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Innovation and investments in a regional cross-sectoral growth model: a change is needed in European cohesion policies

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Abstract

This paper illustrates the macroeconomic role of industrial and regional policies and their interaction with monetary and public budget policies. It illustrates a new model, called the model of the cross-sectoral demand and supply, which represents a theoretical framework different from the analytical tools of the aggregate demand and supply (AD-AS) adopted in mainstream macroeconomics. The paper indicates that an economic recovery of the European economy requires an increase of the aggregate demand and the adoption of a new European cohesion policy having an industrial and a territorial dimension and aiming to promote innovation and investments. According to this model, growth is based on the interdependent changes in the sectoral structure of the aggregate supply and the demand. A crucial role is attributed to the flows of new knowledge, innovation and investment, which are the factors affecting both the aggregate supply and the aggregate demand. The paper illustrates the characteristics of the equilibrium between the cross-sectoral demand and the cross-sectoral supply and their role on the pattern of growth. It indicates that a “new industrial and regional policy” by creating new productions can determine an increase of GDP and of employment, also in a short-medium term perspective and not only for long term development.

JEL Codes: E14, L52, O14, O18, O33,

Keywords: innovation, investment, industrial economics and policies, regional economics and policies, macroeconomic theory and policies, European economic recovery

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1. Introduction¹

Due to the fall of investment in the Euro (12) area, 269.351 millions of Euro were lacking in 2015, in order to return to the investment level in 2007. That value almost coincides with the value of 300 billions of Euro indicated by the President of the European Commission, Jean-Claude Juncker, in his proposal for a recovery of the European Economy (2014).

Investments in the Euro (12) area have fallen by 12,3 per cent since the beginning of the crisis and their share on the GDP has decreased by 3 percentage points in favor of the other components of the final demand. That decrease has been much greater than the increase of private consumption (0,5%) and it represents the main factor of the decrease of the GDP (-2,82%). On the contrary, notwithstanding the public debate in Europe focuses always on the Government budget, in fact public consumption have increased (7,7%) in the Euro area in the period 2007-15. Moreover, the decrease of fixed investment is mostly accompanied by a decrease of immaterial investment into new knowledge, in the design of product and process innovation and also in new jobs, since firms have to invest both in capital expenditure and in qualified new jobs in order to create new productions.

The traditional monetary and public budget policies have not been capable to promote a recovery of the European economy after nine years of recession and stagnation (Cappellin , Marelli, Rullani and Sterlacchini 2014; Cappellin, Baravelli, Bellandi, Camagni, Ciciotti and Marelli 2015). In fact, private investment is not sensitive to small decline of the market interest rate and the public budget policies have been deflationary, due to the “Fiscal Compact” rules. Therefore, there is the need of a new course of action in national and EU economic policies and there is the need to adopt a “new industrial and regional policy”, at the national and the EU level.

This paper aims to define a theoretical framework which indicates the implications of the theories elaborated in the literature of industrial, innovation and regional economics in a national and European policy aiming to promote GDP and employment growth. The crucial factor on which the economic policies should act is innovation. Innovation is different from technological change, which is often exogenous, as innovation is the result of an intentional effort by many actors in internal R&D or in formal and informal interactive learning based on increased relations with many other firms and actors. Innovation should not be understood as a specific ICT application or a new technological start up, but in a broader perspective as structural change and evolution. Thus, innovation is represented by the changes in the needs and behaviors of the users, the demand of new goods and services, the discovery of new technological solutions by the firms, the improvement of the goods and services already produced, the production of new goods and services by the firms and by the reallocation of resources from existing declining firms to new and expanding firms and sectors. Innovation is also represented by the design of new instruments of public governance, which can facilitate the users in interacting between themselves and the producers in interacting between themselves and with the users. Therefore, the task of a “new industrial and regional policy” is to manage the complex relationships between the producers and the users and to insure continuous and interdependent structural changes in the aggregate demand and in the supply.

¹ I wish to thank the participants to the Discussion Group “Growth, Investment and Territory” (<http://economia.uniroma2.it/dmd/crescita-investimenti-e-territorio>) for the discussions on earlier drafts of this paper. In particular, I wish to thank for the in depth discussions, the intelligent comments and useful suggestions received Maurizio Baravelli, Enrico Ciciotti, Enrico Marelli, Paolo Paesani and Pier Luigi Porta.

This paper illustrates the macroeconomic role of industrial and regional policies and their interaction with monetary and public budget policies. It illustrates a new model, called the model of the cross-sectoral demand and supply, which represents a theoretical framework different from the analytical tools of the aggregate demand and supply (AD-AS) adopted in mainstream macroeconomics. The paper illustrates a theoretical model, where growth is based on the interdependent changes of the sectoral structure of the aggregate supply and demand. A crucial role is attributed to the flows of new knowledge, innovation and investment, as factors not only of the potential long term growth, but also of the current level of employment and GDP. The paper illustrates the characteristics of the equilibrium and the pattern of growth in the model of the cross-sectoral demand and the cross-sectoral supply. The paper indicates that industrial and regional policies are complementary to the monetary and public budget policies, as they can promote the creation of new productions and determine an increase of GDP and employment at the regional and the national level, also in a short-medium term perspective and not only for long term development.

2. The negative slope of the demand curve and the sectoral structure of the economy

The evaluation of the macroeconomic impact of industrial policies requires a model, which explicitly considers the sectoral structure of the economy, since industrial policies imply a sectoral breakdown and naturally have a selective nature. At the same time this model should allow to evaluate the impact of investments on the aggregate GDP and on the price level, as in the traditional macroeconomic model.

In fact, the aggregate demand schedule in the traditional macroeconomic model does not indicate the demand of the individual sectors of the economy, although the aggregate production is the summation of the production of the various sectors and the aggregate price is an average of the individual prices.

The case of an aggregate economy, such as in a macroeconomic model, may be considered similar to that of a monopolist firm, where there is only one product. However, this assumption does not fit the real world. On the contrary, the model described below is based on the observation that in the overall economy there are an almost infinite number of goods and services and each of these latter has a different and specific price. The price is higher the higher is intrinsic quality of the good and service considered or the value that the user is willing to pay. The price of these goods and services are also related to the technological level of the producing sector considered, as high tech products have higher prices than the medium tech and the low tech products.

Thus, there is a large number of products, which are differentiated and yet are partially substitutes of one another in the individual consumption of the buyers, as indicated by their price cross elasticities. We may also make the hypothesis that each production of a lower level is capable to satisfy although less well the same needs of the productions of an immediate higher level and that allow them to be sold, although at a lower price.

In particular, in a cross-sectoral perspective, the aggregate demand may be constructed by hierarchically adding the quantity of each output, starting from those with the highest price, and this cross-sectoral demand represents the relationship between the sequence of the prices of the various sectors (or the implicit deflator), considered according to a decreasing level, and the total level of the production (or the real value added), which may be obtained by

sequentially adding the production of the various sectors, starting from the sectors having the higher price. This procedure of construction of the cross-sectoral demand schedule, adopted in the model, insures the comparability of the schedules of the demand with that of the supply, as it will be illustrated below.

Thus, the decreasing slope of the cross-sectoral demand curve is determined by the specific procedure adopted for its construction. It also corresponds to the decreasing shape of the individual demand of each production and to the hypothesis that the community of the final and intermediate users tries first of all to satisfy the most qualified needs, which correspond to an higher price of the respective productions, and afterward the needs for the other less qualified productions, for which they are willing to pay a lower price. Clearly also the opposite procedure of starting from the satisfaction of the less qualified goods and services is also valid and compatible with the model.

The cross-sectoral demand schedule in this model is similar to the microeconomic demand schedule of an individual product in the case of “perfect price discrimination” or “first level discrimination”, which represents the case when each producer is capable to sell its respective good and service at a different price than that of the other similar goods and services, due to their different characteristics and the different willingness to pay by the respective users. Thus, the producer is capable to reap all consumer surplus. For example, higher quality goods or services (i.e. a concert of classical music or an iPhone 6) or high tech sectors require higher prices (p_a) than traditional or lower quality products (a concert of pop music or an iPhone 4) or low tech sectors.

In this model, as in the traditional microeconomic demand model, the demand of a specific good and service depends on the relative price and quality with respect to the substitute goods or services. In particular, the demand schedule depends on two factors: a) the prices which the users are willing to pay and their individual preferences, b) the relative quality of the considered productions with respect to the productions with an higher or a lower quality, which depend on the capabilities of the producers. Thus, the price of the goods and services that the consumer is willing to pay is determined by the individual characteristics of the users (i.e. income, free time, knowledge) given the quality characteristics of the good and service considered. On the other hand, the quality characteristics of the good and service depend on the product innovation adopted by the firms producing the good or service considered, the investment in R&D and technical design and on the skills of the firms and their workers.

This cross-sectoral model of the aggregate demand indicates a negative relationship between the GDP and the price level, similar to the aggregated demand curve (AD) in the traditional macroeconomic model. However, the theoretical base is different, since in the traditional macroeconomic model the negative slope is due to the effect of lower prices on an increase of the supply of real money, as that determines lower interest rate and increase of investment and GDP.

Finally, in a macroeconomic perspective, the quantity of the output or the quantity of the product at constant prices of each individual sector in the cross-sectoral demand curve corresponds to the value, which may be obtained by taking into account both the final and the intermediate demand of each sector. That may be computed by multiplying the vector of the final demand components: consumption, investment and public goods and services, measured at constant prices and disaggregated by producing sector, by the Leontief inverse $((I-A)^{-1})$. Therefore, the cross-sectoral demand schedule of this model, as the traditional macroeconomic demand schedule (AD), may shift to right in the case of an increase of the

various components of the aggregate demand (investment, private consumption, public consumption, export, import), due to monetary or fiscal expansionary policies.

3. The sectoral structure of economy and the cross-sectoral supply schedule

In a traditional mainstream macroeconomic model (Blanchard et al. 2011) the supply side of the economy is described by the so called AS schedule:

$$1) P = P^e (1 + \mu) F (1 - Y/L, z)$$

where P^e is the expected level of prices, $(1 + \mu)$ is the mark-up, L is the labor force, z is a set of variables, which indicates all the other variables which may influence the wage level, and output and employment are supposed to be equal ($Y = N$). When the output is equal to its “natural” level ($Y = Y_n$), which corresponds to the natural level of unemployment (u_n), the effective price level is equal to the expected price level ($P = P^e$). Therefore, the AS schedule is derived from the Phillips curve corrected with the inflation expectations (π_t^e) and with the natural rate of unemployment (u_n), where π_t represents the current inflation rate and u_t the current unemployment rate:

$$2) \pi_t - \pi_t^e = -\alpha (u_t - u_n)$$

In this mainstream macroeconomic model, the production function is not explicitly considered and the productivity of labor is unitary and constant. Therefore, in this macroeconomic model, the supply side of the economy basically coincides with the labor supply and no consideration is given to the firms, the productivity of resources, the market structure of the various productions and the sectoral structure of the economy. That contrasts with the reality, where not the workers but rather the firms are producing the investment goods, the consumption goods, the public goods and the exports, which together determine the aggregate demand.

