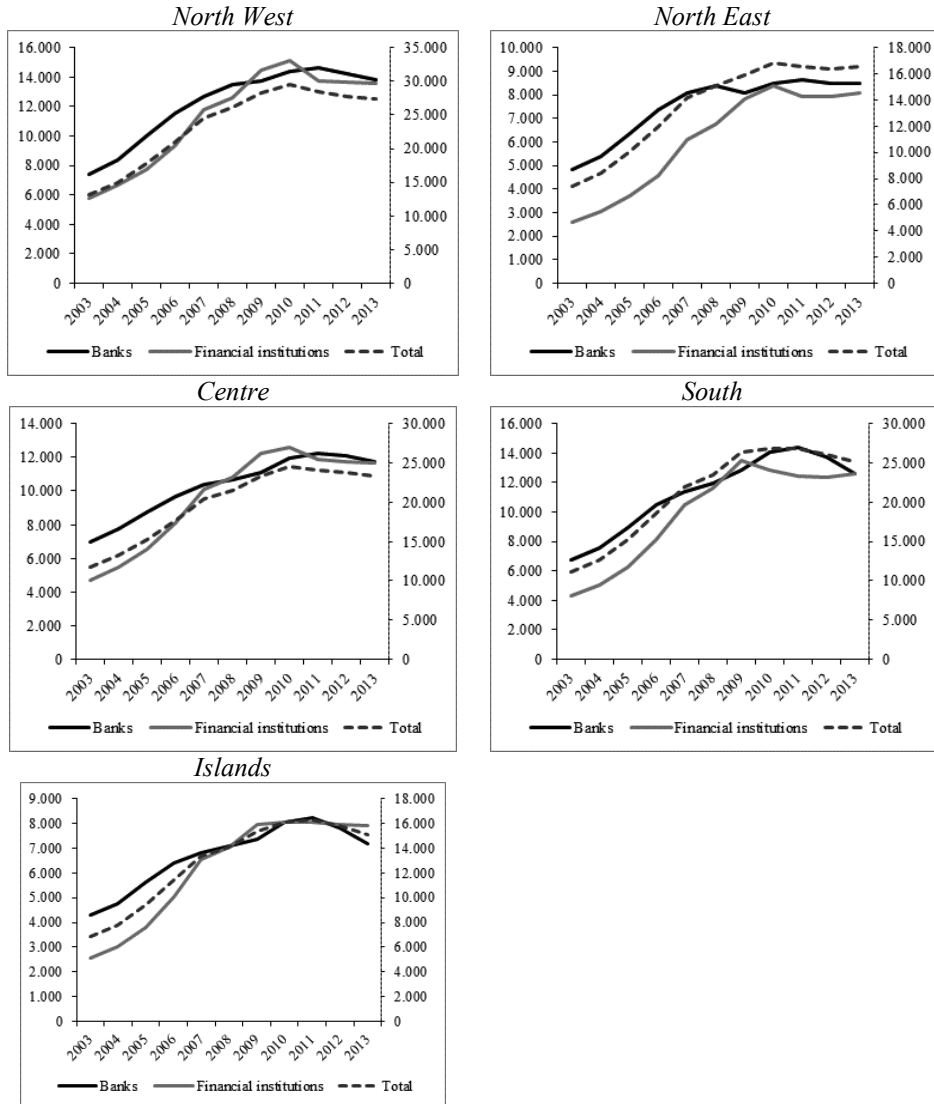
Source: Own elaboration on Bank of Italy database

All macro areas show almost the same dynamic trend. The difference in size, however, could be found in granting paid by the banks and those distributed by other financial companies. The growing importance of the role played by non-bank financial intermediaries in granting consumer credit is evident, with these institutions being prevalent almost everywhere, at least until the outbreak of the crisis.

The two sources, nevertheless, have "alternated" the supremacy of the distribution of delivery in the last three years, when rising unemployment, negative expectations about future income and the instability of financial markets have unnecessarily curbed consumption. The resulting reduction in the total amount of such lending practices has been much stronger in the South, with a decrease of more than 3% just in 2013 (less than 2% in the Centre-North).

It is interesting to note that almost uniformly, in all areas, the market shares of banks and those available as financial firms are almost equal. This segment of the market, with the hoped-for economic recovery, is expected to grow both nationally and at a regional level. In fact, the amount of consumer credit in the country is still too underpowered compared to the most advanced international experience.

Because this type of credit is delivered in some form in a not entirely negligible quantity by local financial expressions, their contribution with respect to the definitions and the efficiency of the local credit markets must not be underestimated. This growing and innovative form of credit supports the creation of new opportunities in more flexible territorial specifications. The presence of high values in the southern regions in recent years, unlike the other types of credit, is evident. These high values are due to the fact that in the South, the households have used the consumer credit not as an alternative form of consumption, but as a form of indebtedness to deal with necessary expenses.

7. Analysis of different forms of credit in the Italian regional context

We present a case study with the aim to investigate the structural differences of local credit markets at the regional level. We apply a Multidimensional Scaling Analysis (MDS) technique in the context of the Italian regions for a deeper analysis. This instrument allows the simultaneous

consideration of a large number of economic variables, in this case, all of the credit types recognized by the Bank of Italy, and the presentation of a graphical output with a clear explanatory intent.

The object of investigation is the grant (and thus availability for businesses and consumer households) of credit in very different forms in the 20 regions that will be positioned in the graph in two dimensions by establishing relationships in terms of proximity/distance with respect to the indicators of credit selected. The resulting positioning map can be useful for detecting the formation of homogenous groups with reference to the Italian situation in the first quarter of 2014. In this manner, it is also possible to see some additional features that characterize the local credit markets, their main similarities and differences, as well as the basic elements that define their very existence.

In this analysis, several credit variables were considered to be related (but not only) to the work of banks (source: Bank of Italy): funding over the short term - investment in construction, funding over the short term - investments in machinery, equipment, means of transport and various products, funding over the short term - real estate purchases, funding over the short term - other destinations, leasing (operating granted), factoring - total nominal value of the loans sold, factoring - advances granted - granted operational, signature loans - businesses, signature loans - households and others, borrowers - operating granted, bank loans - businesses, bank loans - households and more, and consumer credit. For all of the variables, mean values were calculated using data on the population (Istat data) and on the number of firms (Unioncamere data). For a direct comparison of variables of different scope and size and, all data were normalized (before calculating the per capita values and then rescaling the same interval 0, 1) to avoid bias. The analysis permits to define the axis on which to place each type of loan to obtain the best result of the positioning of the regions.

The model's goodness of fit was assessed via the RSQ (0,98464), that indicates the proportion of variability explained by the corresponding dissimilarity distances, and the Stress Index (0,06458).

Table 1. Iteration history for the 2-dimensional solution (in squared distances) - Young's S-stress formula 1 is used

Iteration	S-stress	Improvement
1	,05813	
2	,04957	,00856
3	,04787	,00170
4	,04720	,00066

Iterations stopped because *S-stress* improvement is less than ,001000

Results are acceptable when the size *k* achieves a Stress Index value lower than 0,15. A two-dimensional model was judged suitable according to the values of the previous indexes. Further investigation provided an additional basis for choosing the two-dimensional solution, as observed from the small reductions of the S-Stress after the second iteration. The correlations between dimensions and variables (see Table 2) were useful for naming the axes.

Table 2. Correlations between variables and dimensions

List of variables	*Dimension 1*	*Dimension 2*
Funding over the short term - investment in construction	0,71716	0,48666
Funding over the short term - investments in machinery, equipment, means of transport and various products	0,796079	0,001467
Funding over the short term - real estate purchases	0,895945	-0,16681
Funding over the short term - other destinations	0,931872	0,010632
Leasing (operating granted)	0,887927	0,309699
Factoring - total nominal value of the loans sold	0,726265	-0,57955
Factoring - advances granted - granted operational	0,744159	-0,58598
Signature loans - businesses	0,841616	-0,18452
Signature loans - households and others	0,65176	0,622696
Borrowers - operating granted	0,963882	0,124661
Bank loans - businesses	0,952611	0,179618
Bank loans - households and more	0,951468	-0,01249
Consumer credit	-0,37923	-0,74669

Source: Own elaboration on Bank of Italy, Istat and Unioncamere database

The resulting two-dimensional image is shown in Figure 7.

