



# Manufacturing in Spain: Aftermath of the Global Financial Crisis

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## Abstract

This study looked at different views on the role of manufacturing during and after the Global Financial Crisis, as well as on the consequences for the economy. Technological change and the increase in productivity are believed to be one of the main causes of current unemployment rates. As a result, advanced economies are switching their employment base from manufacturing to services. This study aimed at proving whether this theory is true for the employment base in Spain. In order to do so, the overall performance of the Spanish manufacturing sector in the aftermath of the Global Financial Crisis was analyzed.

**Keywords:** manufacturing, productivity, services, crisis, global financial crisis, technological change, Spain, labor, unemployment.

**JEL Classification:** B15, 014.

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# **Manufacturing in Spain: Aftermath of the Global Financial Crisis**

# 1. Introduction.

This work seeks to offer an overall vision of Spanish manufacturing sector and the development of the sector during the last decade.

The objective in the first section is to provide the reader with some knowledge about different views of how an economic system works. At the same time, we explain the background and main theories of each school of thought: from Classical and Keynesians economics theories to the recent Schumpeter theories' adherents, through the different Neoclassical Synthesis.

Section one also includes a deep explanation of two opposite views of the global financial crisis of 2008 and the causes behind it. Those two theories focus on manufacturing sector since they believe it played a crucial role during the economic downturn. On one hand, a work of Delli Gatti, et al. (2012) states that the main cause of manufacturing job losses is the high and rapid increase in productivity, which decreases needs of labor. On the other hand, Atkinson, et al. (2012) believe that productivity has been overstated by governments and the real cause behind manufacturing job losses is the decrease of international competitiveness and demand.

As long as the previous theories have their roots in American economy, with our work we aim to study the appropriateness of those theories to Spanish scenario.

In section 4 we offer a broad analysis of how productivity is measured, the different approaches, and the meaning of each of its components. This background will help the reader to understand the graphics and the different analysis provided in the next section.

Finally, we analyze manufacturing performance in Spain after the global financial crisis, focusing on different productivity estimators and the evolution of the different sub-sectors of this industry. We get to the conclusion that manufacturing job losses does not seem to be driven mainly by productivity increases, while a quite likely loss of international competitiveness can be.

## **2. Two different views of how an economic system works: New Classical and New Keynesians.**

Throughout the last two centuries there have been several perceptions of the capitalist economy, with different theories regarding how the market system works and why unemployment takes place. In this work, the main thinking movements throughout European history are analyzed: from classical economics, through Keynesians economics and the Neoclassical Synthesis, until contemporary school of thoughts (New Classical Economics, New Keynesian Economics and the New Neoclassical Synthesis).

Classical economics, emerging in the late 18<sup>th</sup>, constituted a breakthrough from the prior widely accepted protectionist vision of the market. Accordingly to Smith (1776), the wealth of nations is based on the trade and not on the gold. Classical economists support price capacity to conduct information between consumers and producers, and the ability and power of the market to auto-regulate itself without constraint, fact coined as the well-known “invisible hand” by Smith (1776). Later on, Walras (1874; 1877) provided it with a mathematics framework in order to obtain a competitive equilibrium, also called Walrasian equilibrium. This concept sets “a vector of prices, and a consumption bundle for each agent, such that every agent’s consumption maximizes her utility given prices, and markets clear: the total demand for each commodity just equals the aggregate endowment.” (Levin, 2006). Besides, Walras (1874; 1877) added that “the fact that everyone in the economy faces the same prices is what generates the common information needed to coordinate disparate individual decisions”.

Walrasian equilibrium theory has been strongly criticized and many flaws have been pointed out. As Kirman (1992) stated: “Given the arguments presented here-that well-behaved individuals need not produce a well-behaved representative agent; that the reaction of a representative agent to change need not reflect how the individuals of the economy would respond to change; that the preferences of a representative agent over choices may be diametrically opposed to those of society as a whole-it is clear that the representative agent should have no future.”

Classical vision of governments is just a merely provider of a legal framework. Classical economists consider unemployment below the natural level as temporary, since in the long run all is corrected by the price system. This aggregate supply-focused view of the economy predominated until the Great Depression of the 1930s, an event that acted as a trigger for the polarization of the economics field.

Some economists, namely John Maynard Keynes, criticized Walras' vision of the market, and consequently classical economists', and shifted the attention from the supply side to the demand side arguing that the original recession causes could be found there (Keynes, 1936). The resulting theory, Keynesian economics, highlights cyclical shortcomings and the episodes of massive unemployment as a major problem, which could persist for long time, and doubts that market forces can cure it by themselves (Keynes, 1936). Keynes' theories point out the incapacity of wages to readjust in the short run in order to clear labor markets, constituting the cause of the persistence of unemployment. Accordingly to Smith (1936) and O'Sullivan and Sheffrin (2003), government intervention, through monetary and fiscal policies, could restore the economy reducing the effect of inefficient macroeconomic outcomes led by private sector decisions. In Smith's opinion, after reducing high levels of unemployment and boosting the economy, classical vision of the market could be restored. The following years after the Second World War experienced the extensive application of Keynesian economic policies in the United States and Western European countries (Jahan S., Saber A., and Papageorgiou C., 2014).

The Neoclassical Synthesis is a consensus view of macroeconomics which emerged in the mid-1950s in the United States. It tries to bring together the two main schools of thoughts at the moment: classical economics and Keynesian economics. As Blanchard (2014) states: "it is a post war academic movement coined by the economist Paul Samuelson who brought both Classical and Keynesian' Schools together." The result is a Classical view of the microeconomics, focusing on Adam Smith's invisible hand, and a Keynesian view of the macroeconomics, explaining the failures of the market economy and the needed action of governments in order to solve them (Greenwald and Stiglitz, 1987). This theory suggests that Keynesian economists are right in the short term, and classical economists in the long term.

Samuelson wrote: "In recent years 90 per cent of American Economists have stopped being 'Keynesian economists' or 'anti-Keynesian economists'. Instead they have worked toward a synthesis of whatever is valuable in older economics and in modern theories of income determination. The result might be called neo-classical economics and is accepted in its broad outlines by all but about 5 per cent of extreme left wing and right wing writers." (Samuelson, 1955, p. 212).

Despite of neoclassical dominance of the economics field, it is actually a psychological theory. At the core of neoclassical synthesis' theory resides the assumption that "all human decision making is assumed to be driven by the pursuit of individual

pleasure/happiness and its maximization” (Calleja, 2016). This type of self-interested and rational representative is coined as “homo economicus” or “economic man”. This agent pursues the “optimization of the utility as a consumer and profit as a producer” (Rittenberg and Trigarthen, 1996). The sum of all rational agents into an aggregate level led to the creation of a rational choice theory, also coined as Choice theory and Rational Action theory. This framework aims to understand and control social and economic behavior.

Other theory of rational implications was that non-rational agents lose money, and in a medium/long term disappear, leading to the existence of just rational representatives in the market.

Unfortunately for neoclassical adherents, their theories fail to explain properly business cycles. As Greenwald and Stiglitz (1987) point out: “Why did wages and prices not fall enough in recessions? Why didn't firms that wanted to sell more simply lower their prices? A quarter of a century of research failed to provide convincing answers to these questions. This state of affairs could not continue for long.”

Additional problems aroused. Keynesian and classical economics criticized each other creating schizophrenia in the way that economics was taught. Microeconomists were accused for the lack of realism of their theories, while macroeconomists were blamed for the absence of theoretical grounds. This theorem lacked of explanation to some questions regarding failures of the market in recessions, such as the sluggishness of prices and wages and the causes of massive unemployment level. As a result of the confrontation between these two sub-disciplines, one of them had to be adapted to the other (Greenwald and Stiglitz, 1987).