Therefore, according to the traditional neo-liberal macroeconomics if the short run equilibrium between the AD and the AS often determines a level of output lower than its natural level or a unemployment level higher than the “natural rate of unemployment”. In this case, an automatic process will lead again to the full employment and to an increase of the output in the long term. In fact, the aggregate supply (AS) would shift downward and the price level will decrease and that will lead to an increase of the GDP along the aggregate demand (AD). In particular, in the traditional framework of the IS-LM schedules, this result is determined by an increase of the real money supply (M/P), a decrease of the interest rates and by an increase of investment and therefore of the aggregate demand. Thus, according to mainstream macroeconomics, the solution for solving the existing historically extremely high unemployment would be a decrease of the current wages and a deflation process, which is currently called the policy of “structural reforms” by the European institutions and the IMF. That, contrasts with what has occurred since the 2008 global financial crisis, as the decrease of the level or growth rates in wages in the European Union has coincided with a decrease of the inflation rates, the incomes, the demand and the output level and an increase of the unemployment (Marelli 2012, 2016, Marelli and Signorelli 2016). Thus, there is the need to elaborate a different theoretical framework, which could explicitly consider the productivity of the firms, the sectoral structure of the economy, the role of investments and of innovation, in determining the GDP level and the price level. A new model can be based on the theoretical tools of the cross-sectoral demand and cross-sectoral supply, which are illustrated below.

To construct the cross-sectoral supply curve it is possible to start from the relationship between productivity and employment, as indicated in figure 1. We may first suppose an aggregate economy where the production is carried out by various production units, either firms or sectors or regions, which have a different productivity level (Y/N) and a different production capacity, which is determined by the investments in the previous periods. We may also suppose that in this economy both the price level (p) and the wage level (w) are the same for all firms or sectors or regions.

In fact, since the various sectors (such as: high tech, medium tech and low tech sectors) have different technological level or knowledge content (K) and labor productivity, the various sectors may be ordered according to a decreasing level of labor productivity.

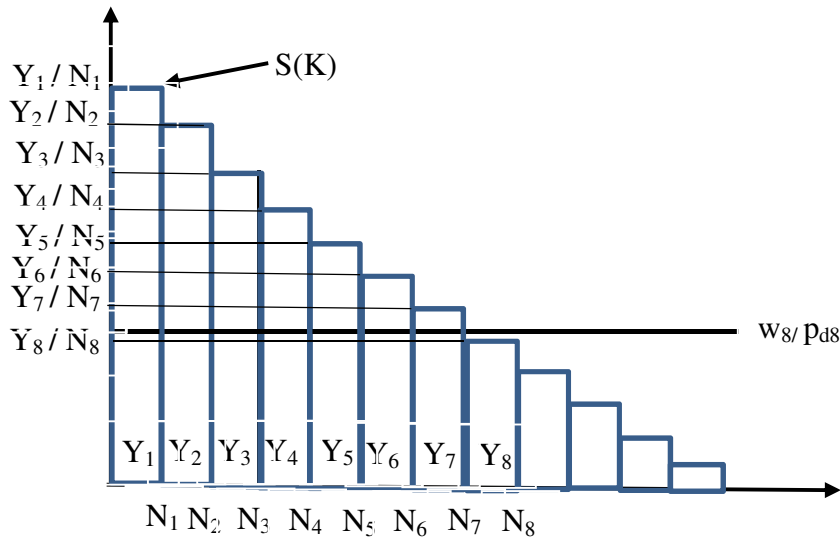


Figure 1 : The cross-sectoral supply side of the economy and the employment and GDP levels

The total cross-sectoral supply of the economy is represented as a decreasing schedule, which is constructed by adding the actual employment level in each sector to the total employment level of the other sectors starting with the sectors, which have a higher labor productivity (Cappellin 1983 and 2014). For construction, the value added of each sector is given by the product between the productivity and the employment or by the surface of the each column. Therefore, the value of the national GDP corresponds to the area below the superior border line and the growth of the GDP corresponds to an increase of the product or the surface of each sector in the figure 1. Therefore, an increase of the GDP can be achieved by industrial and regional policies which either expand employment through the increase of investments and the creation of new production capacity, or increase of the productivity of the already employed workers in the various sectors through innovation and investments. Clearly, the growth rate of the GDP is an average of the growth rate of the various sectors.

However, not all sectors may actually have a positive production level, since that depends on the condition that the unit production cost is lower than the market price, which the users are willing to pay and which is indicated by the cross-sectoral demand, described above. In fact the profitability condition is:

$$3) \quad p_{di} > p_{si} = w_i N_i / Y_i \quad \text{or} \quad Y_i / N_i > w_i / p_{di}$$

where w_i represents the unit labor cost and N_i the employment and Y_i the production of the production or sector or firm or region (i). For example, some sectors, such as the sector 8 in

figure 1, may not be economically feasible and that sector would be eliminated from the economic production range, due to a too high a unit cost (p_{is}), a too low productivity (Y_i/N_i) or to a too high unit labor cost (w_i), given the actual market price (p_{id}).

Looking to the aggregate economy, the maximum level of production, which is graphically indicated by the right extreme of the cross-sectoral supply curve, is usually lower than the level of full employment for two reasons. First of all, the actual production and employment level of each sector may be lower than the level which corresponds to the full utilization of the capital stock, which has been determined by the investments in that sector during the previous periods. Secondly and most important, the supply schedule in a given period may be too low since it does not consider some new sectors, which may be created in the future in order to increase the total employment, if the appropriate conditions on the demand and on the supply realize, as it will be indicated below.

The cross-sectoral model of the supply of figure 1, which indicates a relationship between the productivity level and the employment level of the various sectors, may be easily transformed into a new model, which indicates a relationship between the price level and the production level of the various sectors. This model, which is indicated in figure 2, has the advantage to be compatible with the above illustrated cross-sectoral demand schedule and also with the traditional macroeconomic model of the aggregate demand and supply curves (AD-AS).

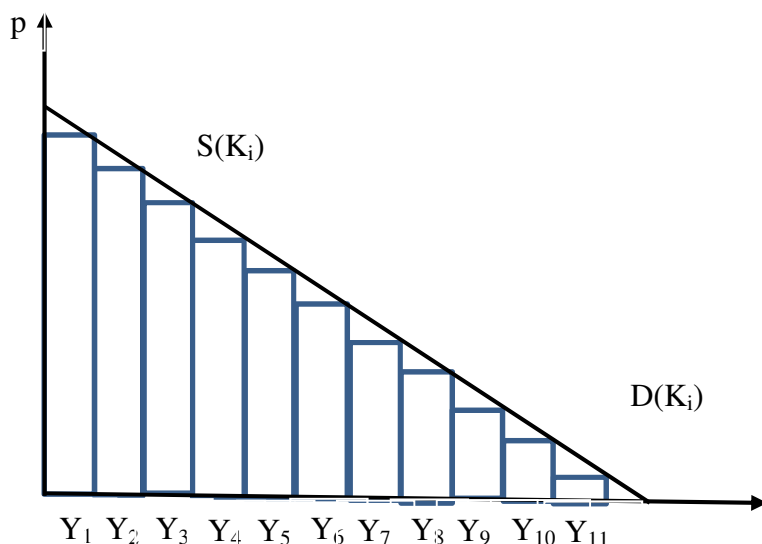


Figure 2 : The balance between the supply and demand of the various sectors in the economy

Differently from the previous model in this model we may suppose that the price levels and the wages levels are different in the various firms or sectors. The production of the various firms or sectors are determined by the equilibrium conditions in the respective markets, which may be that of perfect or the imperfect competition. In any case, the condition of efficient production should be satisfied and the revenue should be at least equal to costs to avoid financial losses of the firm or sector considered.

By construction, the product level of each sector measured at constant prices, indicated on the horizontal axis of figure 2, corresponds to the product of the employment level and the productivity level in the figure 1 for the same sector or to the surface of the corresponding column. The surface of the area below the demand schedule or its integral in figure 2 indicates the product measured at current prices for each sector and their summation is the GDP at current prices for the overall economy. Therefore, the aggregate price level can be computed as a weighted average of the prices of the individual sectors. Otherwise, the aggregate price

level or the deflator of the GDP is represented by the ratio between the integral of the cross-sectoral demand curve or the area below the cross-sectoral demand curve, which corresponds to the GDP at current prices, and the GDP at constant prices, indicated on the horizontal axis, in figure 2. Therefore, the model of the cross-sectoral demand and supply curves indicates the same variable: price (P) and GDP (Y) of the mainstream macroeconomic model of the aggregated demand and supply (AD-AS).

In particular, given the values of the productivity (Y_i/N_i) and the unit wage rate (s_i) in each sector and the interest rate (r) and the unit capital coefficient or the capital which is required to create a job place ($K/N=\beta_i$), it is possible to calculate the unit production cost (p_{si}):

$$4) p_{si} = s_i N_i / Y_i + r K_i / Y_i = (s_i N_i + r \beta_i N_i) / Y_i = w_i N_i / Y_i$$

Where (w_i) may be defined as the total unit production cost, which includes the cost of labor and the per capita cost of capital.

The total unit production cost increases with the productivity level of the individual sectors and in the case of two sectors 1 and 2, we may have:

$$5) \text{ if } Y_1/N_1 > Y_2/N_2 \text{ then } w_1 > w_2$$

In fact, the more advanced sectors have to use more skilled labor resources, having a higher wage (s_i), and they also need a greater capital per capita (β_i), since they use more modern techniques.

We may also suppose that the price that the users are willing to pay for the various products and services considered is related to their respective quality and that this latter is related to the labor productivity level (Y_i/N_i) of the respective sectors, since the sectors which are more technological advanced can produce goods and services, which have an higher quality and an higher price. Thus:

$$6) \text{ if } Y_1/N_1 > Y_2/N_2 \text{ then } p_1 > p_2$$

From the expressions 5 and 6 indicated above it is possible to derive that:

$$7) w_1/w_2 > p_1/p_2$$

which indicates that the total unit production cost in the more productive sectors increases more than the price of the respective production. That implies that the supply schedule increases more than the demand schedule and it may eventually become higher than the demand schedule.

Finally, in equilibrium the market price (p_{di}) should be equal to the unitary cost of production (p_{si}). In fact, the productions which are economically efficient should satisfy the profitability condition:

$$8) p_{di} \geq p_{si} = w_i N_i / Y_i$$

This condition for the profitability of the current productions can also be interpreted in an inter-temporal or industrial strategic perspective and it is similar to the profitability condition of the investment projects aiming to create new productions (Baravelli 2016, Bellandi 2016),

as the future values of revenues and of the costs of an investment project should be compatible with the financial criterion of a positive net present value (NPV) or of an internal rate of return (IRR) greater than the average cost of capital (r), taking into account the risk premium required by the investing firm:

$$9) \text{ IRR (R\&D, project design, education, } \Delta Y) \geq r + \text{ risk premium}^*$$

Clearly these financial conditions only represent a condition for the financial compatibility and do not explain the various factors, which lead the firms to identify, technically design and politically decide an investment project and the external and internal factors which will affect the revenues and costs of these projects in the future. These factors are analysed by the large literature on industrial and regional economics and other disciplines (Lundvall and Johnson 1994, Capello 2007, Fagerberg 2005, Cappellin and Wink 2009, Cappellin 2010).