Figure 7. Clustering of the Italian regions for loans granted (per capita values of the first quarter of 2014)
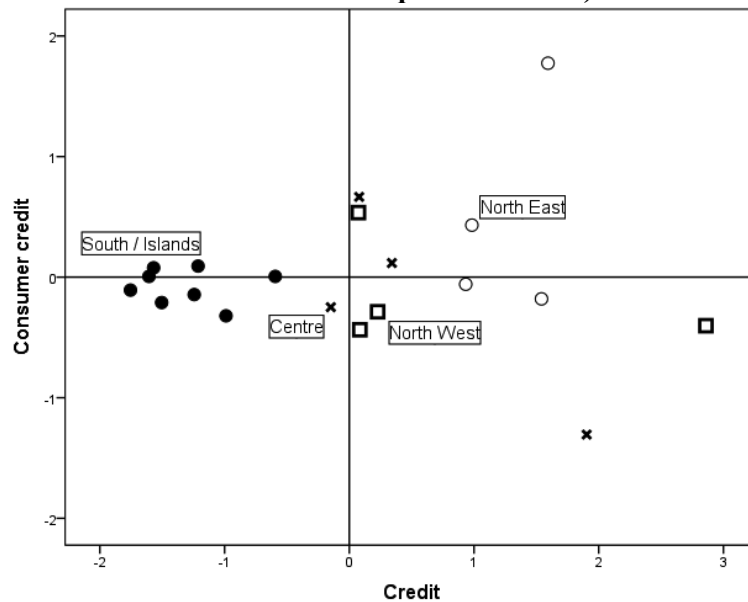
Source: Own elaboration on Bank of Italy, Istat and Unioncamere database

The MDS analysis shows that almost all the variables considered are positioned on the horizontal axis (for convenience defined "Credit", fig. 7) for emphasis of the correlation. Variables of residual interest are present on the vertical axis: signature loans to households (also significant on the horizontal axis) with a low degree of positive correlation and the consumer credit with a high negative correlation.

The results highlight a very significant graphical configuration, with almost all the Italian regions that are arranged as "ordered" from the economic point of view along the most important axis, the horizontal one, where are concentrated almost all the types of credit disbursed.

In particular, we find on the left side of the graph (values for credit granting lower than the average) the regions of the *Mezzogiorno* of Italy (South and Islands) and on the right the ones of the Centre-North. In this

perspective, the outlier cases are two (both of the Centre-North) because of the extreme values of the variables with an influence on the ordinate axis. These two cases, however, confirm what was said if they are observed in the outlook of the "Credit" axis.

The higher than average values of credit granted to firms and households in the central and northern regions promotes the possibility for firms to invest and produce and for households to consume, thereby contributing more effectively to the support the domestic demand.

The sharp division of the average values for the credits addressed to businesses is of great importance in this analysis. Average values recorded in the North are always at least twice the average values in the South. The values are closer only for loans for consumers' households. As mentioned earlier, this is a clear indicator of how the richest areas of the country must enjoy greater efficiency and greater credit business dynamism, which is reflected in the investments aiming at increasing the already higher levels of average income. In contrast, in the South the shares targeted to consumption are higher in proportion, denoting not only the neglect of businesses, also due to possible difficulties in accessing credit but also above all the need to support consumption in a period of rising unemployment. However, this type of household debt cannot support the production of new wealth in the long run, representing a transitory and unreal wealth.

Consumer credit has a weak negative correlation with the other variables. This variable is indeed the only one that, in the considered period, presents high (average) values in some southern regions, and all data are close and similar to the national average. As anticipated, consumer credit, which in most advanced economies characterizes an innovative style of consumption, is also used for purposes related to the consumption for subsistence in the poorest regions of the country. For many households, consumer credit is a necessary addition to disposable income. This form of credit is then used excessively, not only to defer payments but also to gain access to even the basic consumption.

Even within the limits of accurate data, the snapshot of the first quarter of 2014 finds a strong correlation between per capita volumes of credit granted and the existence of financial institutions with autonomous governance anchored mainly to the territories considered.

This should give a reason for reflection to the Authorities that govern the functioning of the markets, as well as to the holders of the various Policies that aim to streamline the national (and European) credit market, but the

aims are not properly achieved by neglecting the existence and efficiency of local credit markets.

8. Conclusions and policy implications

Preliminary analysis has been conducted on the configuration of the local Italian credit markets and their evolution over time, limited to the Euro period and distinguishing the assessment between those relating to the first phase and those that have to be contextualized in the recent and extended *Great Recession*.

The analysis has deliberately avoided taking the "localism" as an archetype of the economic literature, which leads to sharing two distinct perspectives: on the one hand, the well-known theory of industrial districts and on the other hand, the role of local banks.

In both directions, many contributions are committed to demonstrating the viability of the two dimensions, although there are criticisms addressed to them.

This study highlighted the deep links and convergences that have been established between the real economy and local credit markets while giving priority attention to the financing of investment projects, programs of production and consumption activities.

The trend analysis of the main variables and the development of a multidimensional model, which has been used to interpret a wide range of variables of the broader category of loans, have shown the existence of distinctive peculiarities of local credit markets related to the different Italian macro areas.

Above all, this study found a pronounced structural difference in the ability of credit disbursement between the central and northern regions and those of the South, with the consequent and different opportunities for businesses to finance investment and production and for households to feed consumptions activities, even with the leverage. With particular reference to the experience of the South, the apparent inconsistency between the lack of a significant local credit industry and a regional model hinged on the existence of business districts become evident. In the southern area, the presence of productive activities carried out by companies of all sizes, but with a high prevalence of small and artisanal businesses, does not correspond to a financial industry that, for spontaneous and consistent market orientation,

has declined with a symmetric articulation in the governance of its business activities in two directions of collecting deposits and granting loans.

As analyzed in this paper, the causes of the credit crunch can be found both in the recent international financial crisis as well as in the structural weaknesses of the domestic credit market. Difficulties in the financial market and the general slowdown in the real economy have interacted in a negative way. The demand and the supply sides of credit have been affected by the trend of the granting of credit. The increases in costs during the financial crisis and the sovereign crisis have affected the demand for loans differently, according to the elasticity of the same demand with respect to the cost, while there has been no different intensity from the side of bank rationing (Del Giovane *et al.* 2013 on the Italian case). This situation has even more worsened the deficit between the various macro areas: the structural deficits are naturally non-homogeneous when present on a territory, primarily affecting areas with a less efficient and developed financial market. Therefore, the credit rationing was not caused only by the supply side of financing. The difficulties on the supply side have been, among others, the risks on the balance sheets of banks and the deterioration of the creditworthiness of many borrowers. We can then define this context of capital crunch as a result of the restriction due to the alarm of banks to offer loans, due to low capitalization. This indicates a capital crunch, *i.e.* a credit crunch due to poor capitalization of banks.

Of course, the growing uncertainty in the markets and the general distrust led, on one hand, the banks to more controls and to the risk of increasing costs; on the other hand, the slowdown in the real economy has sharply declined the borrowers' activities, that are often businesses.

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DIFFERENT OR ALIKE? INVESTIGATING THE IMPACT OF GDP ON ENVIRONMENTAL PROTECTION EXPENDITURE IN SELECTED EUROPEAN STATES

Abstract

For several decades, many governments have spent a lot of money for environmental protection, for designing and implementing complex policies able to steer consumers towards "green" behaviors and products, and determine producers to act responsibly and even to pay for environmental damage. Understanding the correlation between economic growth and the amount of public and private funds spent for environmental protection, and improving their allocation may be a chance to develop an eco-efficient economy, to create new "green" products and markets in order to prevent and fight with the adverse effects of the economic development, to create a better and healthier environment. This article investigates the relation

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between GDP growth and environmental expenditure, by analyzing data on the evolution of GDP and expenditures for environmental protection in several European countries during 1995-2011. After briefly reviewing the main relevant aspects and contributions related to the relation between environmental expenditure and GDP growth, we launched and tested certain hypotheses related to the shape of this relationship valid for each country. The results reveal different shapes of this relationship, depending on the used indicators (the type of expenditure), or even no relationship at all. Selected countries, relevant for all the relation types found, are presented and discussed, in order to identify the meanings and further implications of our findings.

JEL CLASSIFICATION: O44; Q56;
KEYWORDS: ENVIRONMENTAL EXPENDITURE; KUZNETS CURVE; GDP GROWTH; EU MEMBER STATES;

1. Introduction and research background

All human activities affect, in one way or another, the environment. Public authorities, businesses, specialized providers of environmental services, households and individuals are responsible in reducing pollution and maintaining a healthy environment (European Commission, 2011). In order to involve all these entities in environmental protection, governments use a wide range of instruments, e.g. imposing regulations and restrictions, levying taxes directly related to pollution, providing economic incentives to encourage the environmental friendly techniques and innovations, or stimulating consumption of "green" products. Although the administrative issue and coercion dominate governmental policies, there are also environmental measures which are taken on a voluntary basis. Some of them are strongly marked by enthusiasm and idealism, specific to individual or community action. Other measures, mainly originated from the business world, have a pragmatic purpose, i.e. to build a positive image of the company as "environmental friendly", to increase market share or stock prices, to meet the expectations of consumers and stakeholders.

How much costs and, especially, which are the results of funds spent for environmental protection? Is there a pattern in environmental spending evolution in different countries, with different levels of development and, if case, could this pattern be correlated with other macroeconomic indicators? Do developed countries spend (in relative terms) on the environment protection more or less than other (less-developed) countries?

These are some of the questions that concern researchers and policy makers, in their attempt to design more effective environmental policy proposals. As stated by European Commission (2011, p.6), "At the same time, spurring environmental protection is also an opportunity for the creation of new markets for goods and services to prevent or treat environmental damages stimulating the development of a greener economy".