On one hand, New Classical Economics seeks to adapt macro models to microeconomic principles, namely the importance of dynamics in a world of rational, maximizing firms and individuals. Lately, this analysis has been coined as microfoundations. This School is also referred as the Rational Expectations School because expectations have a key role in shaping those dynamics. This tendency emerged in the 1970s in response to stagflation and Keynesians' incapacity to explain what caused it. The new classical perspective is based upon three variables which can explain the sources of business fluctuations: productivity wedge, capital wedge and labor wedge. These economists also developed the use of representative agent models, not without being gravely criticized by other economists because of the incongruence between microeconomic behavior and macroeconomic results.

On the other hand, New Keynesian Economics seeks to analyze the imperfect information and incomplete markets, and their importance in the existence of business



cycles, with the consequent increase of unemployment and credit rationing. Since these episodes are incompatible with standard microeconomic theory, this school of thought derives its theory from microeconomic principles. Unlike new classical view of the labor market, new Keynesians do not believe in wages falling to market clearing levels. The reason is that when the wage level increases, labor turnover and productivity increases, but companies' profits decreases. Consequently, firms which choose to low the wages face a decrease in the quality of the labor force (aka. productivity), bearing with some of the turnover costs and a decrease in their profit. Besides, there is interdependence among firms, where, theoretically, no one low wages even in the face of demand shortages. As a result, wage rigidities would explain, at least partially, unemployment levels during recessions. Analogous models are used to explain why interest rates did not fall to equilibrium levels in the capital markets.

New Keynesian economics also attempts to interpret business cycles and the causes behind their existence. Greenwald and Stiglitz (1987) explain clearly this concept: "The theory of business fluctuations it provides is simple: in broad outline, certain shocks to the economy affect the stock of working capital of firms. Even if firms had perfect access to the credit markets (that is, they could borrow as much as they wished, at the actuarially fair interest rate), the amount they would be willing to borrow is limited by their willingness to bear risk; the fixed commitments associated with loan contracts implies that, as the working capital which is available is reduced, the risk (bankruptcy probability) associated with any level of borrowing increases. Thus, if their working capital is reduced, their desired production level (given that they do not have fixed commitments to sell their products") is lowered; and it takes time to restore working capital to normal levels."

Other weaknesses from Keynes original theories are corrected by this new school of thought. Keynes' aggregation of long term bonds and equities has been proved to be wrong by recent researches (Greenwald and Stiglitz, 1987). Risk properties differ mainly during recessions, when bonds raise while equities fall. Firm's commitment to pay back both items also bears no resemblance: companies have to return a certain amount with bonds, while it does not exist such obligation with equities. These two main differences make bonds and equities greatly imperfect substitutes.

More weaknesses have been found. Keynes' first theories argue that the level of investment is affected through changes in the interest rate, not specifying whether it is the nominal or real level. On the contrary, new Keynesian economists establish credit availability as the major determinant, emphasizing monetary policy as a powerful tool to

mitigate the eventual shortage, even though it could be ineffective when a lack of willing borrowers exist, especially during recessionary periods.

Nowadays, the predominant economic view is the New Neoclassical Synthesis which, as neoclassical synthesis did, combines elements from both major, modern macroeconomic schools of thought: new classical and new Keynesian. This tendency sets the parameters and theoretical grounds for much of contemporary mainstream economics and most of the actions carried by many European central banks and the Federal Reserve. The four central elements are costly price adjustment, intertemporal optimization, rational expectations and imperfect competition.

Since late 2007, a global financial crisis has hit the international panorama and the causes and solutions are still under discussion. Evidence of this state of confusion is the intervention of the Queen of the United Kingdom, Elizabeth II, during a briefing by academics at the London School of Economics regarding the turmoil on the international markets (Pierce, 2008). The Queen asked why no one had noticed the credit crunch coming. After this, the Queen received a three-page missive dealing with it. It stated: "the failure to foresee the timing, extent and severity of the crisis and to head it off, while it had many causes, was principally a failure of the collective imagination of many bright people, both in this country and internationally, to understand the risks to the system as a whole." (Stewart, 2009).

Arguments about the origin of the global financial crisis have mainly focused on traditional causes, as the excessive optimism regarding assets prices and their inherent risks, easy monetary policies and the creation of lax regulations. This circumstances led households and financial institutions to unsustainable levels of leverage, which after the collapse of the assets prices brought "widespread bankruptcies, foreclosures and impaired balance sheets among households, firms and financial institutions" (Delli Gatti, et al., 2012). Meanwhile, the recovery of the system is driven through the accumulation of savings and debt reductions. Nowadays, this constitutes the conventional vision about the present crisis.

Another interpretation of the last Global Financial Crisis has been stated by some new Keynesian economists within the framework of the USA. On the basis that in any crisis problems in real and financial sectors are interwoven, last crisis was assumed to be a financial one setting a sense of preferences to governments. As a result, most of the policies undertaken have aimed to repair the finance sector, assuming that the economy would heal shortly after. However, the weaknesses in the economy are lasting longer than expected. For this reason, Delli Gatti, et al. (2012) hint at the failure

of the analysis. In the USA, investment has not been particularly low during the present crisis, showing that financial sector is not a binding constraint for the economy, in line with new Keynesians' view of the availability of funds as the major determinant. Besides, analyzing crises around the world shows that the strength of financial sectors does not seem to have a relation with the severity of the output declines. The United States and the United Kingdom had relatively smaller GDP declines than Finland, Denmark, Italy and Japan even though the impact in their financial system has been more intense. In other countries, as Spain, Ireland, Greece and Portugal, financial problems aroused after experiencing a real economic recession. Moreover, as Delli Gatti, et al. (2012) state: "the depth and duration of the present crisis is outside the normal range of post-World War experience".

New-Keynesian Economics introduces an "extended structural crisis operating within the framework of an asset-based cycle" (Delli Gatti, et al., 2012). From their point of view, the core of the problem is "the escalation of productivity in manufacturing at a faster pace than the increase in demand, being the latter negatively affected by consumers choice to spend a greater part of their incomes towards services" (Delli Gatti, et al., 2012). This imbalance of speeds leads to an increment of unemployment in the sector. As individual incomes fell, it affects negatively the demand in other sectors, especially the service sector. Shrinking incomes makes harder to incentive the transition towards the booming services sector, becoming that excess labor "trapped" in a dying sector exacerbating the fall on wages. There are some inevitable costs for unemployed workers when moving to another sector, especially when there is a geographical migration. Aside of this mobility cost, a retraining is also needed, since skills required in each sector are markedly different.

Those countries with a large dying manufacturing sector which undergo a shift in their comparative advantages will face the most extensive structural transformations and a plausible sectoral dislocation (Delli Gatti, et al., 2012). This episode is similar to what happened during the Great Depression, when agriculture was the epicenter of the localized technical change. Income fell since the decline of the labor force could not neutralize the increasing productivity.

New Keynesians defend the need of structural corrections together with Keynesian policies in order to stimulate the economy. On the contrary, new classical economists consider those policies as useless or even counterproductive. They believe that a new "normal" level of unemployment exists and the system must accommodate.

Recently, a new vision of manufacturing performance after the financial crisis has emerged. It confronts the perception of productivity as the main cause behind job losses.

This perception has its framework within a considerably new school of thought: the Innovation Economics. During the last 15 years, this new economic theory has emerged based on Joseph Schumpeter's ideas. Schumpeter (1942) introduced the term "creative destruction" in economics referring to "the process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one". This process of restructuring and downsizing increases the productivity and dynamism of a company and constitutes what "keeps the capitalist engine in motion" (Schumpeter, 1994). This economic doctrine states that innovation is what drives growth, instead of capital accumulation as neoclassical economists assert. Since markets and price signals alone can fail to spur properly innovation and productivity, there is a need of specific policies, even if such policies affect negatively the way that markets operate. Governments should focus on helping organizations (e.g., entrepreneurs, firms, universities and regions), establishing public-private partnerships, and increasing public investment in innovation (Atkinson, 2013).