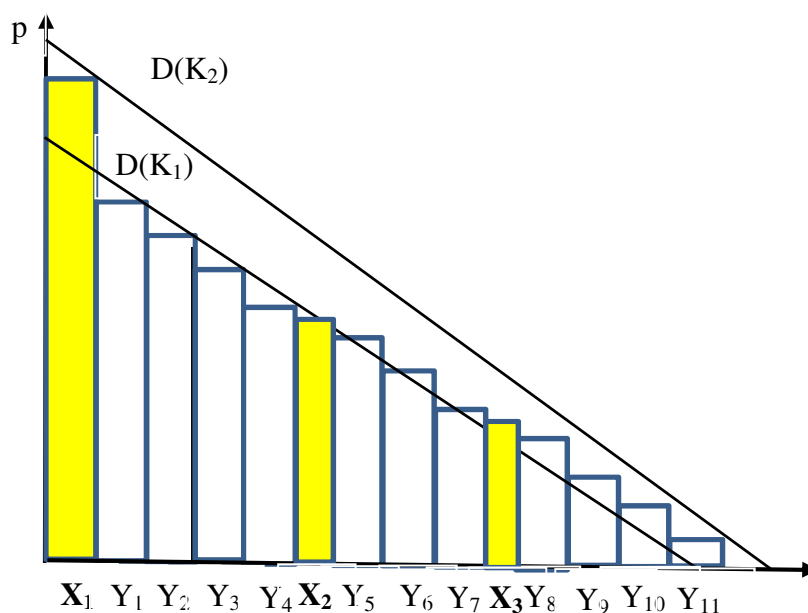


Figure 3 : The creation of new sectors determined by an increase of cross-sectoral demand

The figure 3 indicates the specific case when the demand and the supply of each sector are exactly equal. In this figure, the demand schedule ($D(K_i)$) indicates the prices of the demand of the various firms or sectors, when we suppose that it is possible a perfect price discrimination or a price discrimination of first degree as any unit of production could be sold at a different price given the maximum willingness to pay of the user.

Both the demand and the supply curves may increase either because the productions of the already produced goods and services increase, or because new goods and services are produced. Clearly, this second case is the most relevant in an investment strategy perspective. Thus, the creation of new sectors is determined by an increase of the cross-sectoral demand.

In fact, we may suppose that the cross-sectoral demand schedule increases due to an increase of the aggregate investment by the firms or also due to an increase of other components of the aggregate demand, such as private and public consumption and exports. In this case, which is indicated in figure 3, the new and greater cross-sectoral demand will be distributed between the various sectors according to the quality characteristics of their productions and according to the new specific pattern of preferences of the users. Therefore, that may determine either an increase of the quantity produced by the previously existing sectors or also the creation of

a new demand for some new productions. In particular, an increase of the cross-sectoral demand may allow the production of the new goods and services (X_i), additional with respect to the previous productions (Y_i).

This increase of the demand and the supply may be determined by structural changes in the demand and supply, such as in the case of an increase of the knowledge (K), which increases the needs and the demand by the users, or in the case of an innovation in the firm's production. These changes may be those indicated by the "speciation" process by Marshall (1920) leading to the creation of new sectors from existing sectors or they be determined by a change in the production coefficients and in the income demand elasticities, as indicated in the Pasinetti's intersectoral growth model (1981 and 1993).

To be efficient, the new productions should have a production cost lower than the market prices that the users are willing to pay, as it is indicated by the demand schedule. Therefore, the firms should also have previously increased their production capacity through appropriate investments. In particular, figure 3 indicates not only a shift upward of the demand but also a shift to the right of the supply schedule determined by the creation of new sectors. For example, X_1 indicates a high tech good, which has a very high production cost, but can later be bought by the users, since the increase of the demand makes the cost becomes smaller than the market price. Moreover, X_2 and X_3 indicate two new medium tech goods or services, which can be produced after an increase of the demand, being preferred by the users to some of the other existing productions, due to their higher quality.

This case indicates that the *ex ante* decision by some firms to invest for expanding the capacity in new specific sectors has proved to be correct, since not only the investments have increased the aggregate demand, but also they have also led to an increase of the production capacity, which *ex post* exactly corresponds to the level of the new demand for these productions, due to an appropriate change in the patterns of the user preferences.

In the model of figure 2, the investment determine a shift of the cross sectoral supply curve to the right due to the increase of the production capacity in various firms or sectors. However, that does not lead to a greater production unless the cost is lower than the price the user is willing to pay for the new additional products. Thus, an investment in a medium tech sector would expand the production capacity in that sector, increasing both the employment and the productivity of labor in that sector. If that increase of the production capacity is accompanied by an adequate increase of the quantity demanded at the respective unit production cost, then an increase of the actual production would occur.

In conclusion, investments increase the production capacity of new sectors and determine a shift of the supply schedule to the right. The increase of investment increases the cross-sectoral demand. Finally, the increase of the demand in the specific sector considered allows the overcoming of the barriers to entry and the creation of new productions.

4. The cross-sectoral demand and supply in the general case

The previous figures have considered a limited number of sectors, similar to those considered in the national accounting statistics. However, it may be applied to the case of many productions and firms in various regions of the country considered. When the number of sectors and of productions become very high, then the shape of the cross-sectoral supply schedule becomes continuous and it may have an irregular form, as indicated in figure 4.

Then, the demand (Y_d) and the supply (Y_s) schedules may intersect in various points. Clearly also the cross –sectoral demand curve may have an irregular form.

As indicated above, the value of the national GDP at current prices is graphically represented by the surface of the area below the cross-sectoral demand curve or the integral of that curve, and the value of the national GDP at constant prices is indicated in the horizontal axis, the average level of price and the inflation rate in the economy can be computed as the ratio of the GDP at current prices and the GDP at constant prices, which represents a weighted average of the prices in the various sectors. Thus, the graph 4 is comparable to the traditional graphs of the aggregated demand and aggregate supply (AD-AS) of the mainstream macroeconomic model, as they both indicate a relationship between the GDP and the average price level.

In the model the cross-sectoral demand and supply, economic growth depends on the change of the internal structure of the economy or on the shift from less productive to more productive uses of resources. On the contrary, the mainstream macroeconomic models miss the possibility to consider the impact of structural change and innovation on aggregate growth.

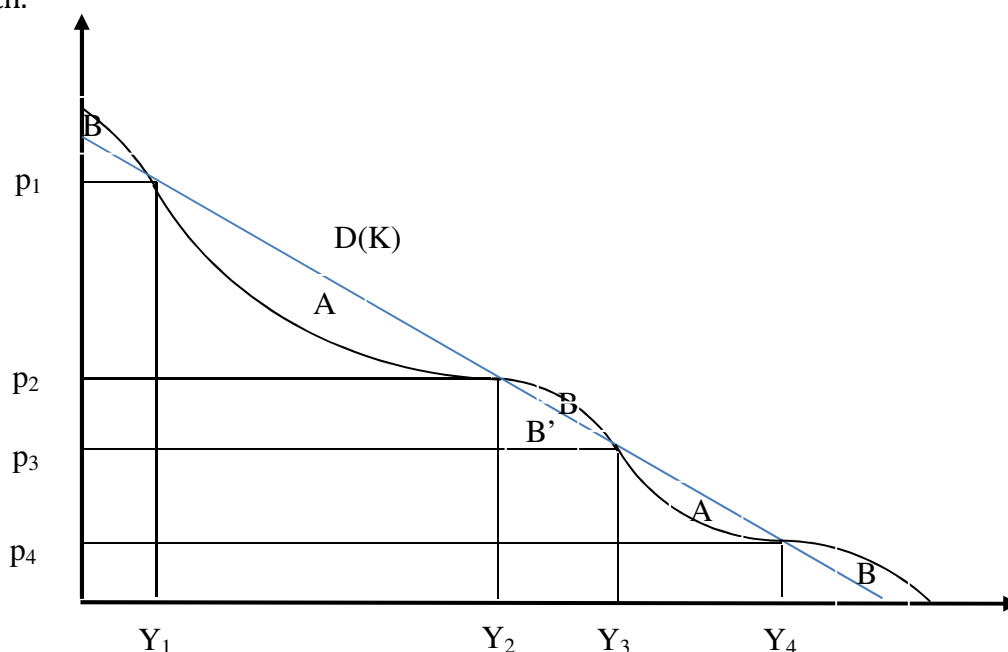


Figure 4: The cross-sectoral demand and supply schedules in the general case

To determine an increase of GDP industrial and regional policies should stimulate both the demand and the supply in the various productions or should lead to a shift downward of the cross-sectoral supply and a shift to the right of the cross-sectoral demand. That implies greater innovation and investments, leading to an increase of the labour productivity and of the production capacity, which are reducing the unit production costs in the various productions, and also innovation and regulation of the product markets in order to stimulate the demand of new products by the potential users. The areas A, B and B' have a particular meaning. In order that production is feasible it is required that the demand schedule is greater than the supply schedule, as in the intervals: $Y_1 - Y_2$ and $Y_3 - Y_4$, where the prices which the users are willing to pay are greater than the costs of the producers. If the various goods are different one from the other and the producer can discriminate the users, they can ask the highest price that the users can pay. Thus there is a rent, or producer surplus, indicated by the area A, determined by the difference between the market price and the production cost for each sector.

On the other hand, when the supply schedule is higher than the demand schedule, as indicated by the area B in the interval $Y_2 - Y_3$, the costs of the producers are higher than the price that the users are paying and production is not economically efficient. In this case, we may suppose that the users are willing to consume more of the lower quality goods and substitute them to the more qualified and too expensive goods, which are not produced. That implies that the interval $Y_2 - Y_3$ indicates an additional production of the good or service which has a lower price (p_3), as indicated by the intersection between the demand and the supply schedule.

Moreover, if the users are willing to buy less qualified goods and services in alternative for the higher quality goods which, as indicated above, can't be economically produced, then the difference between the market price, indicated on the cross-sectoral demand schedule, and the cost of the producers (p_3) represents a rent for these latter and that is indicated by the area B'. In fact, the cost of the less qualified goods and services, which the users are willing to buy in alternative for the higher quality goods, is indicated by the new point of intersection between the cross-sectoral demand and the cross-sectoral supply curves (p_3).

Also, the two extreme areas B (before Y_1 and after Y_4) indicate the cases of goods and services, which can't be produced, unless there is a shift of the demand or of the supply schedule. In fact, the continuous increase of the wages costs and of the capital costs for the most technologically advanced productions, where productivity is very high, may lead to the situation when the costs are higher than the market price, notwithstanding the higher prices that the users are willing to pay for these more qualified products or services. Similarly, in the case of the least qualified productions, a too low decrease of the wages and of the capital required may imply that the decrease of the costs may be lower than the decrease of the price, that the users are willing to pay. In fact, when the quality and the productivity of the goods and services decrease, the consumers may not be interested in too obsolete products or services even if the price is very low. However, also in these two cases the production may become possible after changes of the demand or of the supply schedules, determined by appropriate industrial policies, as it will be indicated below.