This paper aims at examining the form of the relationship between GDP and environment spending, by using data on the evolution of GDP and expenditures for environmental protection in several (i.e. 24) European countries and Turkey during 1995-2011. Thus we can find out if the environmental Kuznets curve applies in those cases, and how could be the future evolution of this indicator. In order to do this, we tested the main hypothesis that the shape of the relationship is positive - GDP growth leads

to increased investment in environmental protection, as to compensate the additional pollution caused by economic growth. The second (concurrent) hypothesis assumes that the form of this relationship is one of inverted U-shape, such as Kuznets curve: up to a critical point, the environmental expenditure and GDP will increase, and in the second phase, the environmental expenditure will decline due to the positive impact of technological developments on economic growth (less polluting processes, effective environmental policies etc.). Both hypotheses are empirically tested by investigating the relationships with regression equations.

The paper is structured as follows: after the Introduction, we review the main theories of the relationship between environmental expenses, economic growth and performance. In the second part we develop the actual research (i.e. the main indicators, methodology, hypothesis and testing), followed by results and discussion. The paper ends with conclusions and policy recommendations in this area.

1.1. Theoretical foundations on the relation between GDP and environmental protection expenditure

The most popular and controversial description of the relationship between economic growth and environmental quality is the Environmental Kuznets Curve (EKC) (Panayotou, 2000; Everett et al., 2010). It refers to the hypothesis of an inverted (U-shape) relationship between economic output per capita and environment protection, and it was inspired by Simon Kuznets' works (1955) and developed by Grossman and Krueger (1991).

EKC hypothesis suggests that economies, in their early stage of development, tend to damage the natural environment. After a time, the environmental quality starts to increase, partly due to structural changes in the economy (i.e. the transition from heavy industry to light industry, from polluting fuels to non-pollutant ones), partly due to efficient use of environmental funds. However, the most explanations of the EKC argue that environmental improvement is due to increased society's demand to have a cleaner environment as GDP per capita increases.

Sme arguments of this theory seem to be obvious: at low income, reducing pollution is almost impossible, as long as the individuals use their (limited) incomes to meet basic consumption needs. Once the society reaches a certain level of income per capita, individuals begin to consider a compromise between environmental and consumption quality, so the

environmental damage is tempered. Further, the costs to reduce environmental damages dominate the individuals' behaviour; they prefer environmental improvement than increasing consumption, and thus environmental quality continues to improve along with economic growth.

The core of this theory is the existence of turning points, hence, a considerable practical interest to determine their values. Thus, in a first estimation, the turning point - or the point beyond which GDP per capita growth starts to reducing emissions - has been established at $4-5,000/capita (Grossman, Krueger, 1991; Panayotou, 2000). Subsequent studies (Cropper, Griffiths, 1994; Galeotti, Lanze, 1999) estimated a higher turning point, and the EKC had to face a larger set of environmental variables. Recent researches, as Dutt (2009) or Everett et al. (2010), estimate turning point at about $34,000 per capita. According to these studies, only 10% of the developed economies have exceeded this point now and most of the (moderate) developed economies can expect to reach their maximum pollution in mid-century.

Some researchers consider that achieving environmental protection through limiting economic development was unfeasible; the economic growth should be encouraged because only economic development can support environment protection, and not the restrictive environmental regulations - particularly in developed countries, which have gone beyond their turning point (Everett et al., 2010). However, there are several reasons questioning the relevance of EKC hypothesis in environmental policy; Kuznets curve and Lewis (1954) growth model become less applicable in an increasingly globalized world, where technological advances and growing incomes do not reduce the (global) pollution levels. Briefly, as long as there is evidence that EKC relationship works only for certain economies and for certain local pollutants, it cannot be generalized to all kinds of environmental damage, in all countries and for all levels of comparable GDP per capita. Moreover, the EKC applicability as a predictor of environmental performance or a signal of convergence, as countries are developing, is limited (Everett et al., 2010; Magnani, 2000).

There are also alternative theories describing the relationship between economic growth and environmental quality. The "*limits theory*" considers the possibility to go beyond the environmental thresholds before the economy reaches the EKC turning point. An exclusive focus on economic growth to generate environmental results could be counter-productive (Arrow et al., 1996). The limits theory approaches the economy-environment

relationship in terms of environmental damage. Beyond a certain threshold (limit), the damage will seriously affect the production so the entire economy will decline (Everett et al., 2010; Meadows, Randers, Meadows, 2004).

The existence of turning points is questioned by some authors (Davidson, 2000); their approach is similar to Stern's theory (2004) or the "*new toxics view*": the existing pollutants' emissions are decreasing, meanwhile there is a continuous economic growth, but new pollutants (more dangerous) appear, and so the environmental destruction is increasing. Stern discusses a possible ongoing relationship between economic growth and the environment in the context of international competition, known as the "race to the bottom". International competition initially leads to increased environmental damage, to the point that developed countries realize the environmental damage and begin reducing their environmental impact, both by improving green technology, and by "outsourcing" pollution in poorer countries.

A similar explanation of the relationship between the level of certain pollutants and GDP per capita resides in the hypothesis of countries' propensity „as they get richer, to spin-off pollution-intensive products to lower income countries with lower environmental standards" (Panayotou, 2000), or through the international trade and direct investments in these less developed countries. Although there is no clear evidence, this hypothesis cannot be excluded, as rich countries (in the past 20 years) have experienced significant cuts in pollution levels along with continuous economic growth. Hettige, Lucas and Wheeler (1992) have noticed some evidence of an "industrial displacement effect" of "dirty" industries, as a result of tightening environmental regulations in industrialized countries since 1970.

A major concern of researchers and policy makers relates to the influence of environmental spending and regulation on economic growth or *environmental drag* (Pearce, Palmer, 2001). Thus, they have outlined several assumptions. The first one concerns the international competitiveness of industries highly environmental-regulated, compared to the less regulated ones. The second one refers to the companies' propensity to leave the national jurisdiction when it is overcharged with environmental regulations. Consequently, foreign investors will avoid those countries burdened by environmental regulation and taxes. The third hypothesis concerns the impact of environmental regulations on productivity (Pearce, Palmer, 2001). However, there is no clear evidence for this, but on the contrary, as Jaffe et al. (1995) show, net exports are insignificantly affected by environmental

regulations (Jaffe et al., 1995); moreover, the decision of international (de-) localization of large companies takes little account of environmental costs, primarily because they represent only a small fraction of the total costs (Jaffe et al., 1995; Eskeland and Harrison, 1997).

Several authors take into consideration the level and structure of consumption, rather than production, when approaching the relationship between income and environment. Ekins (1997) argues that, when consumption patterns do not follow the changes in production structure, it is possible to deal with the effects of environmental movements from one country to another, but the negative consequences of this process are born by the less developed countries (the pollution haven hypothesis).

The threats related to decreased competitiveness and employment are widely used by industry interest groups to lobby against regulations and excessive spending for environmental protection. The literature on the negative impact of environmental policies on competitiveness and productivity, although rich and well-structured, brings forward only partial effects. Focusing on financially measured outputs, these theories completely ignore the non-market effects and the spread of negative externalities. At the same time, the positive effects of clean environment on well-being, on human health and its impact on labour productivity are minimized (Pearce, Palmer, 2001). There are also opinions that, far from displaying a negative impact on economic growth, environmental policy could lead to competitiveness. This "win-win" approach, otherwise criticized for its excessive theoretical approach, is mainly associated with the contributions of Michael Porter (1998), or Porter and van der Linde (1995). Accordingly, companies concerned by social and environmental responsibility obtain better financial results (i.e. will be preferred by customers) compared to those neglecting the social-environmental dimension.

1.2. Some key facts and figures

The environmental protection expenditure plays an important role in a wide range of EU policy areas. In terms of a comprehensive definition, "environmental protection expenditure is the money spent on all the activities and actions that are aimed at the prevention, reduction and elimination of pollution as well as any other degradation of the environment, resulting from the production processes or the consumption of goods and services" (European Commission, 2011, p.8). Environmental expenditure

can be analysed by investigating three main stakeholders: the public sector, industry/business sector, specialized producers and providers of environmental services (public and private enterprises specialized in environmental services such as collection waste) (Eurostat, 2015).

According to Eurostat data, the expenditure of specialized producers reported the highest level in EU-27 in 2011, i.e. about 151 million, representing over a half (52.7%) of the total expenditure for environmental protection. The rest are expenditures of the public sector (EUR 83.4 billion, representing 29.1% of total) and of the industrial sector (EUR 52.3 billion, i.e. 18.2%). In evolution, between 2001 and 2013, the spending of specialized producers, in current price value terms, grew by more than a half (53.6%), see Table 1. At the same time, environmental expenditures of the public sector increased by 38.1%, while expenditure made by industry remained relatively unchanged.