Followers of this tendency have strongly alerted about the mistaken perception that some economists are sharing to the world. Manufacturing has been losing weight in total U.S. employment with the share steadily decreasing since the 1950s. (Atkinson, et al., 2012). This fact has been used as an alibi by those who deny the U.S. manufacturing decline and argue a transformation of the U.S. into a "post-industrial economy". They consider job losses as a proof of being an advanced economy which is moving "beyond all that commodity-based activity of actually making things" (Atkinson, et al., 2012). Some famous tabloids also reflect this thinking: "deindustrialization —the shrinkage of industrial jobs— is wrongly perceived as a symptom of economic decline, when it is really a stage of economic development, because as a country gets richer, it is inevitable that a smaller proportion of workers will be needed in manufacturing" (The Economist, 2005).

Innovation Economics adherents refuse new-Keynesians' dominant view of the decrease of manufacturing jobs for being essentially inaccurate. Superior performance of manufacturing is not the cause behind the huge losses in terms of jobs. While increases in productivity always play some role in employment falls, output decline has been the prevailing factor in U.S. scenario. Proof of this is 2010 production levels of the

19 U.S. manufacturing sectors: only 6 had production levels higher than in 2000 in terms of inflation-adjusted output (Atkinson, et al., 2012).

In their opinion, government statistics have constantly been overstating changes in U.S. manufacturing output, helping to keep alarm bells silent. The Information Technology & Innovation Foundation (ITIF), strong supporter of Innovation Economics tendency, asserts that from 2000 to 2010 U.S. manufacturing labor productivity growth had been overstated by a 122 percent, while manufacturing output had decreased by an 11 percent instead of increasing a 16 percent (Atkinson, et al., 2012). That loss of output is a function of the shrinking competitiveness in global market caused by an abrupt increment in the manufactured goods trade deficit.

Innovation Economics adherents have strongly criticized U.S. policies such as an uncompetitive corporate tax rate and the lack of finance to manufacturing technology support plans.

### **3. The problem of “productivity”.**

#### **3.1. What is productivity?**

The Organisation for Economic Co-operation and Development (2001) defines productivity as a ratio between the volume of outputs and the volume of inputs. In other words, it measures how efficiently production inputs, such as labor and capital, are being used in an economy to produce a given level of output. The agency SPRING Singapore (2011) considers productivity critical for the long-term competitiveness and profitability of organizations since it offers a wide range of statistical information which allows comparisons and performance assessments. As Paul Krugman (1994) states: “Productivity isn’t everything, but in the long run it is almost everything.”

During last decades, companies have increased the emphasis on tracking the performance of their plants, departments and employers. Nowadays, analyzing the efficiency and overall competitiveness of a company centers most of managers’ efforts.

Productivity measurement is a needed condition in order to improve productivity because it plays a crucial role in determining how efficiently and effectively an organization is performing. Measuring productivity appropriately has become a potential issue because it helps ascertaining the position in the market of each organization and avoids misleading conclusions. (Instituto Nacional de Estadística, 2010). It also provides a sound basis on how well an economic unit is progressing

throughout time (SPRING Singapore, 2011). Peter Drucker, widely considered as the inventor of modern management theory, states: “Without productivity objectives, a business does not have direction. Without productivity measurement, a business does not have control.”

Productivity is commonly defined as a ratio of a volume measure of output to a volume measure of input use. While there is a general agreement on this notion, productivity literature exposes a confusing array of different measurements and purposes for its use.

## **3.2. Components of productivity.**

### **3.2.1. Types of input measure.**

Input comprehends the resources used to obtain output. The most common forms of input are labor and capital.

#### *Labor*

Labor is a term which encompasses all types of employees in an organization. All working directors, proprietors, partners, unpaid family workers and part-time workers are included in this classification, if not specified otherwise. It has three ways to be measured: numbers of hours worked, numbers of workers engaged and cost of labor (SPRING Singapore, 2011).

Chew (1988) states that measuring labor based on its cost can shed a misleading picture because workers' salary cannot be related with their real productivity.

#### *Capital*

The Statistics New Zealand public service department defines capital as the volume of assets, such as buildings, machinery, computers and information technology, and land used by the organization in the production of goods or provision of services. Capital can be measured in physical quantity (e.g. number of machine hours) or in financial value, net of depreciation to account for the reduced efficiency of older assets. (SPRING Singapore, 2011).

### **3.2.2. Types of output measure.**

#### *Gross output*

Gross output can be defined as the sum of gross sales, receipts, or other operating income (Bureau of Economic Analysis, 2014). It resembles to gross revenue. Gross output is flawed when counting transactions between companies within the same sectors because it double counts the intermediate goods.

### Value added

Value added (VA) is the most commonly used measure of output. It represents the wealth created through the organization's production process or provision of services. This measure avoids the "double counting" problem since it subtracts the value of goods and services used in production from the gross revenue. GDP is calculated as an aggregation of all sectors' value added.

In figure 1 we can observe how the combined efforts of employees, employers and investors produce the resulting wealth and how it gets distributed within some of the internal components of a business environment.

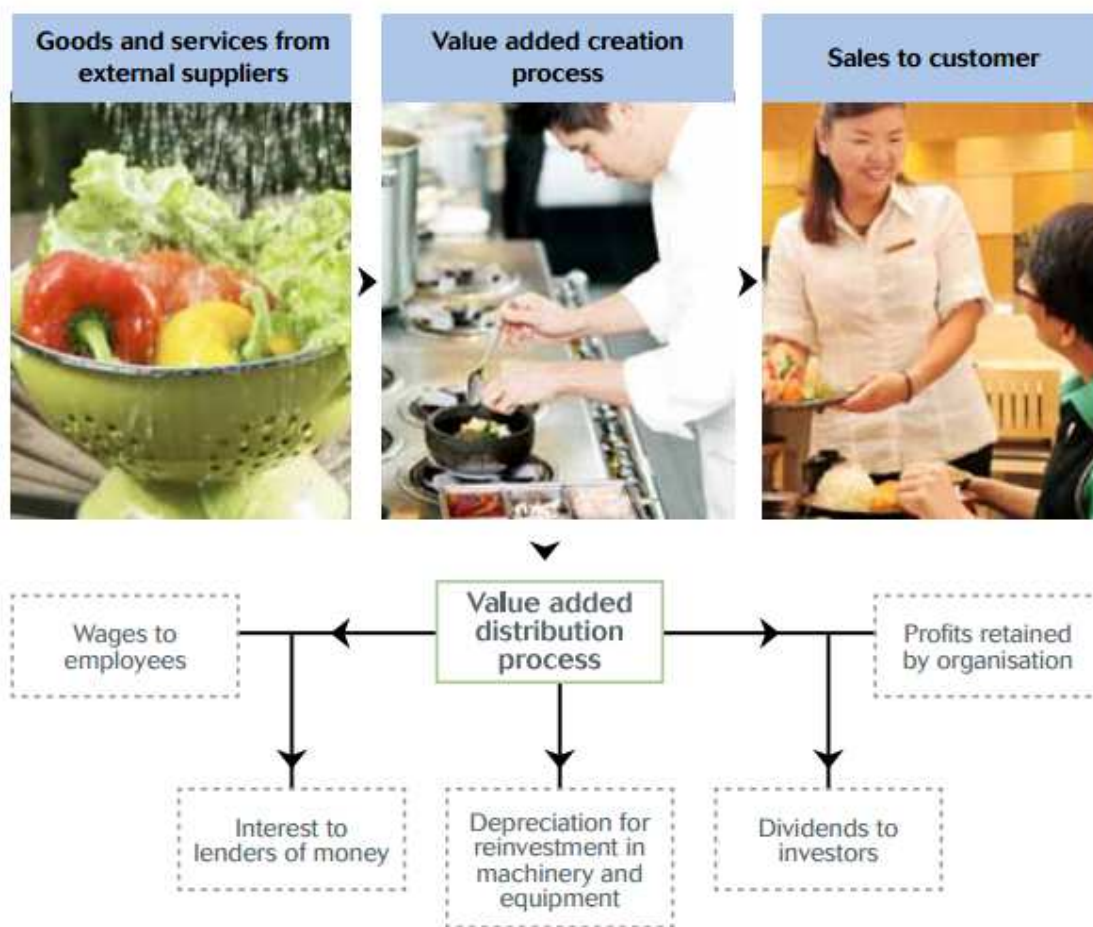


Figure 1: Value Added Distribution Process. Elaborated by SPRING Singapore, 2011..