The equilibrium of the cross-sectoral supply and demand, indicated in the model, is based on the idea that the market prices exclude those productions, which are much less efficient than the average of the other productions, as it occurs in the sector X_8 of figure 2 or in the areas B of figure 4 (Cappellin 2014). That is similar to the indications of the Von Thünen - Alonso model of the urban rent and also in other well-known economic models, such as the Keynesian investment schedule and also the barriers to entry model, where the less efficient productions are excluded from the market

The demand and the supply schedules in figure 4 define a level of total production (Y_4), which is normally lower than the level which corresponds to a full employment situation. Thus, appropriate industrial and regional investment policies may increase the level or change the form of the demand or supply schedule. That is required in order to promote a change of the cost structure of the various sectors and of the patterns of the demand and to increase the employment and production in the existing sectors and/or to promote the creation of new sectors. Otherwise, if employment is greater than the full employment level, the salaries of the workers (s) would increase and that would lead to an upward shift of the supply schedule and to a lower production by the firms and a lower demand of labor.

5. The impact of higher knowledge on the rotation of the demand and supply

Technological progress works both on the supply and on the demand side of the economy and it has a positive effect on the production of high tech goods and services, while it may have a negative impact on the low tech sectors, due to the lower demand and the increase in the wages and costs. In particular, technological change may determine a shift of both the supply and the demand schedule.

Thus, greater knowledge and technological change determines a clockwise rotation of the demand schedule, as indicated by figure 5, since the increasing knowledge and education leads the users to increase their propensity to consume high quality goods and services and decreases their demand for more traditional goods. Users are willing to pay higher prices for more qualified or more innovative goods or services and lower prices for less qualified or obsolete productions or even they do not want them anymore.

This structural change of the demand patterns may be further increased by an upward shift of the demand schedules. That, as indicated above, can be determined by an increase of the aggregate investment, as a greater knowledge increases the internal rate of return (IRR) of the investment projects by the firms.

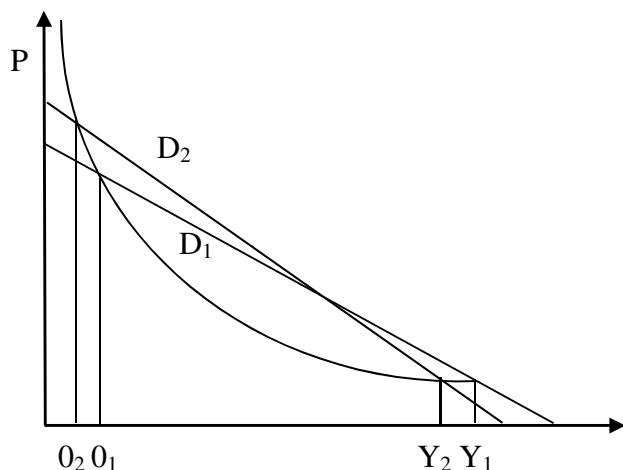


Figure 5: The effects of the evolution of the demand on the production area ($O_2 - O_1$; $Y_1 - Y_2$)

On the other hand, greater knowledge and technological change determine both a downward shift and an anti-clockwise rotation of the supply schedule, since they determine a decrease of the costs, due to a process of learning by doing and of gradual imitation, or an increase of average labor productivity (Y_i / N_i) and a decrease of the capital inputs, which are greater for the more qualified goods and services, than for the more traditional productions. On the contrary, the cost of these latter productions may even increase due to an increase of the minimum wage to be paid to the workers. These two simultaneous shifts of the demand and of the supply schedule may determine the possibility to produce new high quality goods and to increase the total employment, since the intersection between the demand and the supply schedules in figure 7 shifts to the left from O_1 to O_2 .

The introduction of new more qualified goods and services increases total employment and that contradicts the widely diffuse belief that technological progress determines a decrease of employment. In particular, the increase of the productions of more qualified products is usually greater than the decrease of the production of the more traditional and less qualified

goods and services, as a downward shift of the demand for these latter goods and services could be at least partially compensated by the downward shift of the supply and of their costs.

The Schumpeterian process of “creative destruction” works both on the supply and also on the demand side. Consumptions shifts upward or toward higher quality goods and services and the demand decreases in the lower quality sectors. That creates excess capacity in these sectors and determines a disinvestment and the workers and the capital shift to the sectors where the production increases. Therefore, the model indicates the importance of policies aiming to increase the rate of knowledge creation, leading to joint shifts of the demand and the supply schedule.

The model of the cross-sectoral demand (CD) and cross-sectoral supply (CS) of figure 2 allow to indicate the impact on GDP of the process and product innovation. In particular, process innovation determine a down-ward shift of (CS) while product innovation determine a right-ward shift of (CS).

In fact, process innovations increase the labor productivity (Y/N) and if wages are stable the CS shift downward. Product innovation lead to the increase of the production capacity of the existing firms or to the birth of new innovative firms. In both cases the production capacity of the economy increases and that leads to a rightward shift of the (CS). Moreover, product innovations improve the perceived quality of the product by the users and lead to an increase of the value for money or the price that the user is willing to pay and that would lead to an upward shift of the (CD), provided that the user have an adequate income. Product innovation are similar to the overcoming of the barriers to entry by new firms in a competitive market and depends on the shift both of the demand and of the supply curves.

Both process and product innovation expand the supply side of the economy. However, it should be underlined that neither process nor product innovation could exist without greater investment.

As the shifts of the cross-sectoral supply and demand schedules are the result of innovation and investment they can be linked to the indication of the life cycle model, which may provide an useful interpretation of the long term evolution of the both schedules. In fact, the product life cycle model indicates that economic growth is linked to the sequence of many different innovation waves, which determine the creation, growth and decline of new productions, characterized by an increase of labour productivity with respect to the previous productions and the creation of new employment. That leads to the increase of wages and incomes and also of the internal demand in the country and this latter drives the investment by the companies.

As indicated in the product life cycle model the change in the structure of the final and intermediate demand and of the sectorial structure of the economy is the factor leading to the economic growth. The preferences of the consumers shift from goods exported in the international markets to services and infrastructures, which are mainly addressed to the domestic market (Cappellin 2016). The development of “disruptive” technologies creates new production opportunities and the market of these new productions is not created, as in the past, by the general growth of GDP, but rather by the gradual substitution of new productions to the more traditional productions, which become obsolete, since they imply a lower productivity of labour and also are less capable to satisfy the changing needs of the citizens (Markusen 2007, Markusen and Schrok 2009, Cappellin 2011 and 2012). The process of “creative destruction” works on the supply side, with the transfer of production factors: labor

and capital, from the traditional productions to the new productions and also on the demand side with the shift of consumption from traditional goods and services to innovative goods and services.

The shift from an industrial society to a knowledge society is characterized by a shift from individual to “collective goods” or “common goods”. In fact, the demand of individual goods is almost saturated, while the demand of collective goods and services, which are addressed to specific local, social, age and cultural groups of consumers or citizens, is still largely unsatisfied. Due to the collective nature of the new productions, the individual demands should first be aggregated by the producers in order to create new “*lead markets*” (Cappellin 2011), which may allow the efficient production of the new goods or services not only by public organizations but also increasingly by private companies. In fact, while the production of these services was traditionally reserved to public institutions the growing demand, the increasing specialization of the citizen’s needs and the development of new technologies and forms of organization has led to the development of an increasing number of private firms working for the market in the productions indicated above. The new productions should respond to the to the increasing needs by the citizens (Eurostat 2008), such as those of: a) housing, b) mobility and logistics, c) free time and leisure, culture, sport, tourism media, d) health, wellness and education, e) environment and energy saving. Moreover, these new service productions may drive the development of new manufacturing supply chains or clusters, both within the specific urban areas and also at the national and international level (Cappellin et al. 2014 and Cappellin et al. 2015, Ciciotti 2016, Bellandi 2016).

6. A formal model of the cross-sectoral demand and supply

The model of the cross-sectoral supply and demand (CS-S and CS-D) is a growth model of the economy, which may be formally described with the following equations:

$$1) X = (I-A)^{-1} (C + I + G + EX - IM)$$

$$2) (C + I) = f (Y_d, p_i)$$

$$3) (EX - IM) = n_3 (p_i, Y_d, \text{external demand})$$

$$4) p_i = u_i + w_i N_i / Y_i$$

$$5) u_i = f (X_i / X_i^*)$$

$$6) w_i = f (p_i, u_i, X_i / N_i, N_i)$$

$$7) Y_d = \sum_i w_i N_i + \sum_i u_i X$$

$$8) N_i = f (X_i, X_i^*)$$

$$9) X_i^* = \text{Resources}_i * \text{Productivity}_i^*$$

$$10) \text{Resources}_{i t}^* = n_4 (\text{input flows}_t \dots, \text{input flows}_{t-n})$$

$$11) \text{Productivity}_{i t}^* = n_5 (\text{input flows}_t \dots, \dots, \text{input flows}_{t-n} \text{ knowledge flows}_t, \dots, \dots, \text{knowledge flows}_{t-n})$$

12) Knowledge flows $t = n_6$ (output flows, input flows, knowledge flows) $_{t-1}$

13) Input flows $t = n_7$ (output flows, input flows, knowledge flows) $_{t-1}$

Input flows are flows of labour (N) and capital (I). The model considers (i) production units, which may represent individual productions or companies or industrial sectors within a specific region. In the case of a national economy, the individual production units may represent the various production units of the various regions. The empirical disaggregation of the model may depend on the data availability. Thus, in a theoretical perspective, the number of units could be extremely high, as indicated in the figure 4, which represents the “continuous” case.

Therefore, in the model, an increase of investment determines an increase of the aggregate demand and of the productions in the various sectors (equation 1) and it activates the Keynesian and the Leontief’s multipliers. Considering the supply side, an increase of investment or of the capital input flows (equation 13) increases the stock of resources (equation 10) and in the medium-long term the productivity (equation 11) of the resources, thus leading to an increase of the production capacity (equation 9).

Equations 11-12-13 indicates the complex interdependence between the flows and the stocks of material and immaterial resources and their productivity (Cappellin 2003, 2010). Their theoretical explanation is based on the theories of regional innovation systems and on the various theories illustrated in the literature of innovation, industrial and regional economics. In the model these input flows explain the growth of the production capacity in the individual productions, companies or sectors considered at the regional or national level. In particular, an increase of investment (capital inputs) leads, in the long-medium term, to an increase of the labour resources or of employment flows into the firms and sectors (equation 13), due to the complementarity between capital and labor inputs. In fact, material investments in capital stock by the companies are complementary to immaterial investments in labour and especially to the increase of skilled labour resources, which incorporate modern technologies.

Equation 4 has a key importance in the model as it indicates the crucial profitability condition, which is represented in figure 4, of the equilibrium between the cross-sectoral demand and the cross-sectoral supply or between the prices, which are determined by the demand, and the production costs, which are determined by the production capacity, for each production unit (i).

Equation (8) explains the level of current employment, which depends on the short term cyclical behaviour of productivity, which may be described thorough the Okun’s or Verdoorn’s laws. An increase of the production capacity and a decrease of the capacity utilization, in the short term, decrease the labour demand per unit of production (equation 8) and they increase the productivity of labour. On the other hand, the increase of the production capacity decreases the capacity utilization and it decreases the companies unit return or the mark-up (equation 5) and the prices (equation 4). That leads to an increase of the demand (equation 2) and then of productions (equation 1).