Table 1. Total environmental protection expenditure, EU-27, 2001-2013

Year	Industry (EUR million)	(% of GDP)	Specialised producers (EUR million)	(% of GDP)	Public sector (EUR million)	(% of GDP)
2001	50,043	0.5	94,281	1.0	63,147	0.7
2002	45,593	0.5	95,974	1.0	62,892	0.6
2003	43,665	0.4	100,654	1.0	62,445	0.6
2004	45,011	0.4	107,164	1.0	65,682	0.6
2005	45,875	0.4	111,220	1.0	72,177	0.7
2006	49,569	0.4	122,388	1.1	74,431	0.6
2007	52,923	0.4	125,954	1.0	76,886	0.6
2008	53,210	0.4	144,516	1.2	81,316	0.7
2009	49,125	0.4	139,326	1.2	86,409	0.7
2010	51,126	0.4	144,661	1.2	85,910	0.7
2011	52,318	0.4	150,998	1.2	83,408	0.7
2012	51,618	0.4	145,472	1.2	87,340	0.7
2013	51,628	0.4	144,778	1.1	87,184	0.7

Source: Eurostat (2015).
Note: 1 EUR=0.88 USD (December 2001); 1 EUR=1.29 USD (December 2011)

The impact of the current economic crisis was also reflected in the environmental protection spending, which declined in 2008-2009 by 7.7% for the industry and by 3.6% for specialized producers, while for 2010-2013 a revival of the environmental spending was reported.

An alternative analysis can be performed by investigating the evolution of the share of environmental expenditure in gross domestic product (GDP). For the specialized producers, within the EU-27, this ratio was 1.2% of GDP in 2011, compared with 0.7% for the public sector and 0.4% for industry (see Table 1). In evolution, the share of expenditures for environmental protection made by the industrial sector decreased by 0.1% since 2003, the share for specialized manufacturers have increased (with some fluctuations) from 1.0% of GDP in 2001 to 1.2% in 2011 and 1.1% in 2013, and the public share remained (more or less) stable in this period (between 0.7% and 0.6%). In specific areas, most of the expenses (in 2013) were directed to waste management, followed by wastewater treatment. Two thirds of the expenditure was made by the specialized producers. At the opposite are the expenditures for air pollution, made especially by industrial operators (Eurostat, 2015).

2. Methodology

Aiming to investigate the form of the relationship between GDP and environment spending in several EU countries, we have launched and then tested (by using regression equations) a series of research hypotheses, i.e.:

H1. The shape of the relationship between GDP growth and environmental expenditures is positive for all countries: GDP growth leads to increased investment in environmental protection, as to compensate the additional pollution caused by economic growth.

H2. The form of this relationship is an inverted U-shape, Kuznets curve type: up to a critical point, the environmental expenditure and GDP will increase; in second place, the environmental expenditure will decline due to the positive impact of technological developments on economic growth (less polluting processes, effective environmental policies).

Concerning the chosen indicators, as a measure of country economic development and standard of living, Gross Domestic Product (GDP) chained-linked values at constant prices as reported by Eurostat were used. As measures of environmental protection activities we used two indicators, reported by Eurostat (2015), i.e. Environmental protection expenditure by

central government and Environmental protection expenditure by private and public specialized producers of environmental protection services (E37 Sewerage, E38.1 Waste collection, E38.2 Waste treatment and disposal and E39 Remediation activities and other waste management services).

We decided to use the values as measured in euro / inhabitant rather than gross values, as it would be very likely that differences in country size to act as a confounding variable, and since GDP values are also expressed in euro / inhabitant. Overlapping data for the three time series investigated was only available for the 1995 – 2011 timeframe; however, we consider the time series to have a sufficient length to serve as an indicator for any strong effects.

Concerning the sample, our intentions was to include in the analysis all 28 EU member states, as well as Turkey; however, insufficient data was available for some countries (a list is presented for each analysis), and so the final sample size was comprised of 24 countries.

Data analysis was conducted using SPSS 17, after data being collected from the Eurostat database and undergoing preliminary preparation and formatting. We decided to use the Mixed method in SPSS, as recommended for this purpose (Shek, Ma, 2011; West 2009; Peugh, Ender, 2005), but, because of the high variance due to inter-country differences, we decided to resort to regression analysis instead.

3. Results and dıscussıon

When testing the relationship between GDP and Government Environmental Protection Expenditure, no significant effects were initially found, as can be noticed in Table 2.

Table 2. Mixed model fixed effects test, dependent variable – Central Government Environmental Protection Expenditure

Source	Numerator df	Denominator df	F	P
Intercept	1	88.736	4.858	0.03
Year	1	118.393	2.324	0.13
GDP	1	86.952	0.359	0.551
Year $^\wedge$ 2	1	140.445	1.716	0.192
GDP * Year	1	115.557	0.325	0.57
GDP * Year $^\wedge$ 2	1	140.623	0.274	0.602

Source: Authors' calculation based on European Commission (2011) and Eurostat (2015)

The lack of a significant p value for any of the variables included in the model could be explained in several ways. Firstly, it is a distinct possibility that a relation simply does not exist. That is to say, Central Government Environmental Protection Expenditure, measured in euro / inhabitant, is independent from the effects of time, both linear and quadratic, as well as the GDP of the country. Secondly, it is possible that a relation does exist in reality; however, due to low power or error in our design, we were not able to detect it. To counter this possibility we included as many countries as possible and the maximum available time series length to ensure maximum statistical power and optimal sampling. We then proceeded to calculate the Inter-class correlation indicator (ICC) in order to estimate the amount of variance due to country differences. We found that 93% of the variance in Central Government Environmental Protection Expenditure could be explained by the differences between countries, and as such using a mixed model would not be optimal. Therefore, we decided to resort to individual country level analyses in order to investigate the desired relationships. The results are briefly presented in Table 3.

Table 3. Country level analysis of Central Government Environmental Protection Expenditure

Relation type	Country	Valid model	GDP effect	Time effect	Quadratic effect
Only GDP	Sweden	Yes	Yes +		
	Turkey	Yes	Yes +		
GDP and time linear	Poland	Yes	Yes +	Yes -	
GDP and time quadratic	Latvia	Yes	Yes +	Yes -	Yes +
	Lithuania	Yes	Yes +	Yes -	Yes +
	Norway	Yes	Yes +	Yes -	Yes +
	Romania	Yes	Yes +	Yes -	Yes +
Time quadratic	Belgium	Yes		Yes +	Yes -
	Italy	Yes		Yes +	Yes -
	Spain	Yes		Yes +	Yes -
	Germany	Yes		Yes -	Yes +
	Finland	Yes		Yes -	Yes +
	Slovakia	Yes		Yes -	Yes +
Time linear	Luxemburg	Yes		Yes +	
None	Austria, Bulgaria, Croatia, Denmark, Estonia, France, Hungary, Malta, Portugal	No			
Not available	Czech Republic, Greece, Iceland, Netherlands, United Kingdom, Ireland, Switzerland	Not enough data			

Source: Authors' calculation based on European Commission (2011) and Eurostat (2013).

As it can be noticed in Table 3, the investigated countries fall into 6 distinct categories. For almost half of the investigated countries, no effects were found. For Turkey and Sweden, the relationship between GDP and Government Environmental Expenditure is linear, positive and time-independent. For these countries, GDP reveals to be a strong predictor of expenditure (R-squared > 0.9 in both cases). Therefore, periods of increased GDP coincide with and explain approximately 90% of the increase in Government Environmental Expenditure. In the case of Poland, in addition to the GDP effect noticed in the case of the previous category, there is also a significant negative, linear time effect. Therefore, we can conclude that in time Central Government Environmental Protection Expenditure has the tendency to decrease, while under the effect of GDP growth the opposite effect can be noticed. Together time and GDP explain more than 88% of the variance of the dependent variable.

For Latvia, Lithuania, Norway and Romania, in addition to the effects of time (linear) and GDP, we can also notice a quadratic effect of time, with a positive coefficient, leading to the conclusion that in time Central Government Environmental Protection Expenditure tends to change according to a convex path. Left alone, Central Government Environmental Protection Expenditure in these countries would decrease along a convex path, at smaller increments each year. However, due to the GDP growth effects, this negative influence of time is counterbalanced and even reversed, leading to a net growth of the Expenditure.

In the next category there are two distinct groups of countries. Belgium, Italy and Spain show an increasing trend in time, with a negative quadratic coefficient suggesting a concave curvature. Germany, Finland and Slovakia show a decreasing trend in time, with a positive quadratic coefficient suggesting a convex curvature. For both groups, GDP does not seem to significantly influence governmental environmental expenditure. Rather the expenditure seems to be influenced only by time. For the first group, it tends to increase in time, however at a smaller rate each year, while for the second group it tends to decrease in time, at diminishing rates. This could lead to either stagnation or could eventually show a cyclic evolution, but longer time series will be required to correctly identify the long term trends.

Luxembourg forms a distinct category, showing only a positive trend in time. This indicates that Central Government Environmental Protection Expenditure grows in time, regardless of GDP evolution. Investments in the environment are on a positive trend, increasing efficiency. However, due to

the relatively small industry and agriculture sectors, these investments are independent of GDP change.