SPRING Singapore (2011) supports that VA is a better measure of output than gross output because:

- It measures the real output of an organization.  
VA provides a customer-centric perspective and focuses on the real value created by the organization, excluding supplies that are not a result of the organization's efforts.

- It is practical.  
Measuring in financial units, as value added does, allows aggregating different outputs.
- It is easy to calculate.  
VA can be obtained by the difference between a firm's profit and losses.
- It is an effective communication and motivation tool.  
VA provides a shared goal for employers and employees. The larger the value created, the higher is the wealth distributed.
- It is applicable to both manufacturing and service industries.  
VA is measured the same way for both industries. VA can measure the commonly intangible output of service industries.

### **3.3. Overview of main productivity measures.**

Ultimately, the choice among the broad range of productivity measures depends on the purpose of productivity measurement and, in many cases, on the availability of data. (Organisation for Economic Co-operation and Development, 2001).

Productivity measures have two major classifications: single factor and multifactor.

Single factor productivity relates output to one particular type of input. It is useful to identify the sources of aggregate productivity trends but it can lead to confusing or misleading results. Chew (1988) reveal this severe problem with the following example:

Let's imagine a hypothetical firm focused on the production of motors. In this firm, machines acquired castings counts as one step in its creation process. One day, the firm decides to buy that component premachined by another company. These new premachined elements have a cost 20% higher than the usual castings. However, buying them makes possible for the company to fire skilled workers and put up for sale the machine tools which they used in the production process. The result for productivity is an increase. The motive is that output has suffered no change, while the number of employees have decreased. Capital productivity also raises, since the asset base is lower than at the beginning. However, materials productivity is much lower than before, because the value of acquired materials has experienced a growth of a 20% while the output has remained constant.

In such a situation, a single factor productivity index focusing on capital or labor would shed a deceiving picture. This points out the need of using more complex measurements which get information from more than just two variables.



Productivity measurement should center its attention on a comprehensive range of capabilities and not just on one series of costs. It should approach how good a company is at turning a bundle of inputs into useful good or services. As Chew (1988) stated an effective productivity measurement requires the development of an index that identifies the contribution of each factor of production and then tracks and combines them. Multifactor indexes can present a problem because they sometimes need to gather data over lengthy periods of time.

Table I presents the main productivity indexes organized by the type of input and output measure and number of factors used.

| <b>Type of output measure</b> | <b>Type of input measure</b>                |  |  |  |
|-------------------------------|---|--|--|--|
|                               | <b>Labour</b>                               | <b>Capital</b>                               | <b>Capital and labour</b>                      | <b>Capital, labour and intermediate inputs (energy, materials, services)</b> |
| <b>Gross output</b>           | Labour productivity (based on gross output) | Capital productivity (based on gross output) | Capital-labour MFP (based on gross output)     | KLEMS multifactor productivity   |
| <b>Value added</b>            | Labour productivity (based on value added)  | Capital productivity (based on value added)  | Capital-labour MFP (based on value added)      | -  |
|                               | <b>Single factor productivity measures</b>  |  | <b>Multifactor productivity (MFP) measures</b> |  |

Table I. Main Productivity Indexes. Elaborated by SPRING Singapore, 2011.

Ultimately, the utility of a productivity measurement system resides in the correctness and appropriateness of its use when making comparisons. Nowadays, productivity indexes serve as a tool to analyze and contrast the performance of units at different levels: departments, plants, companies, etc. Those comparisons have a high impact on a large-scale range of decisions: budget allocation, management compensation, judgements about factory closings, etc. Consequently, managers must be cautious in order not to get a confusing picture. Their analyses should consider an overall perspective of the situation, accounting for changes in price and quality, relative performance and temporal trends, etc. (Instituto Nacional de Estadística, 2010).

Another factor to take into account is not sacrificing factor for form. Constantly, managers seek to answer the question “how are we doing?” But a productivity index can only provide an appropriate answer if employers and employees understand it. Economists and mathematicians like to provide firms with complex functions when they combine different elements into one index. Logarithmic and multiplicative techniques are commonly used to identify the performance level. In a statistical research, this

perspective offers a wide range of advantages. As Chew (1988) explains “when the primary goal is to influence behavior, the simpler the better must be the rule. If the people who use an index can’t understand it at a gut level, it probably will not affect their decisions and priorities.” Moreover, Chew (1988) also adds that “executives should seek the measure that promises the greatest impact not the measure boasting the greatest accuracy or technical elegance”

A good measure to increase the value of a productivity measurement system is to incorporate workers in the design of department-specific productivity indexes. As a result, workers’ understanding will be higher and goal-oriented actions will have brighter results.

Time is another factor which can also rise costs. Time spent to design and put into practice a productivity measurement system affects directly to the profit that managers can get from its implementation. Chew (1988) shows this dilemma with a manager’s statement: “Explain to me how taking an extra six months to get the measure more accurate is going to raise my productivity during those six months.”

Finally, data presents the same difficulty than time. The analysis of the trade-off between a more accurate system and implicit costs needed to collect the extra data.

## **4. Manufacturing in Spain.**

### **4.1. Statistical review.**

European Classification of Economic Activities (NACE) is a statistical nomenclature developed by the European Union in order to classify the different «statistical units» related to economic activity (companies, establishments, etc.). The goal is to create homogenous units to allow a wide range of international comparisons and analyses. In the last decade of the 20<sup>th</sup> century, previous versions of NACE classifications were reedited leading to an integrated classification system which all countries can use. Consequently, harmonized nomenclatures were set in a world, European Union and national scale in order to benefit the comparison of international data. Table II reflects the integration of economic activity classifications.

| Activities     |   |          |
|----------------|---|----------|
| World scale    | ISIC  | 2 digits |
| EU scale       | NACE  | 4 digits |
| National scale | <b>National version of the NACE called CNAE</b> |          |

Table II: Integration of Economic Activity Classifications. Elaborated by: INE.

Economic structures change, especially due to the origination of new technologies that generate new activities and products. Furthermore, their importance varies over time, and so their weight in the classification system. Periodically, there is a revision of the nomenclature. On one hand, each revision improves the quality. On the other hand, it negatively affects the comparability of data over time and causes breaks in time series.

As we can see in the previous Table III, CNAE are the initials that represent the national version of Spain. Currently, CNAE-2009 version is used in the Spanish framework. CNAE-93 Rev.1 is the former system originated in 1993 and slightly modified in 2003. As we can see, two different systems have been used for statistical purposes within last decades.

Manufacturing, core of analysis in this essay, suffered a breakdown resulting in two new categories: “Electricity, gas, steam and air conditioning supply” and “Water supply; sewerage, waste management and remediation activities”

As a result, the comparability of data has become a laborious issue.