In fact, there is a complex relationship between investment and employment. In fact, the investment decision temporally anticipates the production decision. First of all the firms should decide the production capabilities and the related material and immaterial investments in capital stock and in key labour resources, then they decide the production

level and the use of the variable inputs. Therefore, investment and the capital stock determine the level of “normal employment” in the firm or sector considered, as the level of normal employment is related to the production capacity of the firms or sectors and no long term increase of employment can be obtained without a material investment. Second, the investments and the capital stock determine the level of normal productivity of labour, as it will be indicated in the section 6 of this paper.

Differently from the assumptions in most macroeconomic models, an increase of productivity leads to an increase of wages (equation 6), provided a suitable behaviour of companies and appropriate labour market policies, and then to an increase of the income (equation 7) or of GDP and of the aggregate demand (equation 2). Therefore, as indicated above the increase of the supply also enhances an increase of incomes and of the demand, thus insuring the balance between the demand and the supply at the aggregate level.

7. The microeconomic equilibrium and the creation of new productions.

In a microeconomic perspective, it is important to establish the relationship between the cross-sectoral demand (D) and the cross-sectoral supply curves (S) in the overall economy, as indicated by the graph (I), and the equilibrium price and quantity determined by the microeconomic demand and supply curves of the various individual sectors (y_1 and y_2) in their respective markets (II and III), as indicated in the figure 5.

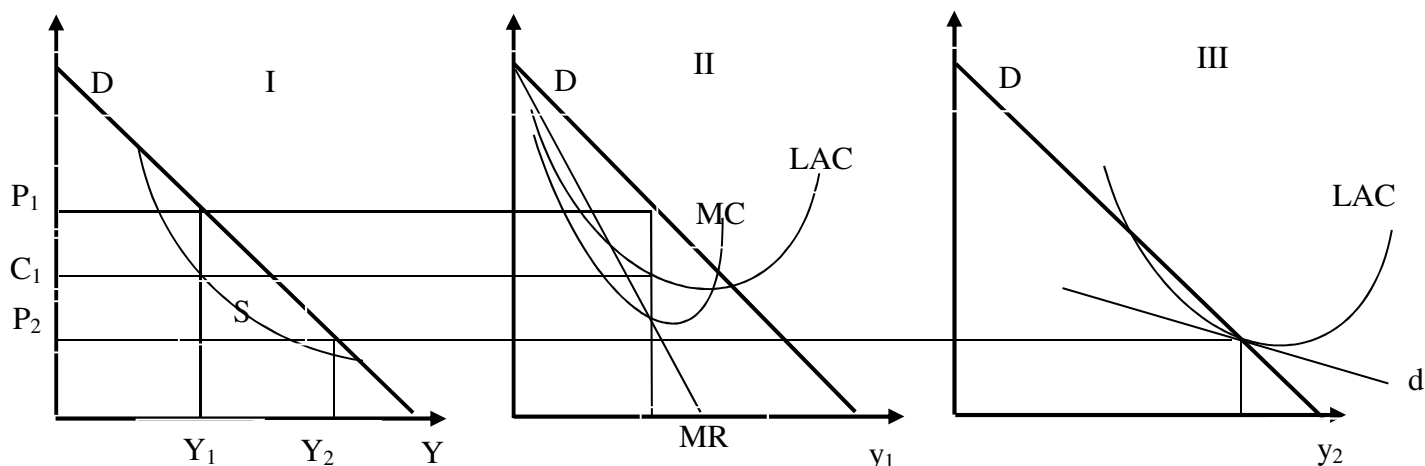


Figure 6: The price and the production levels in two sectors: monopoly (y_1) and monopolistic competition (y_2)

In particular, as indicated in figure 6, we may assume that each production is sold in a different market, which is characterized either by a monopoly or, when the firm is one of a large number of sellers, by monopolistic competition a la Chamberlin-Robinson. In these models, both the demand and the cost curves have a declining shape and the price should be equal or greater than the costs, in order to allow to the producers to overcome the barriers to entry, similarly to the cross-sectoral demand and supply curve described in the model of the figures 4, where the areas A and B indicate the existence of barriers to entry in specific productions.

In the long run, the equilibrium is achieved through the adjustment of the prices by the existing firms and by new firms entering in the economy. In particular, in the case of the

monopolist firm (y_1) the price is greater than the average cost and the quantity produced allows that the marginal revenues and the marginal cost are equal. On the other hand, in the case of the monopolistic competition (y_2), the equilibrium in the market is determined by the entry of new firms and the tangency of the short term demand curve with the long run average cost curve and the profits are zero or just normal. Then, similarly to the case represented in the figures 2 and 4, the construction of the cross-sectoral demand and supply schedules in the model requires that the equilibrium quantity determined in the market of one production, which has an higher price, is added to the equilibrium quantity of the other productions, which have a lower price. Clearly, the microeconomic equilibrium in the markets of the two productions (y_1 and y_2) and at the aggregate level is stable unless innovation does not occur in the technology of the firms and in the needs and behaviors of the customers.

From an industrial and regional policy perspective, the creation of new productions requires a change in the demand and/or in the supply and that the price in each production is higher than its production cost, in order that firms can overcome the barriers to entry. That implies an increase of investments, as investments are crucial for the following three types of innovation:

- a) a product innovation, which determines an improvement of the quality of productions and the increase of the price that the users are willing to pay: that may allow overcoming the barriers to entry in new productions, by making prices higher than the average costs;
- b) a process innovation, which can decrease the costs below the level of the market prices and would allow overcoming the barriers to entry into new productions;
- c) an innovation in the public governance, facilitating the reciprocal coordination of the innovative producers with the innovative users in the new productions. In fact, local and national public institutions should coordinate the many private actors, which have to cooperate in order to organize large, long term and risky investment projects in the development of new productions. Moreover, public regulations are required for the aggregation of the demand of the many individual users of collective goods and services, as these should be financed either through regulated prices or tariffs on the individual users (i.e. the case of “club goods”) or through taxes imposed by the State (i.e. the case of “public goods” financed by the public sector and sometime produced by private companies).

Innovations determine an increase of the revenues or a decrease of the costs of the investment project in the new productions and that may determine an internal rate of return (IRR) of the investment project greater than the cost of financial funds or may determine that the flows of revenues minus the costs of the project, discounted by the cost of funds plus the risk premium, is at least equal to the value of investment. Therefore, greater innovation represents a preliminary condition for an increase of the productivity of capital expenditure, a recovery of the aggregate investment and of an increase of the aggregate demand and of GDP after the current long term stagnation of the European economy.

If the demand and the supply schedule in a new potential sector are as those indicated in the graph (II) of figure 7, an innovative firm, for example a “temporary” monopolist producer, could anticipate the less innovative competitors and decide to produce (y_1) and sell it at the price (p_1), which maximize its profit. The positive difference between the market price (p_1) and the average cost (AC) indicates that an investment in these new productions would be convenient or that the internal rate of return (IRR) of the investment project is higher than the capital costs. Otherwise, if the new sector is a “public good”, which is characterized by a high production cost (AC_1'), the public sector could purchase or subsidize the production by paying a price (p_1), which is equal to the average production cost.

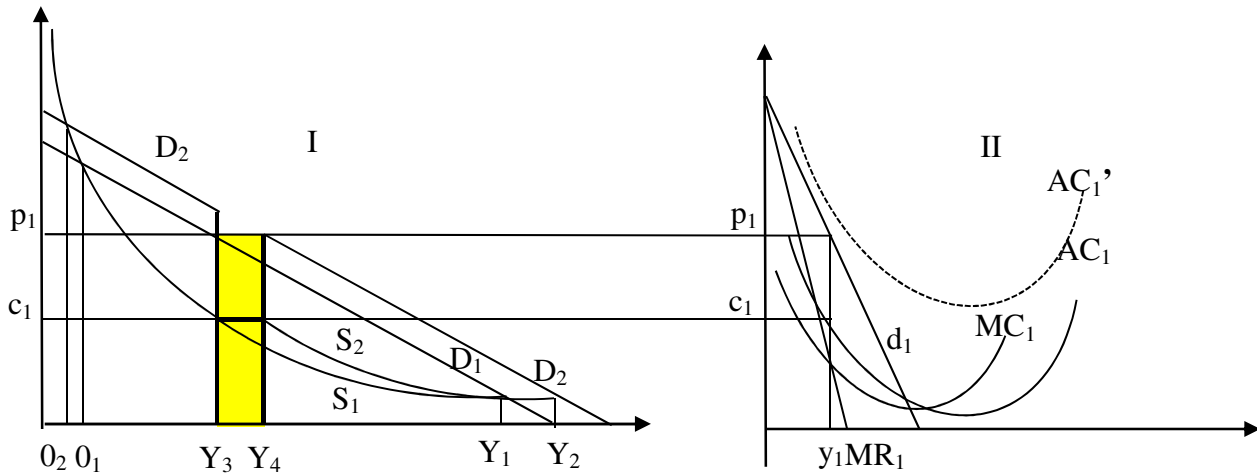


Figure 7: The effects of investment and of the creation of new productions on GDP growth

In the graph (I) of figure 7, the creation of the new production determines a shift of the cross-sectoral supply schedule, equal to $(Y_3 - Y_4)$, from S_1 to S_2 , at the level of the price (p_1). The revenue of the producers in the new sector is indicated by the shaded area. Then, the new production would increase the national GDP and determine a shift $(Y_1 - Y_2)$ of the cross-sectoral supply curve.

Moreover, as indicated in the cross-sectoral model of the figures 2, 3 and 4 above, greater investments would determine an increase of the demand through the Keynesian multiplier and then an upward shift of the cross-sectoral demand schedule. That would increase the prices and the revenues of all existing sectors.

A third case may be illustrated by the area (B) in the middle of the figure 4, which indicates a production, which is not economically efficient, so that its demand is satisfied by a lower quality production (area B'), having a lower quality and a lower price. In this case, a policy of innovation and investment should aim to improve the quality of the product thus increasing the price, that the users are willing to pay, and/or to a decrease of the production costs. That would allow overcoming the barriers to entry into this production. This case is the most frequent as new productions are often medium tech productions and neither high tech nor low tech productions. These medium tech productions can be produced by private companies or directly by public institutions, and financed by taxes or tariffs. The creation of a new more qualified production may, however, imply a decrease of the demand of some competing more traditional goods and services and, as indicated by the Schumpeterian process of "creative destruction", that would lead to a shift of labor and capital from the more traditional to the more innovative productions.

In a technological perspective, the new productions usually develop "at the margins" of existing productions and, in fact, the shaded area in figure 7 are contiguous to other existing productions. That is similar to the concept of diversification through "related variety" (Boschma 2013). Moreover, looking on the supply side, the creation of new productions implies a reconversion of the material and immaterial resources previously used by more traditional productions. Instead, looking at the demand side, the new productions allow a better satisfaction of the emerging needs of the users, which often are the evolution of previous traditional needs of the same users. This process of structural change in the

consumption patterns may also be described as a “creative destruction” process, as it implies a shift of production factors from less efficient to more efficient productions and an evolution of the demand from lower to higher quality goods and services.