Table 4. Country level analysis of Environmental protection expenditure - Specialized providers (public and private)

Relation type	Country	Valid model	GDP effect	Time effect	Quadratic effect
Time and time quadratic	Austria	Yes	No	Yes -	Yes +
	Germany	Yes	No	Yes +	Yes -
Only GDP	France	Yes	Yes +	No	No
	Hungary	Yes	Yes +	No	No
	Latvia	Yes	Yes +	No	No
	Luxemburg	Yes	Yes +	No	No
	Poland	Yes	Yes +	No	No
	Spain	Yes	Yes +	No	No
GDP and quadratic	Romania	Yes	Yes +	No	Yes +
GDP, time and quadratic	Bulgaria	Yes	Yes +	Yes -	Yes +
None	Belgium, Croatia, Czech Republic, Denmark, Estonia, Finland, Italy, Lithuania, Portugal, Slovakia, Sweden	No			
Not available	Malta, Netherlands, Norway, Turkey, Ireland, Greece, Iceland, Switzerland, United Kingdom	Not enough data			

Source: Authors' calculation based on European Commission (2011) and Eurostat (2013)

When it comes to the expenditure of specialized public and private providers, there are only five distinct groups. Similarly to the previous analysis, about half of the countries show no significant relations; however, only four countries show no relation in both cases, i.e. Croatia, Denmark, Estonia and Portugal. Czech Republic shows no relation in the current analysis, but not enough data was available to compute the indicators for the previous analysis.

The largest group is that of countries which are influenced only by GDP and it includes France, Hungary, Latvia, Luxemburg, Poland and Spain. They all show a positive relation, and therefore in the case of these countries we can conclude that GDP is a significant and strong (R squared is larger than 0.8 for all countries) predictor of Environmental protection expenditure by specialized providers (public and private), in a linear and time independent manner.

A third group comprises Austria and Germany, which both show a linear and quadratic time effect, however in opposite directions. While in Austria we have a negative linear time effect, which shows that in time the Expenditure tends to decrease, and a positive quadratic coefficient, which suggest a convex curvature in time. So we can conclude that in Austria, in time, Environmental protection expenditure by specialized providers (public and private) tends to decrease, but with smaller differences year to year. In the case of Germany, we register a positive time effect with a negative quadratic effect, which indicates that Environmental protection expenditure by specialized providers (public and private) tends to increase year to year, but with decreasing increments.

The other two groups include one country each. Romania has a significant positive GDP and a negative quadratic effect. Therefore, we can conclude that in its case GDP is a positive predictor of Environmental protection expenditure by specialized providers (public and private), however, the shape of the relation is concave, and so this effect tends to accelerate in time. Bulgaria has a similar trend to Romania; however, it also shows a significant negative time effect. So, in the case of Bulgaria, GDP increase predicts increases in Environmental protection expenditure by specialized providers (public and private), while in time it tends to decrease, with increasing intervals.

What is the relevance of our findings? One might argue against using environmental protection expenditure as an indicator, since expenditure does not guarantee environmental protection actions are actually working. While the efficiency of the measures being taken is not the purpose of the current paper, we did check for any correction among expenditure and change in environmental factors. For instance, we choose CO_2 emissions per capita, as reported by The World Bank, and investigated its correlations with environmental protection expenditure. Since environmental protection expenditure is not expected to exert an instant effect on pollution reduction, we investigated the time series with various time lags (0, 1 and 2 years). Out of the 25 countries investigated, 17 report a significant correlation between Government Environmental Expenditure and CO_2 emissions per capita, with a time lag of up to 2 years. As expected the 1 and 2 year(s) correlations were negative, therefore revealing that an increase in expenditure is related to a significant decrease in CO_2 emissions per capita. Countries which show no relation (i.e. Estonia, Cyprus, Luxembourg, Netherlands, Poland, Slovenia, Finland and Sweden) are evenly distributed among our categories in relation to GDP influence on government environmental expenditure, so this factor cannot explain why a correlation was not found in their case. It is more likely that the explanatory factor is either that the implementation efficiency differs between countries, or perhaps CO_2 emissions were not the main focus of the environmental protection expenditure in their cases. Further investigation is required to settle this issue.

4. Conclusions and recommendations

When it comes to Environmental protection spending, whether by central government or specialized providers, public and private, the countries of Europe show quite different relations with GDP, as a relation of time. This could be explained according to two main theories: (1) The explaining model is universal; however, the countries are in different evolution stages on the model, which would explain the differences between them; (2) Different countries have different models of these relationships. Under this theory, a universal model that can predict the evolution of all countries should not be computed and used.

We analysed in detail each country's relation between GDP and both types of investments, and a first conclusion is that most countries display different relations between the two indicators. This suggests that indicator's

choice would be a very important factor and researchers should pay attention and try to explain the differences between them.

We also conclude that for around half of the countries no relation was noticed. We are either faced with a relatively weak relation that could not be noticed due to the limited number of observations, or, simply, there is no relation at all.

Our paper shows that, in most cases, the Kuznets curve (EKC) is not found in environmental investment: even more, the relationship between GDP and investment in environmental protection fails in about half of the analysed countries. If the GDP growth in these countries is sustainable, without significant environmental impact, this absence is not necessarily a negative fact. However, if GDP growth is associated with an increase in pollution and in the consumption of non-renewable energy (as in the majority of analysed countries), the deficiency of serious investment in environmental protection will result, in the long run, in severe environmental damages. If Kuznets' theory would be valid in this case, the problem would resolve itself by the positive impact of economic growth on the environment, in the second part of the curve. But since most studies show that the theory is not supported by empirical data on pollution, in those countries where GDP growth is not accompanied by a corresponding increase in investment in environmental protection, effective policies should be developed to increase involvement in environmental protection. Otherwise, the negative consequences will arise and they may be persistent in a long run.

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Appendix

Figure 2. Graphical representation of the relationship between GDP (dotted line) and Government Environmental Expenditure
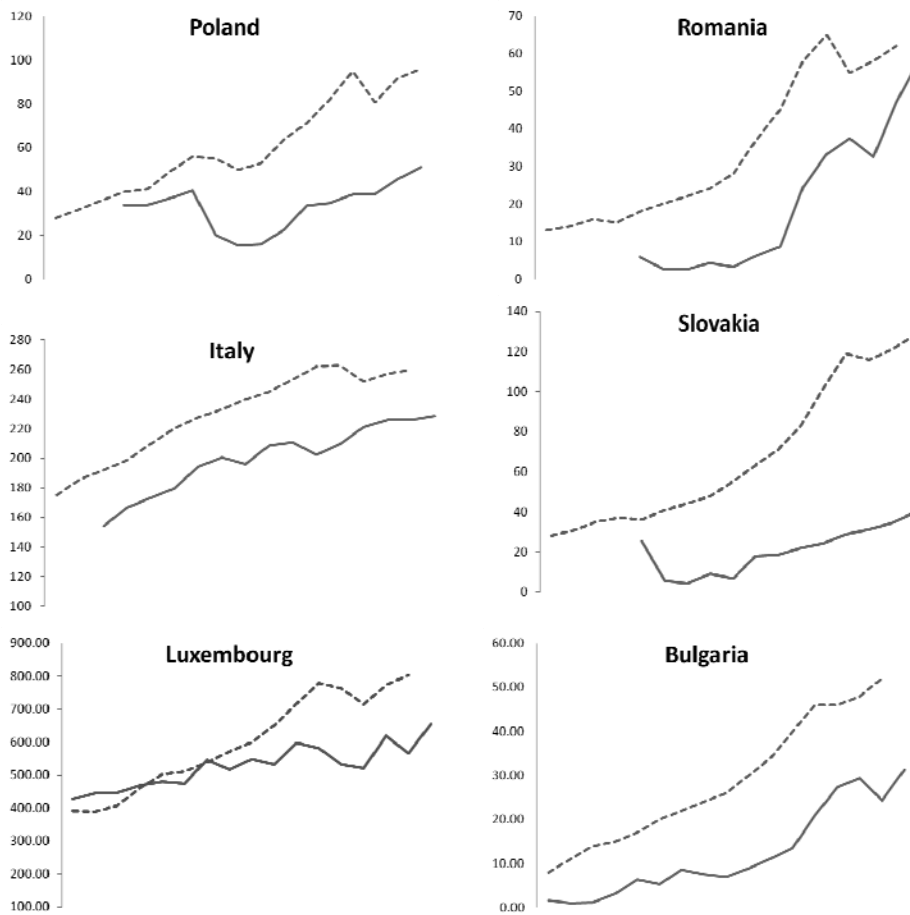
Note: GDP values are expressed in hundreds of Euro / capita
Source: Authors' calculation based on European Commission (2011) and Eurostat (2013).