## 4.2. Analysis.

In our analysis, we have taken data from EUROSTAT database. This database, available online in “<http://ec.europa.eu/eurostat/data/database>”, includes a wide range of variables: absolute numbers, percentages, productivity indexes, etc. All our data can be found in the theme of “Industry, trade and services”. The period under analysis is from 2008 until 2013, with few exceptions depending on the availability of data. Similarly, the countries used to create multi country analysis are the ones without gaps of data in each time series. Once this condition was fulfilled, we chose the most representative countries within European Union.

Manufacturing effect on an economy is not constrained to the direct wealth and employment that it generates. Additionally, an indirect effect exists. This effect comes from the impact of the value chain of all firms of the sector. These firms provide the sector with goods and services needed to their activity. Another contribution comes

from families' wealth because their income depends directly and indirectly on employment generated by the industry. Besides, those families also consume goods and services produced by different sectors of the economy, raising the indirect effect of the manufacturing sector on the economy.

The manufacturing sector covers a wide scope of production techniques and activities. It includes from large companies producing complex products such as vessels to smaller enterprises employing classical production methods as the industry of musical instruments. At the NACE section level of detail, this variety is also present in other large and diverse sector as transport sector, construction and distributive trades. Regardless of this fact, the manufacturing sector still shows the maximum level of internal differentiation among the non-financial business economy.

Manufacturing is the second biggest of the NACE sections within the European Union non-financial business economy regarding employment and the largest concerning value added. The levels were 22.4% and 26.2% in 2012, respectively.

During last decades, advanced economies have experienced a decrease of manufacturing jobs to the share of total employment. The reason behind it is typically stated as the higher productivity of manufacturing compared with other non-manufacturing industries. This fact normally leads to a modest and gradual loss of jobs.

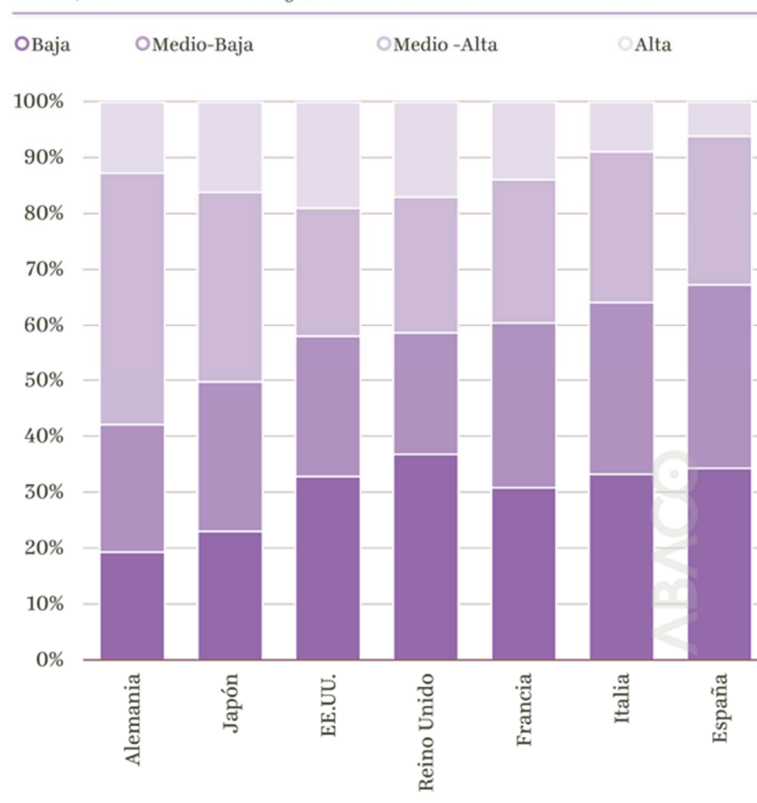
Starting our analysis in the subsector level, we look at employment evolution in each industry. As we can see in Appendix 1, in the national level, 22 of the 24 manufacturing industries experienced job losses in the period between the first trimesters of 2008 and 2016. This adjustment has not been equally proportioned over the different activities. The most abrupt job losses have taken place in low-value-added industries most influenced by globalization. 60.92% of furniture jobs disappeared, a 56.44% in textiles, and a 44.12% in wearing apparel. Other industries least affected by globalization — food products and petroleum refining— underwent some of the lowest job decreasing, or even a remarkable increase as the case of the manufacture of paper. Recent research (Atkinson, et al., 2012) has found that this inconsistency proves that productivity growth is not the main cause behind the job loss over the last decade. The authors stated that “there is no reason why an industry like apparel should be able to attain productivity growth rates eight times higher than the food processing industry.”

During last years, a transfer of lower-skill, commodity-based manufacturing from advanced nations towards lower-wage nations has taken place. Those activities are generally part of lower-value-added industries. Some economists argue that while

those lower-wage countries grow due to the mentioned transfer, developed nations, consequently, experience an increase on the international demand for their higher-value-added products. In other words, global integration should lead countries not to a deindustrialization but to a transformation towards the production of more complex products. This is a way of maintaining a country's manufacturing competitiveness and to alleviate consequences of a shrinking international dominance in traditional manufacturing. In this line, a recent OECD report found that countries as Germany and Japan have experienced losses in low-skilled manufacturing jobs while gaining in high-skilled industries.

In Figure II we can observe the composition of manufacturing sector by technology intensity of a group of representative countries. On one hand, Spain shows the smallness of its high-value-added manufacturing sectors among those countries. On the other hand, the size of the value added by low and medium-low industries is the highest.

*VAB, total manufacturas por intensidad tecnológica, 2007, Unidad: Porcentaje; Fuente: OCDE; Elaboración: ABACO*



*Figure II: Composition of Manufacturing Sectors by Technology Intensity. 2007. Source: OCDE. Elaborated by ABACO.*

In line with the literature, Spain should have transformed its manufacturing bases towards higher-value-added industries in order to maintain its international

competitiveness. It is believed that high-value added industries are going to be the most prominent growth sectors in the next decades.

If we compare Figure II and III, Spain has barely restructured the composition of its manufacturing sector regarding technology intensity in the period from 2007 to 2013. Low and medium-low value-added industries still predominate in our territory.

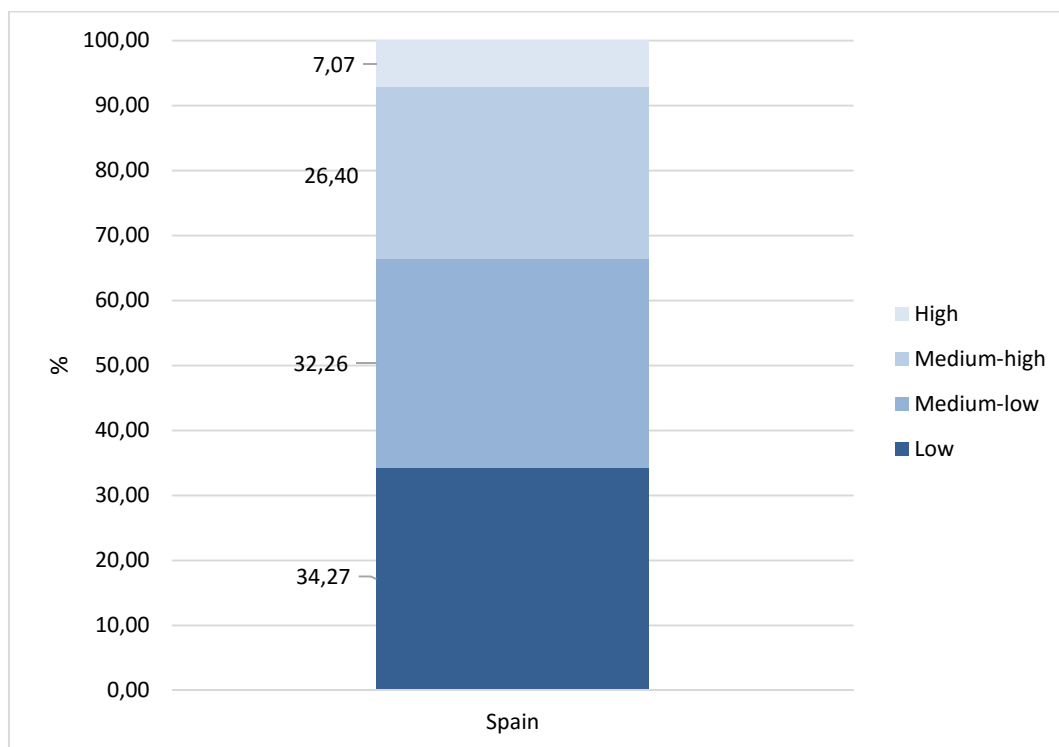


Figure III: Composition of Manufacturing Sector by Technology Intensity. 2013. Source: EUROSTAT database.