Therefore, a modern industrial policy should, through immaterial and material investments, increase the knowledge or the innovation both in the supply (by developing the production of new modern collective services) and in the demand (by stimulating the needs and the demand of these services by an increasing number of citizens) and that would determine a shift to the right of the cross-sectoral supply curve and an upward shift of the cross-sectoral demand curve.

8. The balance between the aggregate demand and the aggregate supply

The case of the investment in the creation of new productions clarifies the difference between the model of the cross-sectoral demand and cross-sectoral supply and the mainstream model of the aggregate demand and supply (AD-AS). In fact, according to this latter model the supply side of the economy is represented by the supply of labor or by the relationship (“Phillips curve”) between the increase of wages and the unemployment rate (the non-accelerating wage rate of unemployment: NAWRU). In a situation of unemployment or when there is a gap between current GDP and the “potential output” the flexibility of prices and wages brings back the economy to full employment. The continuous decrease of wages would lead to an increase of the real monetary supply, to the decrease of interest rate and to the increase of the investment and of the aggregate demand, until the full employment GDP is reached. This mainstream macroeconomic model considers the labor market, but it does not consider the production structure of the economy or the production capabilities of the companies and the different productivity levels of the various sectors. Therefore, this model can’t consider the process of structural change, such as when an increase of the share of the more productive sectors leads to an increase of the aggregate productivity. In the model of mainstream macroeconomics, the increase in the production capacity does not have any effect on GDP and employment in the short term and only determine a long term decrease of average wages and prices, which would determine an increase of the aggregate demand. On the contrary, in the model of the cross-sectoral demand and supply, investment and innovation affect the equilibrium between the supply and the demand also in a medium term perspective.

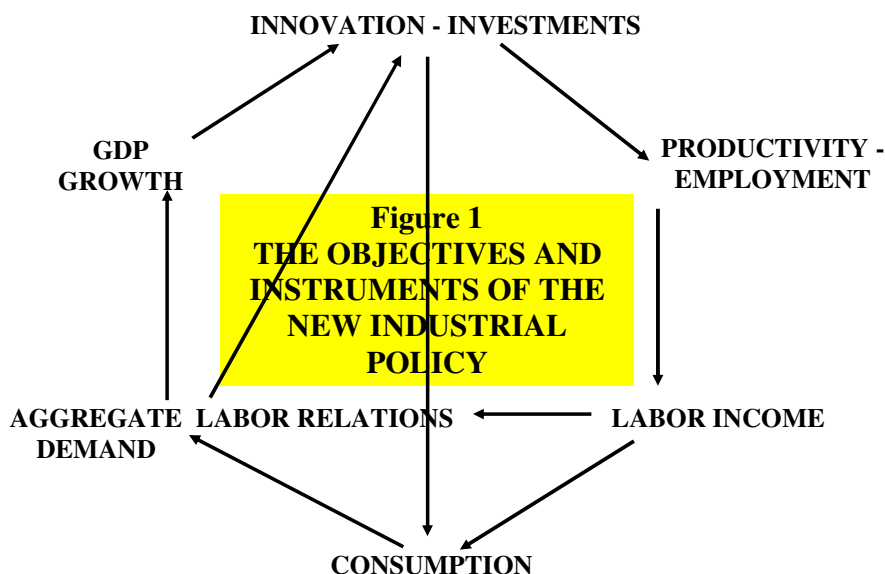
If investments are rigid to the interest rate, then the IS curve and the AD curves of the traditional macroeconomic model are rigid. Therefore, the equilibrium is not changed by an increase of the money supply, since a lower rate of inflation and lower interest rates do not have any impact on investments and hence on GDP and employment. As it is said: “it does help to bring water to a horse who does not want to drink”. On the contrary, a step change in innovation, technology and consumer preferences may stimulate a major program of private and public investments capable to increase the domestic demand and the GDP.

In the model of the cross-sectoral demand and supply, a specific investment in new high-tech sectors would determine not only an increase of employment, but also an increase of the average national wage, since in these high tech sectors the wage level is greater than in the other sectors of the economy. That would determine an increase of the average price of the economy or of the GDP deflator.

On the contrary, in the mainstream macroeconomic AD-AS model, the increase of the production capacity within a sector does not have any effect until the wages, the prices and

the AS curve start to decline along the AD curve. However, this deflationary process, as it can be indicated in the model of the cross-sectoral demand and supply, would have a negative impact on the incomes and consumption of the workers and then it would also lead to a decrease of the aggregate demand and the GDP.

In an aggregate perspective, the model of the cross-sectoral demand and supply indicates that the creation of new productions and the increase of the value of total production determine an increase of the incomes of the workers and of the other factors used in the production of the various sectors and that corresponds to an equal increase of the aggregate demand or GDP. Thus, demand and supply are equal at the aggregate level.



In fact, a characteristic of the model of the cross-sectoral demand and supply, as it is indicated by the figure 4, is that the GDP at current prices or the revenue by the producers in the various sectors is indicated by the surface of the area below the demand schedule. These revenues are distributed to the different production factors of the various sectors and correspond to the incomes of the workers ($s_i N_i$) and of the owners of the capital ($r K_i$) and to the profits or rents to the firms, as indicated in the equation 4 of section 3 above and in the corresponding equation 4 of the model in section 6. In fact, since the price is equal to the unit labor costs plus the profit margin, the value of the turnover is equal to the sum of the costs and the financial returns. Therefore, “ex post” or in an equilibrium situation, the value of the total demand is equal to the value of the total supply.

These equations, indicated above, represent a theoretical cornerstone of the model of the cross-sectoral demand and supply as they indicate that the model allows the equivalence between three different concepts of the GDP, as: the summation of the aggregated demand components, of the value added of the various sectors and also of the incomes to the various production factors. In fact, a limit of the mainstream macroeconomic model (AD-AS) is the fact it does not explicitly consider this last definition of the GDP and it does not consider that the revenues of the various production factors affect the prices and the costs of firms and then economic profitability conditions of the firms, both for their current productions and for their inter-temporal decision on investment, thus determining the behaviour of the supply side of the economy.

Clearly, the development or the improvement of the supply is a precondition or facilitates the growth of the demand, while a new and more modern demand stimulates the respective supply, whether these changes are accompanied by appropriate industrial and regional policies, promoting the required investments and structural adjustments. Thus, the strategic choices of the firms are complex and should ex-ante consider the evolution of the factors leading to changes in both the demand and the supply.

While at the aggregate level supply and demand always are equal, in a sectoral perspective, the model implies that firms should solve the difficult problem of anticipating if there will be a balance between an increased supply, eventually created by the investments in a new sector, and the future or “expected” demand for the specific goods and services produced by the same firm. This balance between the supply and demand at the level of each firm or sector may be reached as the result of a strategic investment decision by a policy-maker, in the case of a “public good”, which will be produced for the public and it will be financed through new taxes. Otherwise, in the case of “private goods”, which are sold by the firms to individual private consumers, the balance between the demand and the supply may occur according to iterative spontaneous marginal adjustments, accompanied by appropriate industrial and regional policies, which can facilitate the appropriate choices of the private firms.

In fact, if various innovative firms make available a new product or service, the existence of an effective supply facilitates the diffusion of its use between various innovative users (called “lead users” by Von Hippel, 1994). On the other hand, the existence of a potential and emerging demand by innovative users stimulates the innovative firms to produce new goods and services. (Cappellin 2007 and 2011, Ciciotti 2016) In the model of the cross-sectoral demand and supply the full employment is reached through the creation of new productions, firms and sectors, which aims to respond to the new needs of the citizens and which requires new immaterial and material investments and the growth of the labour income and the demand for consumption and investments. That interaction between demand and supply is indicated by the example of the increasing capabilities of the new hardware, which facilitates the development of more complex software programs, while the increased requirements of the improved software stimulate the advances of the hardware. That dynamic balance between the innovative demand and the innovative supply may be represented as a boat with eight rows, where the four left rows pull to the right and the four right rows pull to the left, but their forces are balanced and they jointly push the boat forward, while the skipper give the timing and the direction, similar to the role that the public institutions should play with the use of appropriate regional and industrial policies. In fact, the complex and original combination of the new needs by the users and the improved competencies of many complementary firms and the intelligent governance of these combinations by the public institutions seem to be the most significant dimension of the concept of the so-called “smart innovation” strategy (Foray 2015).

This process of increasing specialization and market selection is very similar to the creation of variety and to the increasing division of labor through the birth of new firms, as it is described by the modern evolutionary approach and also by Marshall (1920) in the case of the ‘industrial districts’ of small industrial firms, where the division of labor and the increasing returns are the result of a dynamic process of learning, variety creation and specialization. That is different from the Adam Smith’s approach, which bases the specialization on the static concept of economies of scale.

Finally, the model of the cross-sectoral demand and supply is also similar to the model of inter-sectoral growth developed by Pasinetti (1981 and 1992), that considers the case of

producer learning, which results in productivity growth and product innovations, and of consumer learning, which leads to the adoption of new consumer goods and a change in the composition of final demand. In fact, the diffusion of new consumer goods requires not only the use of new knowledge in production technologies but also new knowledge among consumers, who learn new preferences and discover new needs. A higher per-capita income entails a qualitative change of preferences, which shift towards higher quality goods and services, and also a quantitative increase in the demand for goods. Thus, the increase of output capacity in the aggregate supply will be balanced by an increase in the aggregate demand.

9. Conclusions

The European economy is in a stagnation characterized by slow growth of GDP and productivity, low inflation, negative interest rates, increased the cash propensity of the actors and low investments and innovation. Neither monetary policy nor public budget policies or “structural reforms” are capable to increase productivity growth, as much as industrial and regional cohesion policies can. The expansionary monetary policies have determined exceptionally low interest rates and lifted asset prices thus encouraging speculation and the increase of the investment in financial assets rather than in the productive plants. The policy of negative or zero interest rates has promoted the use of futures and derivatives and it has increased the volatility of financial markets and discouraged long term fixed investments. The fiscal austerity, the decrease of taxes and the increase of financial transfers to companies and households have determined a decrease of the expenditure on public services, while the private expenditure on consumption and investments has increased by a smaller amount than this latter decrease: thus the aggregate demand has decreased. The neo-liberal “structural reforms” and the labour policies promoting an higher job “flexibility” have decreased the wages and the pressure to the firms to increase the productivity of labour and to adopt better technologies or to reconvert to higher quality productions and, on the other hand, they have decreased the willingness of workers to collaborate to major innovations in the firms.

The model of the cross-sectoral demand and of cross-sectoral supply illustrated in this paper indicates the relationships between the level of GDP and the aggregate price level and it is similar in that perspective to the mainstream macroeconomic model of the aggregate demand and supply (AD-AS). The model illustrates the effect of important factors of development, such as the change in the sectoral structure of the economy, the profitability of the productions in the various sectors and the barriers to entry into new productions. It demonstrates that investment, innovation and knowledge are factors which affect both the aggregate supply and the aggregate demand. They can determine an increase of the GDP also in a short-medium term perspective, as in stabilization policies, and not only in the perspective of long term development.

The model is compatible with the macroeconomic (IS-LM) model and with the aggregated demand schedule (AD), while it is alternative to the model of the macroeconomic aggregate supply schedule (AS), which is based on the neoclassical theories of the labor supply or on the Phillips curve.