**Figure 3. Graphical representation of the relationship between GDP
(dotted line) and Specialized providers (public and private)
Environmental protection expenditure**
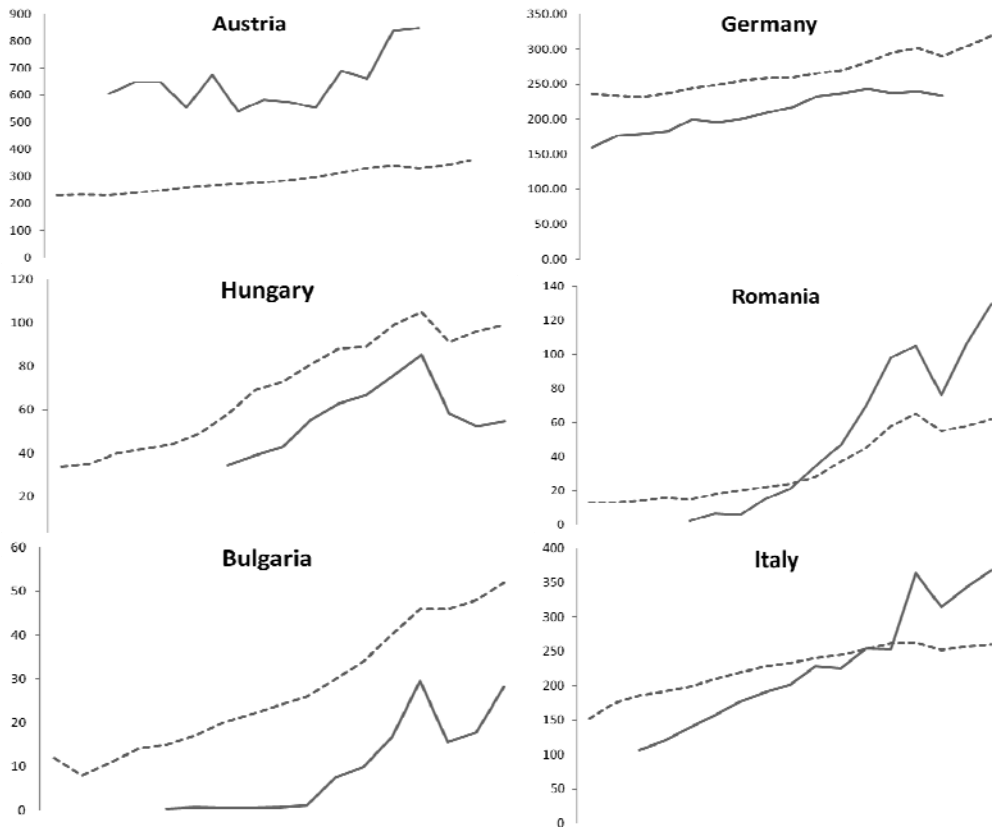
Note: GDP values are expressed in hundreds of Euro / capita
Source: Authors' calculation based on European Commission (2011) and Eurostat (2015).

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SPATIAL INTERLINKAGES BASED ON A NETWORK ANALYSIS.

A STUDY CASE: CHINA [**]

Abstract

The objective of our article is to present an original spatial methodology based on the network analysis approach in order to identify and to track spatial linkages among economic activities. By comparing patterns of local employment, this methodology shows interlinkages among activities. Important for understanding potential interrelated phenomena especially in the case of an exogenous choc. The case study for our research is economic activities in China whose interlinkages has usually been examined by using an input-output matrix (IOM). Indeed, IOM allows to depict and analyze the dependence of one industry or sector on another very useful for estimating the impact of eventual shocks and analyzing the ripple effects throughout and economy but is inadaptable for a spatial dependency relations analysis.

Using the local employment of 287 municipalities across 14 economic activities, the approach proposed identifies spatial interlinkages among them

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in terms of employment patterns. What spatial interlinkages tell us regarding a Chinese economic structure?

JEL CLASSIFICATION: R12, C55.
KEYWORDS: NETWORK ANALYSIS, REGIONAL INTERDEPENDENCIES, ECONOMIC TRANSITION, CHINA, EMPLOYMENT POPULATION, MINIMUM SPANNING TREE.

1. Introduction

The most common approach to analyze linkages among industries, sectors or economic activities revolves around the input-output (IO) model, which documents the production and disposal of the goods and services in an economic system for a particular period (usually one year). It provides a very detailed picture of the structure of the economy and a basis for the analysis of the intersectorial relationships.

However, in recent years, scientists from a range of fields have been building a new "science of networks" who allows to specify another dimension of linkages in different areas. The study of networks has had a long history in mathematics and science (Newman *et al.* 2006). One of the most important findings, popularized by Albert-László Barabási and his team, is that real networks behave very distinct from traditional assumptions of network theory. Indeed, modern network research show that the majority of nodes of real networks is very low connected, and, by contrast, there exists some nodes of very extreme connectivity (hubs).

Identifying linkages between industries, sectors or economic activities following a network approach becomes very pertinent because it helps us to identify and track linkages in the case of an exogenous stimulus. It helps us, also, to have more precision in distinguishing various social forces which can have substantial policy implications.

Regarding our a study case and taking into account that the Chinese economy is undergoing significant changes thanks to national and international institutional modifications: defining the spatial similarities among economic activities would be very interesting in draw the trajectory of an exogenous stimulus and to better control its damaging cascades.

Our article will be structured around three sections. In the first one we will examine a literature review of the network analysis in economics. The second one will be dedicated to our original methodology. We will present, in this framework, the theoretical background who inspired it and will explain it. In the third and last section will apply our methodology to china by using the local employment of 287 municipalities across 14 economic activities 14 economic activities.

2. Literature review

The inclination of economists to represent an economy as a linkage structure is not new. For a long time, this interest has encouraged the development of mapping patterns of trade and interrelations between different economic actors. In the USA, Wassily Leontief (1936) developed the first input-output table of the US economy.

The Input-Output model is an adaptation of the neoclassical theory of general equilibrium to the empirical analysis of interdependence between activities (Leontief 1966). An Input-Output table is very useful framework for analyzing various types of economic issues. An article by Leontief (August, 1936) on Input-Output relationships in the US economy marked the beginning of this major branch of quantitative economics.

After that, Leontief (1941, 1951 and 1953) developed his methodology and applied it to the detailed study of the structure of the US economy. Combined with the new opportunities that the development of IT offered in 1950-1960, these IO-tables would therefore encourage the expansion of complex models of economic analysis. This methodology allowed to quantify the effect of some real changes, anticipated or hypothetical relating to an economy.

However, in recent years, scientists from a range of fields - including mathematics, physics, computer science, sociology, and biology - have been building a new "science of networks" who allows to specify another dimension of linkages in different areas. The study of networks has had a long history in mathematics and science (Newman *et al.* 2006). Recall that, the analysis of networks has received a major boost caused by the availability of enormous network data resources. One of the most important findings, popularized by Albert-László Barabási and his team, is that real networks behave very distinct from traditional assumptions of network theory.

Traditionally, real networks were supposed to have a majority of nodes of about the same number of connections around an average. This is typically modeled by random graphs. But modern network research could show that the majority of nodes of real networks is very low connected, and, by contrast, there exists some nodes of very extreme connectivity (hubs). This scale-free characteristics can be found in many real networks from biological to social networks.

It is for this reason that the network analysis has been used in several disciplines to understand the trajectory of an exogenous stimulus. "*When a network acts as a transportation system, a local failure shifts loads to other nodes. If the extra load is negligible, the system can seamlessly absorb it, and the failure goes unnoticed. If, however, the extra load is too much for the neighboring nodes, they will too tip and redistribute the load to their neighbors. In no time, we are faced with a cascading event, whose magnitude depends on the position and the capacity of the nodes that failed initially*" (Barabasi 2014, p. 3). Their impact can travel along the network's links and affect other nodes, consumers and individuals.

From an economist's perspective, understanding many economic behaviors, from the dynamics of product adoption to financial contagions, requires to account for the patterns of interactions by using the network theory.

There are two prominent areas for analyzing social networks: developing economics and labor economics. Indeed, it is pertinent to analyze a social network in developing economics where the informal and social interactions are very important: relations are "not relying on formal contracts or exogenous institutions, but relying heavily on social interactions (see the chapters by Breza 2016; Mobius and Rosenblat 2016; Munshi 2016).

Concerning labor economics, networks play important role in the access to opportunities. However research is newly interested by new questions and avenues. For example: the impact of family and friends on the decision of individuals to study in the university or not and how much is hard to do it. Looking carefully at network patterns of interaction should help us to disentangle information spillovers, from norms, and complementarities, from opportunity (Jackson 2008).

Elsewhere these two areas of application, economists have shown particular interest in financial networks and economics fluctuations analysis (see the chapters by Cabrales, Gale and Gottardi 2016; Acemoglu, Ozdaglar and Tahbaz-Salehi 2016), as it has become evident that an appropriate understanding of risk and interdependencies in an economy has to account for indirect effects and transmissions of shocks, and these are inherently network phenomena.

Economists' forays into the study of networks over the past couple of decades have helped to "identify the impact of network structure on economic behaviors, and as a result is reshaping some policies, as well as testing and refining theory" (Jackson 2008). It helps, also, to highlight

another kind of dependency relations who could be helpful to anticipate the trajectory of an exogenous stimulus and its damaging cascades.