In face of the recent global crisis and the effect on manufacturing jobs, with huge decreases in some countries as the U.S.A., the United Kingdom, Italy and Canada, some economists state that full-time job losses in manufacturing do not show a clear picture of the underlying trauma that the industry is experiencing. This theory states that a big part of those workers who lost their full-time status have become part-time employees. The causes which drive this shift are an increasing productivity and more employment flexibility, together with a transitory economic situation. We know that involuntary part-time employment raises in the face of economic downturns. (Bureau of Economic Analysis, 2008).

In Figure IV we can observe the percentage change in the number of full-time employees in the period from the first quarter of 2008 to the first one of 2016. Mining and quarrying, construction and manufacturing show the biggest declines in the period, with levels at least three times greater than changes in other industries.

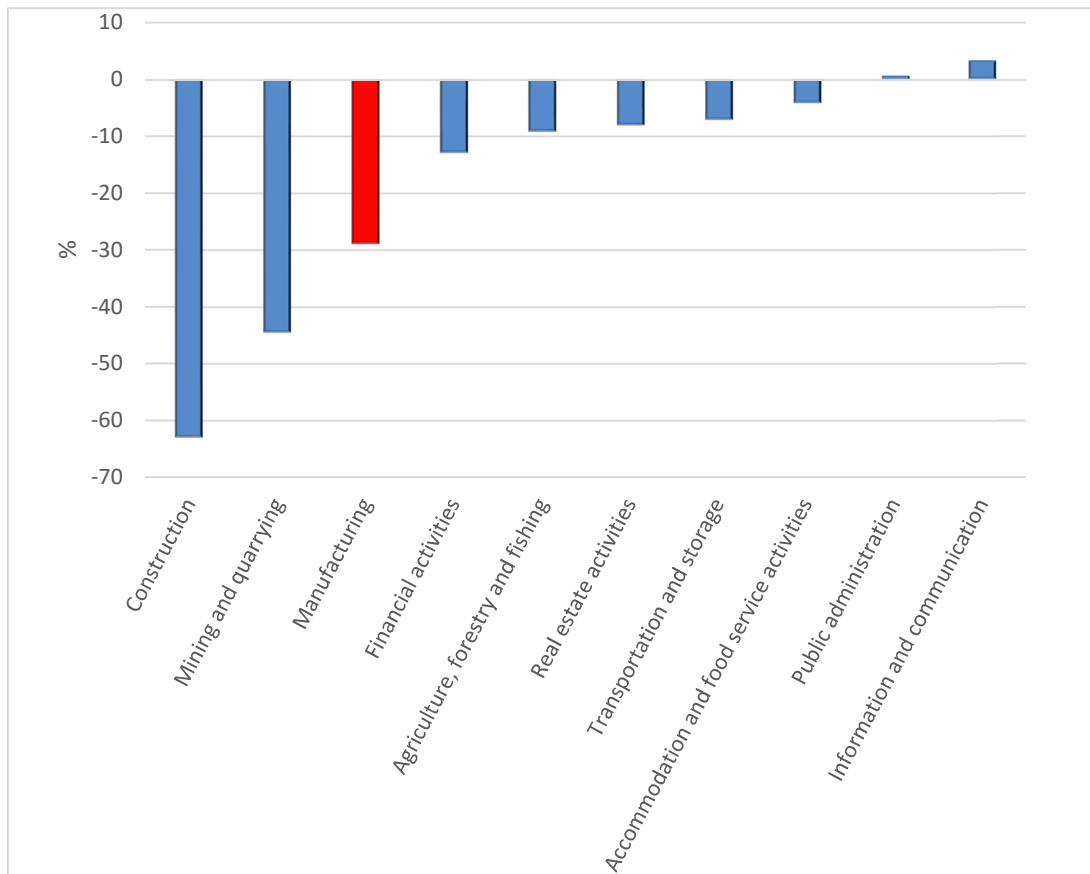


Figure IV: Percentage Change in the Number of Full-Time Employees. 2008-2016. Source: EUROSTAT database.

In line with the theory that many full-time should have been converted into part-time jobs, we analyze in the Figure V the evolution in the same period (2008-2016) of the number of employees with each type of contract. As we can see, there has not been such a huge conversion between full and part-time jobs. Both variables have experience significant decreases, being prominent over full-time jobs, which have shrunk nearly a 30%. In percentage numbers, manufacturing had a 95.82% of full time jobs in 2008, which has decreased until a 94.45% nowadays. Consequently, part time jobs have experienced an increase of 1.32 points in percentage in this period of 8 years.

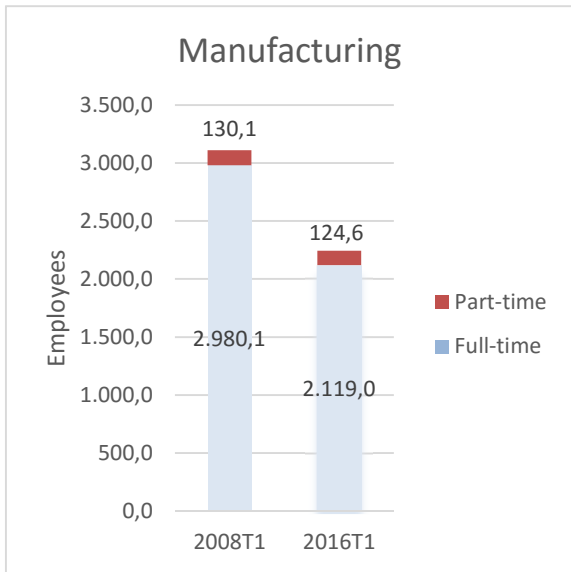


Figure V: Number of Employees by Type of Contract. (Thousands). Source: EUROSTAT database.

However, Figure VI shows how this transition between full-time and part-time jobs has had some effect on the economy at large. Part-time jobs in the whole economy represent nowadays the 15.7% of the total. This represents an increase of nearly 4 points.

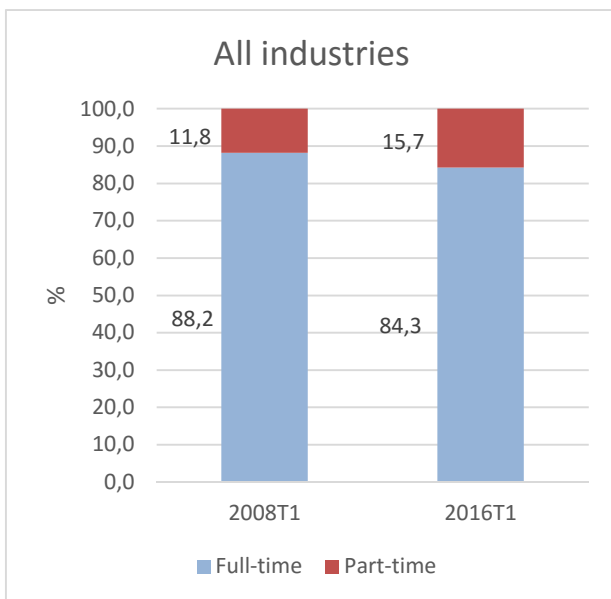


Figure VI: Number of Employees by Type of Contract (Thousands). Source: EUROSTAT database.