The growth of both the aggregate demand and supply depends on the change in the internal structure of the economy and on the shifts from less productive to more productive uses of resources. In fact, the model of the cross-sectoral demand and supply is capable to represent the sectoral structure of a modern economy and its evolution, as it allows to interpret the

effects of crucial factors, such as the change of the demand and of the needs of the consumers, the product, process and organizational innovation, the investment effort by the firms and the governance processes of the relationships between the firms and actors of the economy.

On the contrary, the mainstream macro-economic model (AD-AS), due to its aggregate character, does not consider the sectoral structure of the economy and its effect on the level of GDP. In fact, the mainstream macroeconomic model does not consider the role of investment and innovation on the supply side of the economy, since it does not allow for a change in the sectoral structure of the economy. That is the main reason why this model is incapable to consider the role of industrial and regional policies and why the mainstream economists in the national and international public institutions do not consider industrial and regional policies as an alternative to the traditional monetary and public budget policies. That may be interpreted as a case of “lock in effect” in the use of modern economic theories.

The original characteristics of the model of the cross-sectoral supply and demand with respect to the traditional AD – AS model are that it explicitly considers: a) the various sectors of the economy, b) the role of productivity and innovation in the supply side of the economy, d) the role of investments in the supply side. This model allows evaluating the impact of industrial and regional policies on the macroeconomic growth. It also allows evaluating the relationships between the industrial and the regional cohesion and the macroeconomic policies of monetary expansion, austerity of public budgets and structural reforms on markets.

The model of the cross-sectoral demand and supply represents a theoretical and statistical framework, which allow considering the sectoral structure of the economy and the factors leading to a shift on the right of the cross-sectoral supply curve, such as an upward shift of the cross-sectoral demand curve. It can be useful in the design of policies aiming to the creation of new sectors and also to the traditional macroeconomic objectives of GDP, employment and inflation , both at the national and at the regional and also at the urban level.

In fact, industrial and regional policies promote a dynamic balance between the new demand by the innovative consumers and the new supply by the innovating firms. Moreover, this dynamic process of interdependent development of the demand and of the supply of new productions within an individual national or regional economy increases the per capita income and productivity, quite independently from the effect of the exports to the external markets, and it can be applied in the cases both of an open and of a closed economy (Cappellin 2016).

Industrial and regional cohesion policies may be more capable to promote the creation of new productions than monetary and public budget policies since they directly affect the revenues and the costs of the firms in the specific sectors and increase the return of private investments and decrease the risk premium of investors. Industrial and regional policies are “selective” by nature and should focus on the demand and the production capacity of “specific” sectors, such as high, medium and low tech sectors in the various regions. A modern industrial policy should aim to increase the effect of knowledge and innovation both on the supply (for example, by developing the production of new modern collective services) and on the demand (for example, by stimulating the needs and the demand of these services by an increasing number of citizens). The task of industrial policy is to promote a change in the sectoral structure of the economy and a dynamic adjustment of the demand and supply in the various sectors, leading to the creation of new productions and to the increase both of employment and of the average productivity of the economy.

Low productivity has led to low GDP growth and this latter to the decrease of the inflation rates to a level well below the target of 2%. Low productivity has negative impact on investments, employment, wages, living standards, free time of the workers and also on tax revenues and public services provision, pensions and the saving of energy and natural resources. Industrial and regional cohesion policies can increase the productivity of the economy by: a) promoting the reconversion from traditional low tech sectors to new high productivity productions, b) increasing the demand and/or the supply of these productions and c) promoting the joint action of private and public actors.

The model of the cross-sectoral demand and supply allows establishing a clear or formal relationship between the regional cohesion policy, aiming to economic growth, and the macroeconomic policies, aiming to financial stability. In fact, these two policies have not been integrated among themselves due to the lack of a common formal framework and their relationship has usually been interpreted according to a top-down perspective, as the macroeconomic policies should aim to efficiency or GDP stability at the national or Community level, while the regional policies should aim to equity or GDP redistribution between regions.

The model illustrated in this paper may be useful in the design of the European regional cohesion policies since these policies explicitly aim to increase the employment and the productivity level in the less developed regions of the European Union. In fact, the regional cohesion policies should not only aim to a better regional redistribution of the overall GDP at the European and national level, while they should also aim to enhance investment and innovation in the various regions. Through that, they can also increase both the aggregate supply and the aggregate demand of the national economy and become a key component of an European growth strategy in a medium term and not only in a long term perspective.

According to the policy approach indicated in this paper a program for European growth and full employment should be based on a bottom-up approach, which focuses on the growth of the various firms, sectors and regional economies. That implies a change of course, in at least the following dimensions: a) from an emphasis on the aggregate supply to an emphasis on the aggregate demand, b) from the aim to greater international competitiveness to the focus on the growth of the European internal demand and on orienting consumption to new goods and services especially in the urban areas, c) from a policy aiming to financial stability and deleveraging to a policy aiming to increase material and immaterial investments and growth, d) from a focus on the decrease of the labor costs to a focus on increasing the skills and the participation of labor to industrial restructuring and innovation within the firms, e) from a monetary policy of “quantitative easing” to the restructuring of the banking sector in the European Union and the supply of finance by new types of banks (such as the European Investment Bank, the national investment banks), no-banking intermediaries and the financial markets.

Only a large wave of innovation, finance and investment will lift the economy out of the stagnation. That requires a step change from the mainstream monetary and public budget policies to a major program of private and public investments (European Commission 2010 and 2014) capable to increase the internal demand and the GDP in the European Union and to adopt “a new industrial and regional policy” aiming to promote innovation both in the firms and in the preferences of the consumers and citizens. In fact, only an industrial and regional strategy aiming to increase productivity, innovation and investment can promote a recovery of the economy and provide a response to the aims, which are most felt by the citizens, such as

growth of employment especially for young people, improvement of the quality of life in urban areas, decrease of income disparities due to the inflation of financial assets and greater opportunity to participate to decisions. Therefore, a new European growth strategy should be based on an “investment compact” or on the belief that there is not growth without new productions, firms and sectors and that there is the need of greater immaterial and material investments.

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APPENDIX

Table 1- The decrease of investment has determined the low GDP growth

GEO	NA_ITEM/TIME	2007	2015	Contribution	Difference 2015- 2007	SHARE- 2015	SHARE- 2007	Growth 20015/2007
Euro area (12)	Gross domestic product at market prices	9.550.965,0	9.614.856,6	0,67%	63.892	100,0%	100,0%	0,7%
Euro area (12)	Household and NPISH final consumption expenditure	5.258.233,7	5.283.874,5	0,27%	25.641	55,0%	55,1%	0,5%
Euro area (12)	Final consumption expenditure of general government	1.894.120,4	2.040.831,3	1,54%	146.711	21,2%	19,8%	7,7%
Euro area (12)	Gross fixed capital formation	2.190.564,2	1.921.213,0	-2,82%	-269.351	20,0%	22,9%	-12,3%
Euro area (12)	Exports of goods and services	3.659.656,0	4.366.495,2	7,40%	706.839	45,4%	38,3%	19,3%
Euro area (12)	Imports of goods and services	3.518.062,4	3.987.781,4	-4,92%	469.719	-41,5%	-36,8%	13,4%
Germany	Gross domestic product at market prices	2.598.378,4	2.782.594,7	7,09%	184.216	100,0%	100,0%	7,1%
Germany	Household and NPISH final consumption expenditure	1.430.220,4	1.532.471,9	3,94%	102.252	55,1%	55,0%	7,1%
Germany	Final consumption expenditure of general government	457.273,1	529.053,5	2,76%	71.780	19,0%	17,6%	15,7%
Germany	Gross fixed capital formation	521.206,1	558.413,6	1,43%	37.208	20,1%	20,1%	7,1%
Germany	Exports of goods and services	1.089.103,9	1.350.942,3	10,08%	261.838	48,5%	41,9%	24,0%
Germany	Imports of goods and services	916.499,9	1.153.583,5	-9,12%	237.084	-41,5%	-35,3%	25,9%

Spain	Gross domestic product at market prices	1.108.450,0	1.071.965,0	-3,29%	-36.485	100,0%	100,0%	-3,3%
Spain	Household and NPISH final consumption expenditure	644.568,0	589.369,0	-4,98%	-55.199	55,0%	58,2%	-8,6%
Spain	Final consumption expenditure of general government	198.010,0	210.579,0	1,13%	12.569	19,6%	17,9%	6,3%
Spain	Gross fixed capital formation	327.711,0	231.198,0	-8,71%	-96.513	21,6%	29,6%	-29,5%
Spain	Exports of goods and services	285.742,0	345.944,0	5,43%	60.202	32,3%	25,8%	21,1%
Spain	Imports of goods and services	351.746,0	307.499,0	3,99%	-44.247	-28,7%	-31,7%	-12,6%
France	Gross domestic product at market prices	2.015.415,0	2.084.695,0	3,44%	69.280	100,0%	100,0%	3,4%
France	Household and NPISH final consumption expenditure	1.094.551,0	1.152.370,0	2,87%	57.819	55,3%	54,3%	5,3%
France	Final consumption expenditure of general government	453.934,0	512.284,0	2,90%	58.350	24,6%	22,5%	12,9%
France	Gross fixed capital formation	471.153,0	443.354,0	-1,38%	-27.799	21,3%	23,4%	-5,9%
France	Exports of goods and services	536.108,0	629.247,0	4,62%	93.139	30,2%	26,6%	17,4%
France	Imports of goods and services	558.621,0	670.548,0	-5,55%	111.927	-32,2%	-27,7%	20,0%

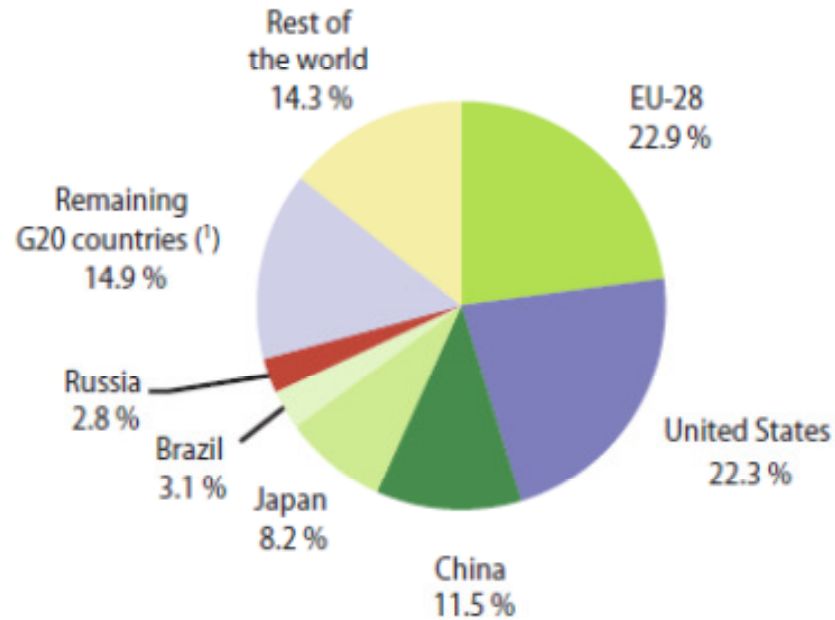
Italy	Gross domestic product at market prices	1.687.143,2	1.547.233,3	-8,29%	- 139.910	100,0%	100,0%	-8,3%
Italy	Household and NPISH final consumption expenditure	993.393,3	930.922,7	-3,70%	- 62.471	60,2%	58,9%	-6,3%
Italy	Final consumption expenditure of general government	321.472,4	310.901,9	-0,63%	- 10.571	20,1%	19,1%	-3,3%
Italy	Gross fixed capital formation	368.619,8	258.887,9	-6,50%	- 109.732	16,7%	21,8%	-29,8%
Italy	Exports of goods and services	455.247,5	470.945,6	0,93%	15.698	30,4%	27,0%	3,4%
Italy	Imports of goods and services	461.900,0	429.885,6	1,90%	-32.014	-27,8%	-27,4%	-6,9%
United Kingdom	Gross domestic product at market prices	1.872.705,8	2.010.028,0	7,33%	137.322	100,0%	100,0%	7,3%
United Kingdom	Household and NPISH final consumption expenditure	1.218.974,4	1.283.675,9	3,45%	64.702	63,9%	65,1%	5,3%
United Kingdom	Final consumption expenditure of general government	380.800,8	420.932,5	2,14%	40.132	20,9%	20,3%	10,5%
United Kingdom	Gross fixed capital formation	343.260,8	344.229,7	0,05%	969	17,1%	18,3%	0,3%
United Kingdom	Exports of goods and services	530.194,8	594.127,4	3,41%	63.933	29,6%	28,3%	12,1%
United Kingdom	Imports of goods and services	587.969,9	657.231,5	-3,70%	69.262	-32,7%	-31,4%	11,8%