3. How we estimate spatial linkages

3.1. Second order head

Following a network analysis, our methodology is based on two concepts:

- − Scale free network
- − Minimum spanning tree

Literature on complex networks defines this class of network on the base of its connectivity distribution P(k), which explains the probability that a node in the network is connected to k other nodes. In contrast to random networks characterized by a P(k) that shows a peak at an average k and decay exponentially for large k (each node has approximately the same number of links), many systems belong to scale free networks, for which P(k) decays as a power law (P(k) = k−γ) free of characteristic scale (Barabasi *et al.* 1999). The power law distribution 79 describes systems in which a few nodes (hubs) dominate.

 It has been shown that an important property of scale free network is their robustness to random failures and an increased vulnerability to coordinated at tacks. This feature is analytically demonstrated by combining graph theoretical concepts with percolation theory (Schwartz *et al*. 2002).

This robustness (vulnerability) is rooted in their extremely inhomogeneous connectivity distribution: since the majority of nodes have only few links because of power law distribution, any attacks against them does not alter the path structure of the remaining nodes, and thus has no impact on the overall network topology. An informed agent that attempt to deliberately introduce an exogenous shock on the network will preferentially target the most connected hubs (Albert *et al*. 2000). Once a hub has been affected by a stimulus it will pass it to numerous other nodes and the effects will spread throughout the entire system or a part of it because they are connected to many other nodes (Barabasi and Bonabeau 2003).

Evocative issues on the empirical evidence of scale free networks are those 95 regarding the connection of social and communication patterns

(Barabasi *et al*. 2000; Albert and Barabasi 2000; Barabasi *et al*. 2002), but they are also used to describe Metabolic networks in different micro-organisms Jeong *et al*. (2000) or as a support to policymakers to suggest interesting policy guidelines aimed at eradicating an epidemic due to viruses (Dezso and Barabasi 2002)[1].

This kind of networks seems to be interesting from our point of view because of the behavior of such a complex network as a reaction to external solicitations seems to act in predictable ways when an exogenous shock puts pressure on them. In other words, this network containing hubs, or nodes with a large number of links, seems to be extremely vulnerable to coordinated attacks because of their inhomogeneous topology (Barabasi *et al.* 2003).

Analyzing an economic environment as network and its topological properties in terms of the links across industries is interesting because when a similarities with scale free networks occurs it implies expected dynamics spreading over economic sectors. Searching topological arrangement of a whole economy will be useful to show the empirical evidence of interdependencies between economic sectors.

The presence of interconnections across sectors is a crucial issue in order to determine the effects of exogenous shocks. Acemoglu *et al.* (2012) show that this effects may not remain confined where they originate. Rather, microeconomic shocks may propagate throughout the economy, affecting other sectors, and generate sizable aggregate effects. They argued that the extent of propagations of idiosyncratic shocks and their role in aggregate fluctuations depend on the structure of interactions between different sectors.

Our work is also related to studies on the theoretical concept of Minimum Spanning Tree (MST), a particular type of graph that connects all the vertices in a graph without forming any loop (Bonanno *et al.* 2004) over the shortest path. Our work is, particularly, inspired by Mantegna (1999). He finds a topological arrangement of equities in financial markets by using a correlation based model in describing the network's shape and topology

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[1] They demonstrate that policies that are not blind in distributing the cures but discriminate between the nodes, taking into account their connectivity and curing mostly the highly connected nodes, can potentially eradicate a virus. They find also, that in terms of costs, such biased policies are more effective than those who spread cures randomly, because they achieve large effects by dispensing less cures to eradicate the virus.

through a MST, as a specialized filtering procedure that allows them to investigate co-occurences of a set of highly capitalized stocks, i.e. some of these stocks act as hub of a local cluster. The main goal of this procedure is that the price time series in a financial market reflects information about the economic sector of the activity of a company (Bonanno *et al*. 2004) grouping them in clusters of nodes over the network.

3.2. Methodological aspects

Using the approach developed by Mantegna (1999), we define a new metric, building the links among industries, in order to explore the structure of the economy and the related industries which eventually act as a hub.

The basic assumption of our new metric is that the urban morphology of the factor endowment (labor) for each sector is a proxy of the local production system. This point of view allows us to analyze each city as an urban pattern whose morphology is described in terms of allocation of resources employed in each sector (Carlei and Nuccio 2014). Our new metric measures the closeness among the sectors that constitute the nodes of a network where the links are represented by the similarity of urban patterns in an Euclidean Space.

When a link exists between two nodes (sectors) it means that they have a similar (in term of Euclidean distance) industrial relevance in terms of a geographical allocation of labor. The more the relative industrial relevance of one sector is similar to that another one in the other cities, the closer they will be in the network. This network structure is configured through a Minimum Spanning Tree (MST), i.e. the path is presented after a pruning process of a connected graph. This way, we obtain a network configuration which indicates the most likely path of a stimulus propagation.

Our objective is to find patterns of interconnection across industries. This network-based approach is particularly appropriate when highly connected sectors (hubs) emerge in the topological map, in this case a microeconomic stimulus will propagate through the intersectoral network structure generating larger and aggregate fluctuations (Acemoglu *et al.* 2012).

Our assumption, in order to build the network, is that the morphology of resources allocation in each sector is a proxy of the local production system. Recall, as such, that both samples and features can be employed at different levels of aggregation: the first one can be Municipality, Province, Region

and Country; the second one can refer to different industries and various classifications, consistently with the number of digit per each industry.

Regarding our paper, we will define cities as geographical samples and the number of employees for each industry as a feature.

This point of view allows us to associate with each city a pattern whose morphology is described in terms of allocation of resources employed in each sector (factor endowment).

From this hypothesis we can build the network. In our analysis the nodes of the network are the economic sectors and the links represent their closeness in the Euclidean space in terms of urban patterns (see eq.1). In other words, spatial similarities between two sectors indicates the existence of sectoral interdependencies.

Our network-based approach takes into account a dataset obtained from matrix X, whose entries $x_{i,j}$ are i-samples of the local economies and j-features of the employees' numbers for each industry. We rescaled X into a new matrix Y whose entries $y_{i,j}$ are defined as:

with
$$y_{i,j} = \frac{e^{\delta^{i,j}}}{1 + e^{\delta^{i,j}}} \tag{1}$$

$$\delta_{i,j} = \alpha_i + \beta_i \cdot x_{i,j} \tag{2}$$

where
$$\alpha_i = \frac{1}{\max_j (x_{i,j})} \tag{3}$$

and
$$\beta_i = \frac{\min_j(x_{i,j})}{\max_j(x_{i,j}) - \min_j(x_{i,j})}$$
(4)

α_i and β_i are the two vectors of parameters for the logistic function to rescale 164 the matrix X by rows to preserve the key properties of the local distribution 165 of employees across the different industries for each sample. In this manner 166 each sample is represented by a pattern whose properties capture how the labor 167 factor is locally allocated across industries (Carlei and Nuccio 2014).

Taking into account the objective of our work, i.e. to draw detailed network maps in order to highlight sectoral interdependencies and their role in spreading an external solicitation, it seems necessary to determine in a unique way an indexed hierarchy (Mantegna and Stanley 2000) between industries. This objective will be achieved by the MST (Bonanno *et al.* 2004).

In this way we are looking for a description of an indexed hierarchically structured system[2] .The spanning tree of the shortest length connecting the n sectors is associated with the distance matrix D, i.e. the Euclidean distance d_{ij} between pairs of normalized sectors y_i and y_j. The method of constructing an MST is well known in multivariate analysis (Mantegna and Stanley 2000).

Once the topological map of the network is defined, it is necessary to identify the centrality of each sector in order to select industries that play a crucial role because they are deeply connected sectors. It means that these sectors are highly interdependent and they play accordingly a crucial role in spreading an external solicitation.

Regarding an eventual economic shock or an external solicitation several countries have experienced throughout history various crises. The world is,

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[2] It is possible to show that a one to one relationship exists between an indexed hierarchy and an ultrametric set (Rammal *et al.* 1986).

today, especially attentive to the transition process of China. Indeed, China is undergoing a period of transition and seeks to better control the trajectory of an eventual shock. Remember, as such, that linkages between sectors or economic activities are very important in order to better control the spreading of any external stimulus. For that, our methodology allows us to identify the sectors that play a role of pivot and which should particularly focus.

4. Empirical results

We decide to estimate spatial linkages across 14 economic activities in 287 Municipalities by using the Chinese occupational employment shares in 2010. We choose 2010 for the data availability.

As such, we will define municipalities as the geographic samples and the number of employees for each industry as its features. The dataset gathers the overall number of the Chinese municipalities[3] , therefore covering the entire country with reference to the year 2010[4] .

Economic sectors include: Farming, Forestry, Animal Husbandry, Fishery; Mining and Quarrying; Manufacturing; Electric Power, Gas and Water Production and Supply; Construction; Transportation, Storage, Post and Telecommunications; Wholesale and Retail Trade; Banking and Insurance; Real Estate and Urban Services; Social Services;

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[3] The list of municipalities is available in appendix.
[4] Data is available at the China Data Center (www.http://chinadatacenter.org).