Table III includes the absolute values of both full-time and part-time. “Accommodation and food service activities” industry shows the greatest impact on the part-time jobs, followed by “transportation and storage” and “public administration”.



|  | Full-time jobs |         | Part-time jobs |        |
|--|----------------|---------|----------------|--------|
|  | Absolute value |         | Absolute value |        |
|  | 2008T1         | 2016T1  | 2008T1         | 2016T1 |
| <b>Agriculture, forestry and fishing</b>         | 789,8          | 716,9   | 80,4           | 60,4   |
| <b>Mining and quarrying</b>                      | 52,8           | 29,3    | 0,8            | 0,6    |
| <b>Manufacturing</b>                             | 2.980,1        | 2.119,0 | 130,1          | 124,6  |
| <b>Construction</b>                              | 2.606,9        | 965,8   | 72,6           | 65,8   |
| <b>Transportation and storage</b>                | 895,7          | 831,5   | 60,8           | 79,8   |
| <b>Accommodation and food service activities</b> | 1.150,4        | 1.101,4 | 254,6          | 402,6  |
| <b>Information and communication</b>             | 498,8          | 515,2   | 44,6           | 42,2   |
| <b>Financial activities</b>                      | 493,3          | 429,3   | 31,3           | 31,9   |
| <b>Real estate activities</b>                    | 104,7          | 96,2    | 18,3           | 14,4   |
| <b>Public administration</b>                     | 1.193,7        | 1.200,9 | 53,4           | 70,1   |

*Table III: Manufacturing Sub-Sectors and Types of Jobs. Source: EUROSTAT database.*

Even though we verified that the theory regarding a transition from full-time to part-time jobs does not apply in Spanish manufacturing sector, we can still agree with those who claim that the manufacturing sector has experienced a decline. If we look at the total hours worked, we can assert that Spanish decline has been steeper and longer in time than others countries' manufacturing sectors.

In the following Figure VII, France could not be added for lack of data, even though its composition based on technology intensity resemblances more to Spain and Italy than the United Kingdom, as we could see in the previous Figure II. The United Kingdom has a similar base of low-value-added industries but nearly twice size of high-value-added.

We can observe the moderation of hours lost after 2009 until 2011, when the United Kingdom started to experience gains while Spain and Italy entered again into the losses path.

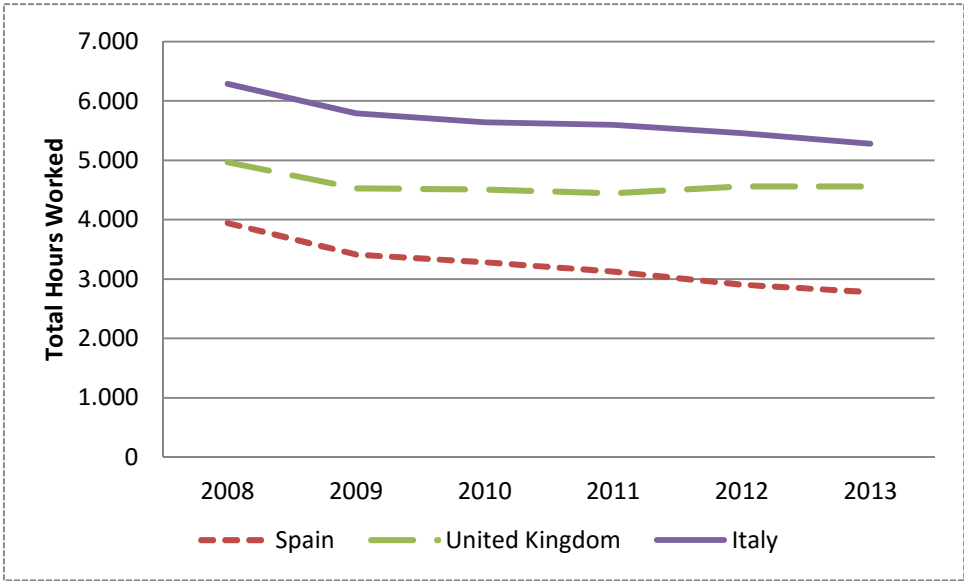


Figure VII: Total Hours Worked in Manufacturing (millions), 2008-2013. Source: EUROSTAT database.

As we can see in Figure VIII, a common trend in the destruction of enterprises has taken place in the most significant countries of Europe. Italy, Portugal and Spain, countries where the global crisis has had a much bigger impact than the rest of the Eurozone, have undergone a continuous reduction of the number of manufacturing enterprises. Even Germany is showing difficulties to come back to previous levels of creation rates. However, France does not exhibit any problem to have higher levels of growth than the rest of countries. Besides, France has already reached the number of enterprises that existed prior to the global financial crisis.

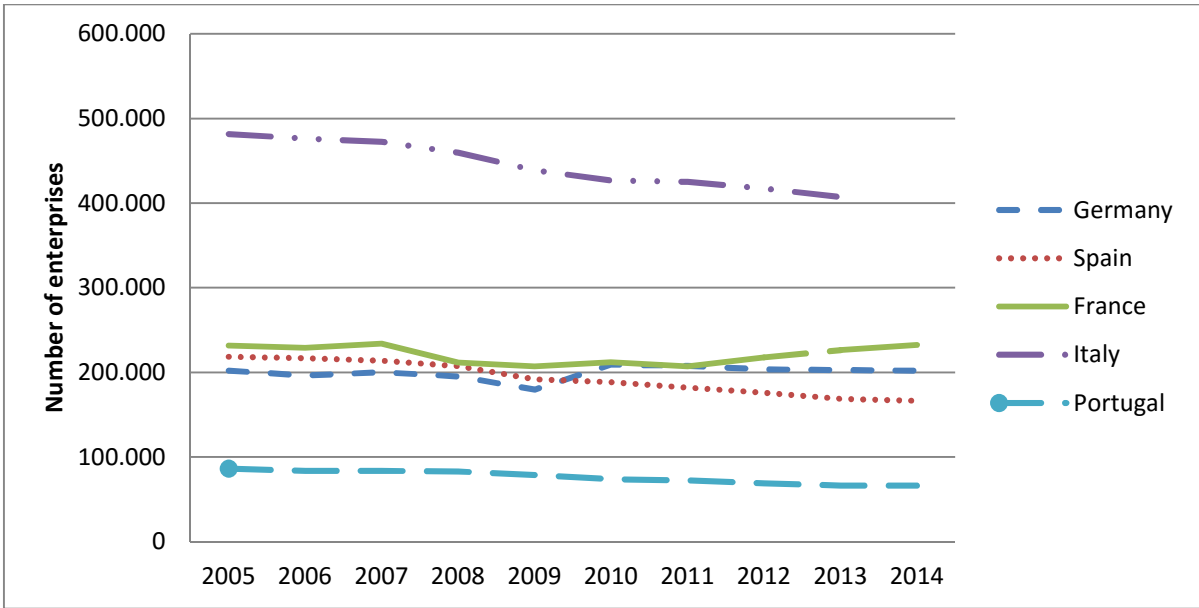


Figure VIII: Number of Enterprises (thousands). Source: EUROSTAT database.