The role of the internal demand and of the external trade balance on GDP					
		2007	2015	share 2007	share 2015
Euro area (12 countries)	Gross domestic product at market prices	9.550.965,0	9.614.856,6	100,0%	100,0%
Euro area (12 countries)	Exports of goods and services	3.659.656,0	4.366.495,2	38,3%	45,4%
Euro area (12 countries)	Imports of goods and services	3.518.062,4	3.987.781,4	36,8%	41,5%
Euro area (12 countries)	Final consumption expenditure and gross capital formation	9.415.995,2	9.238.753,5	98,6%	96,1%
Euro area (12 countries)	Exports-Imports of goods and services	141.593,6	378.713,8	1,5%	3,9%

- The positive effect of exports on GDP is balanced by the almost equal negative effect of import.
- Moreover, the increase of the external trade balance determines an increase of the surplus of saving on investment ($S - I = X - M$) and in the long term the low investment decreases the growth of the internal production capacity

Figure 6.1: Share of world GDP, 2012

(%)



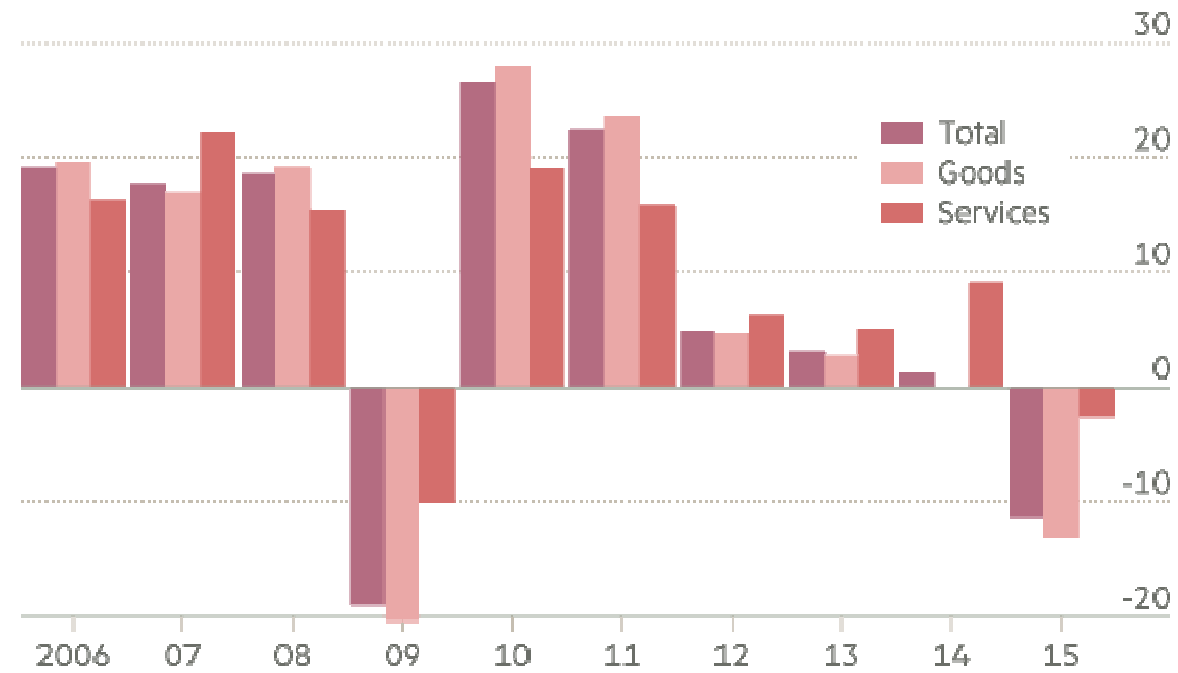
(1) India, Canada, Australia, Mexico, South Korea, Indonesia, Turkey, Saudi Arabia, Argentina and South Africa.

Source: Eurostat (online data code: [nama_gdp_c](#)) and the United Nations Statistics Division (National Accounts & Aggregates Database)

The growth of the European economy should depend on the internal demand, as the European economy represents the largest economy in the world and it is difficult to imagine that the other countries could significantly increase their imports from the EU, in order that exports become the main driver of the long term growth of the European economy.

EM exports: failing to deliver

Developing countries annual % change in value of exports



● ● Source: Unctad

FT

Table 2: Productivity and employment by sector in the EU-12

Euro area (12 countries)	Productivity	Employment	Product change	Product change	Productivity change	Productivity change	Employment change	Employment change
	2013	2013	2008-00	2013-08	2008-00	2013-08	2008-00	2013-08
Real estate activities	694,78	1.214,50	15,71	3,89	- 2,85	10,45	19,11	- 5,93
No manufact. Industry	122,63	1.774,20	9,12	- 1,98	9,43	- 2,79	- 0,28	0,84
Financial and insurance activities	110,86	3.927,90	22,53	1,07	18,05	3,42	3,79	- 2,27
Information and commun.	104,33	3.925,50	45,81	7,15	30,64	7,57	11,61	- 0,40
Industry (except construction)	67,96	21.729,10	11,29	- 3,55	17,67	6,66	- 5,42	- 9,58
Manufacturing	63,10	19.954,90	11,67	- 3,82	18,54	7,34	- 5,80	- 10,40
Total - All NACE activities	53,95	140.728,10	15,51	- 1,68	6,06	1,82	8,91	- 3,44
Professional, scientific and technical activities; administrative and support service activities	43,68	17.899,30	20,35	- 1,05	- 9,70	- 3,57	33,27	2,61
Public administration, defence, education, human health and social work act.	43,51	33.420,10	12,31	3,82	2,04	1,88	10,07	1,90
Construction	43,16	8.733,20	9,49	- 21,14	- 0,20	0,36	9,72	- 21,42
Wholesale and retail trade, transport, accomodation and food service activities	41,24	34.533,00	16,14	- 4,31	4,74	- 1,41	10,89	- 2,94
Agriculture, forestry and fishing	28,04	4.710,30	5,46	- 6,81	22,56	1,55	- 13,96	- 8,23
Arts, entertainment and recreation; other service activities; activities of household and extra-territorial org. and bodies	25,15	10.635,10	11,91	- 0,42	- 4,61	- 2,75	17,32	2,39

Source: elaboration on Eurostat data

NACE_R2	Valueadded Italy			Employment Italy		
	2007	2013	2015	2007	2013	2015
Total - All NACE activities	1.514.368,0	1.394.602,1	1.400.297,3	25.294,90	24.322,80	24.481,40
Agriculture, forestry and fishing	28.452,3	28.603,4	28.996,5	985,20	892,20	912,90
Industry (except construction)	309.087,3	260.529,3	262.047,2	4.905,90	4.251,10	4.170,50
Manufacturing	263.268,2	221.193,4	223.652,2	4.598,50	3.941,00	3.858,00
Construction	94.342,5	68.053,9	64.465,5	1.960,70	1.643,10	1.543,80
Wholesale and retail trade, transport, accomodation and food service activities	310.303,9	280.058,6	285.852,7	6.223,10	6.113,80	6.151,70
Information and communication	59.164,7	58.847,2	57.151,5	603,20	585,40	598,50
Financial and insurance activities	73.095,5	76.537,2	75.009,6	707,90	669,70	660,90
Real estate activities	188.768,6	189.890,6	194.878,2	175,80	179,50	182,30
Professional, scientific and technical activities; administrative and support service activities	144.078,1	128.622,9	126.420,0	2.669,90	2.814,40	2.954,20
Public administration, defence, education, human health and social work activities	252.324,8	247.906,6	248.917,5	4.687,20	4.578,00	4.621,40
Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies	55.832,4	55.675,9	56.667,7	2.376,00	2.595,60	2.685,20
Primary Industry	45.819,1	39.335,9	38.395,0	307,40	310,10	312,50

	Productivity	Employment	Product	Product	Productivity	Productivity	Employment	Employment
Italy	2013	2013	2008-00	2013-08	2008-00	2013-08	2008-00	2013-08
Real estate activities	1.376,04	115,40	7,77	- 1,70	- 10,70	- 2,55	20,68	0,87
Financial and insurance activities	133,40	625,70	23,93	14,59	10,55	20,09	12,10	- 4,58
Information and communication	100,66	630,90	36,93	- 3,21	20,88	- 4,09	13,28	0,91
No manufact. industry	93,03	313,70	7,21	- 11,31	3,59	- 12,92	3,49	1,85
Total - All NACE activities	51,17	24.172,60	8,14	- 6,94	- 1,82	- 2,76	10,14	- 4,29
Industry (except construction)	50,50	4.609,70	2,57	- 14,22	1,91	- 3,57	0,65	- 11,04
Public administration, defence, education, human health and social work activities	48,89	4.378,60	10,64	- 1,51	7,54	2,01	2,89	- 3,45
Manufacturing	47,39	4.296,00	1,96	- 14,62	1,49	- 3,13	0,47	- 11,86
Wholesale and retail trade, transport, accomodation and food service activities	42,34	5.849,60	3,41	- 9,29	- 6,25	- 6,62	10,30	- 2,86
Construction	37,61	1.601,60	15,72	- 24,73	- 7,89	- 6,90	25,63	- 19,15
Professional, scientific and technical activities; administrative and support service activities	37,11	2.867,30	8,00	- 7,56	- 17,25	- 10,84	30,51	3,68
Agriculture, forestry and fishing	29,93	901,30	- 2,18	- 6,09	8,65	2,77	- 9,97	- 8,62
Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies	17,22	2.592,50	6,72	1,86	- 15,51	- 6,15	26,32	8,54