Public Management and Social Organization; Scientific Research, Technical Service and Geologic Prospecting; Management of Water Conservancy, Environment and Public Facilities; Health, Social Security and Social Welfare[5] .

As a result, the matrix $X_{i,j}$ has i= 1, . . ., N= 287 municipalities and j = 1, . ., n=14 industries.

Following our approach, relevant information will be extracted by rough data in an original three steps procedure:

- the original dataset (number of local employees in each sector) is normalized by row (sample) in order to represent each sample as a pattern whose properties capture how the labor factor is locally allocated across the industries (Carlei and Nuccio 2014);

- an Euclidean distance is calculated to capture how similar the pattern allocation of local resources is across industries[6] .

- the definition of the MST associated with the considered metric distance in order to define the indexed hierarchy between the n industries (nodes).

The main result of this network based approach is to map the Chinese economic system in a topological space built on similarities of patterns in terms of industrial employment, as shown in the following figure.

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[5] For easy reading of the further graphics, these economic sectors will be identified as follows: Farming, Mining, Manufact, Energy, Constr, Transp, Wholesale, BankIns, RealEstUrb, Social, PubMgt, RandDTech, WaterEnv, HealthWelf.
[6] Mantegna (1999) identifies, in his methodology, a metric which is defined using as a distance a function of the correlation coefficient computed between all pairs of nodes of the network

Figure 1. Name of the figure
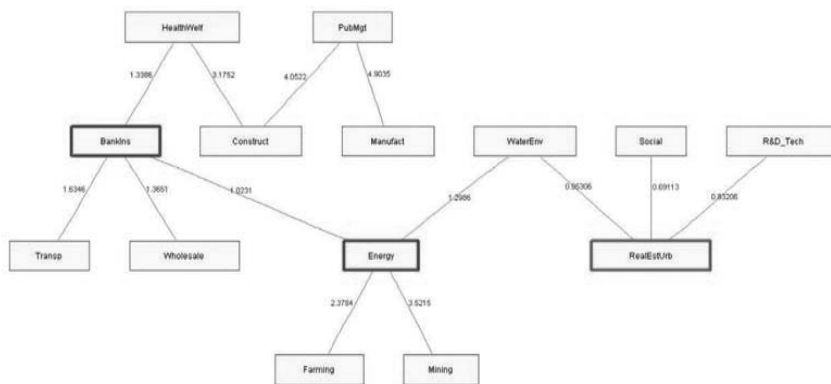
The diagram shows that the whole Chinese Economy may comply with a scale free structure (figure 1).

Once the graph is bobtained, the Bootstrap method has been carried out to control and check the stability of the results. First of all, we used the same analytical procedure by performing steps 1 to 3 on m, with $m = 5000$, random independent subsets of size z, with $z < n$. Each subset of the original dataset has been obtained by a randomly exclusion of a rate $p = 0.2$ of the $N = 287$ municipalities[7]. The test confirm the results obtained in the previous results, this means that Real Estate and Urban Services[8][9]. Financial Services and Energy are deeply connected sectors

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[7] The size of each random subset is $z = (1 - p)N$.

[8] We precise that this sector includes raw land, obtaining the necessary permits, creating building lots, and putting in the sewers, the water and electric lines, the streets and curbs.

[9] The degree of a node is the count of the of other points that are adjacent to it.

in the network and their centrality degree across the nodes of the network is stable over the *m* different random subsamples. After that, an overall MST has been defined taking into account the *m* sub samples.

What we are highlighting, by analyzing the MST that three economic activities emerge from the graph: Real Estate and Urban Services, Financial Services and Energy in terms of their centrality (Freeman 1979) in order to explain the pattern of diffusion of an economic policy effects or other exogenous stimulus.

We noticed that the three economic activities (through their hub role) share a common characteristic. Indeed, employment related respectively to the Real Estate sector is only 2.86 percent of the total employment, for the Finance sector is 6 percent and finally for Energy is 5 percent which defines them as small size sectors. Despite them relatively small size, they are a hub because they are similar among all municipalities. The centrality gives to these activities an important role in terms of propagation of shocks because they are highly connected.

We can conclude that Real Estate and Urban Services, Financial Services and Energy in some senses are focal points in spreading external solicitation effects, at least with respect to the others with whom they are close, just because they occupy a central position in the mainstream of information flow in the network. Why we obtain this kind of configuration and how could we explain the economic significance of links?

Indeed, following emerging facts from our network analysis appear three important hubs. Actually, Energy and Finance hub are common among developing countries remain the real estate and urban services that seems interesting to understand especially in the case of China. Recall that, after the crisis of 2008, China has relied on the real estate development in order to limit the decline of the international demand and its effect on the growth.

There are evidences that banks provided easy credit for housing development projects. Housing investment is an important factor for the short-term fluctuations of economic growth, with its growth stimulating the economic growth and its slumps leading to downside fluctuations

(Liu et al., 2002). Indeed, there is a considerable volume of literature that investigates the dynamic interactions of GDP and housing investment.

Chau and Zou (2000) investigate the short run as well as the long run effects of both public and private housing investment on GDP in Hong Kong from 1973 to 1999. They report that while the growth in public housing investment has a positive influence on the long run economic growth, private housing investment is influential in determining short run economic output.

More recently, Wen (2001) points out that differentiating residential investment from business investment is important in analyzing the relationship between capital formation and economic growth noting that the majority of household savings are in the form of real estate and that economic booms often follow real estate booms and economic recessions follow real estate slumps. Using the postwar U.S. data, Wen shows that it is the capital formation in the household sector that unambiguously and unilaterally causes GDP growth, which in turn causes capital formation in the business sector.

Inspired by this positive dynamic, the Chinese public authorities decided to support the housing investment with a strong commitment of a financial sector, local authorities and real estate developers. It is through this process that the public authorities aim to facilitate access to the property to the middle classes. The real estate development was, thus, a part of the urbanization process and land development.

Beyond the usual development of infrastructure including roads, drainage systems, water and public utilities, the urban researches have to manage projects ranging from urban morphology to the dynamics of rural urban migration to issues concerning housing, crime and changing family structure within China. Actually, China's urbanization faces two inequalities: a "new dualism" between local hukou and migrant populations, and the "old dualism" of urban and rural disparities (World Bank Group, 2014).

This inequality is also reflected in access to social services. Better integration of migrants into urban areas will offer them access to better

jobs and more opportunity to acquire property and thus to benefit from capital gains. Equalizing access to social services between migrants and local hukou holders in urban areas and, over time, across China will contribute to a more inclusive society (World Bank Group. 2014).

For these reasons we notice in our figure (1) a connection between a Real Estate and urban Services, research and development, social and water. This process have to be managed in order to increase the efficiency of urbanization.

Recall that this final configuration of the Chinese economic structure in terms of network is helpful for policymakers for different reasons. First of all, the spatial linkages and the identification of hubs ought to allow a policymaker to identify the trajectory of a microshock through hubs which generate fluctuations. This information will be useful for better control a spreading of an external solicitation and thus to streamline this process. Secondly, it will be interesting to exploit this information for predictions (Gabaix 2015). Policy makers needed, even in the short run, to be conscious of the macroeconomic fluctuations that micro shocks can cause.

Finally, we highlight with our methodology based on the network analysis that it is crucial, beyond the IOM, to take into account the network value (a sectoral interdependency) in order to better understand the regional dynamic. Indeed, the example that we analyze shows, in the framework of interdependencies among economic activities, that a small economic activity could have a big role in term of the propagation of shocks.

As such, Gabaix (2011) develops the view that a large part of aggregate fluctuations arises from idiosyncratic shocks to individual firms. This view is very precious for a future extension of our current paper. Indeed, it will be interesting to stress the configuration of the Chinese economic structure, that we obtain, in terms of network in order to identify its impact.

5. Conclusion

This paper has shown with an original methodology based on the network analysis that spatial linkages help us to define another dimension of sectoral dependency. This information is very helpful in order to better control an exogenous stimulus and its effects. An eventual shock can bring out fluctuations in the economic cycle and cause structural adjustment in different industries, sectors or economic activities. Those that are less prepared, despite its high level of connectivity, or that are vulnerable to economic shocks suffer the most.

As such, key linkages help us to understand what forms sector's ability to respond to a system shock and to reduce costs of an economic shock.

The empirical example for china seems, from this point of view, very interesting because the Chinese public authorities faces currently big challenges following a new national and international economic environment. Shocks are certainly inevitable. With applying our approach to this example, we underlined that the Real Estate, Energy and Financial sectors have an impor3tant position because they are similar and highly connected.

It is through this level of connectivity that they play an important role in the economic structure. They do it despite their small size. For this reason, policymakers should be alert to small economics activities with a big effect.

While pursuing the research illustrated our paper, we learned that analyzing the economic structure in terms of networks is an interesting research direction, which opens up a variety of new questions and requires the definition of a new analytical tool. It will be for example interesting for the future article to stress an economic structure presented as a network system in order to analyze its effect on each economic activity.

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