If we were highlighting the capability of France to create enterprises, the following Figure IX shows that that trend of growth does not take place together with an increase of the production value. In this case, Italy and Germany are the countries which display the best performance. Germany peaked in 2011 a level of production value which overpassed the pre-crisis maximum. Italy is experiencing a continuous upward trend, not achieving pre-crisis levels yet. Spain has not been able to reach pre-crisis performance levels either. After the generalized downturn occurred in 2009, Spain has kept a steady level around the 425.000 level, showing an incapacity to grow a similar levels as its European neighbors.

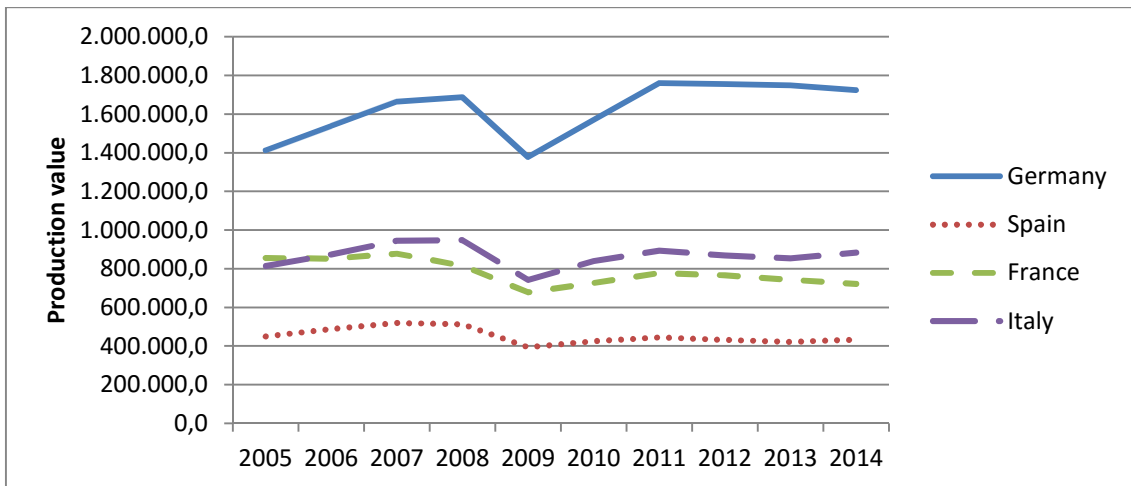


Figure IX: Production Value in Manufacturing (Spain). Source: EUROSTAT database.

Eurostat defines value added at factor cost as “the gross income from operating activities after adjusting for operating subsidies and indirect taxes”. In Figure X we observe the development of this magnitude in the period between 2005 and 2013. Germany shows a much bigger value throughout all the period. The cause underlying is the broader bases of high and medium-high-value-added industries in terms of technology intensity.

Spain constantly shows the lowest values and the worst performance, since the general recover which takes place after 2011 does not imply its manufacturing sector. The latter has been suffering losses on its value added at factor cost since 2010.

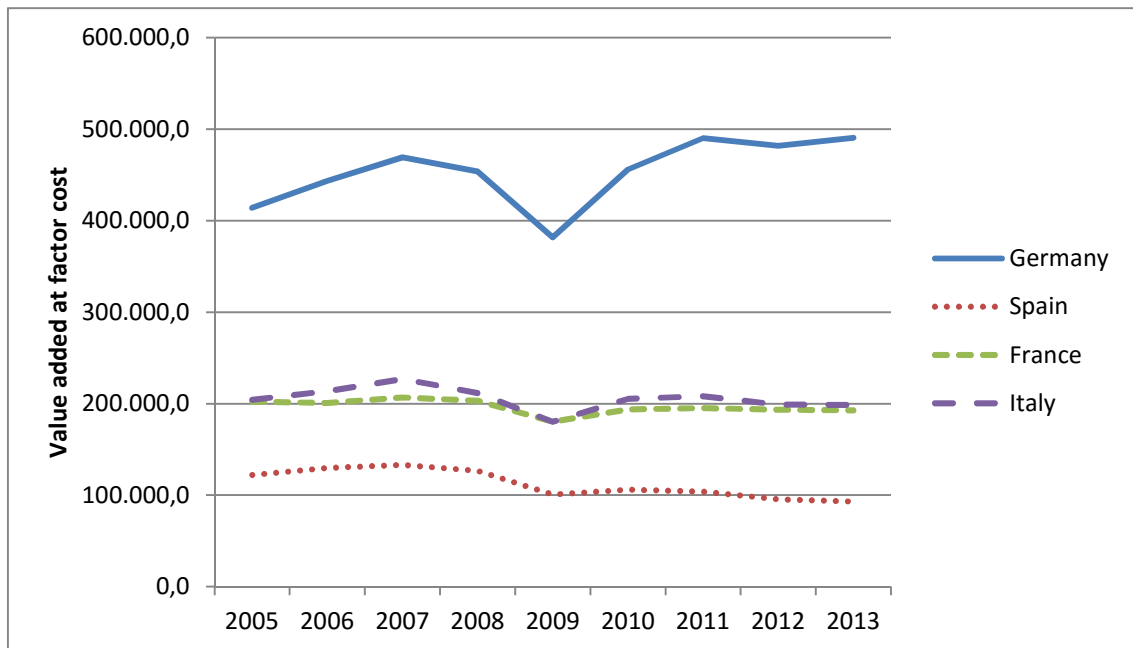


Figure X: Value added at factor cost in the Manufacturing Sector. Source: EUROSTAT database.

Apparent labor productivity is obtained dividing value added at factor costs by the number of persons employed. Commonly, this ratio is measured in thousands of euros per person employed. The expression “apparent” highlights the fact that productivity is a function of not only labor, but all other factors and the way that they are combined.

This variable measures the wealth generated, and it relates with the labor factor. The wealth originated is generally counted as the added value, measured in volume. Labor employed in the production process is quantified and used as a variable. But the way of measure it can differ substantially. First, there is an approach which takes into account the number of hours worked. However, our approach measures the number of people employed, obtaining an apparent labor productivity “per capita”, instead of an “hourly” estimator.

With any of those approaches to labor productivity, putting a value to the input measure—either quantity of employment or hours worked— becomes considerably easy. However, estimating the output level accounting for changes in prices is highly harder. At this point, three main problems arise when evaluating growth in a country’s manufacturing level of output.

Firstly, there could be an underestimation of the value of intermediate goods imports. Productivity growth can appear if a company decides to offshore its supply chain. Let’s imagine that a domestic manufacturer decides to switch its supplier from a domestic to a foreign one with a lower cost. The price of the input would drop, and the productivity

increase. Price indexes may fail to correct to this bias. Consequently, industries as manufacturing which rely considerably on imported intermediate goods can experience the overstating of their output growth. This problem is coined as the “import substitution bias”.

Two other problems found in the American framework are the overestimation of output in the petroleum and coal products industry and a wrong evaluation of the rapid technological change in the computer and electronic products industry. However, these problems seem not to affect Spain's manufacturing sector. Firstly, Spanish national statistical organisms, INE and Minetur, do not picture an incredibly high performance of the level of output growth in the petroleum industry in contrast to the statistics of other organisms, as it happens in the U.S. Secondly, a similar case takes place in the American sector of computers industry, not being found any similarity in Spanish scenario.

Figure XI shows the change in apparent labor productivity in the period between 2008 and 2013. Due to the great number of sub-sectors in manufacturing industry, 23 to be precise, we have just analyzed the 6 which show the most significant changes in the variable under measure, apparent labor productivity.

In this period, the whole industry of manufacturing has experienced an increase of 1 thousand of euros per person employed in the industry as a whole. This average is portrayed in the Figure XI compared to the 6 sub-sectors which most changes showed.

Among the sub-sectors analyzed, manufacture of other non-metallic mineral products shows the biggest decrease, accounting for -10.9 thousands of euros, while manufacturing of motor vehicles, trailers and semi-trailers raised its apparent labor productivity by an 8.7 thousands of euros.

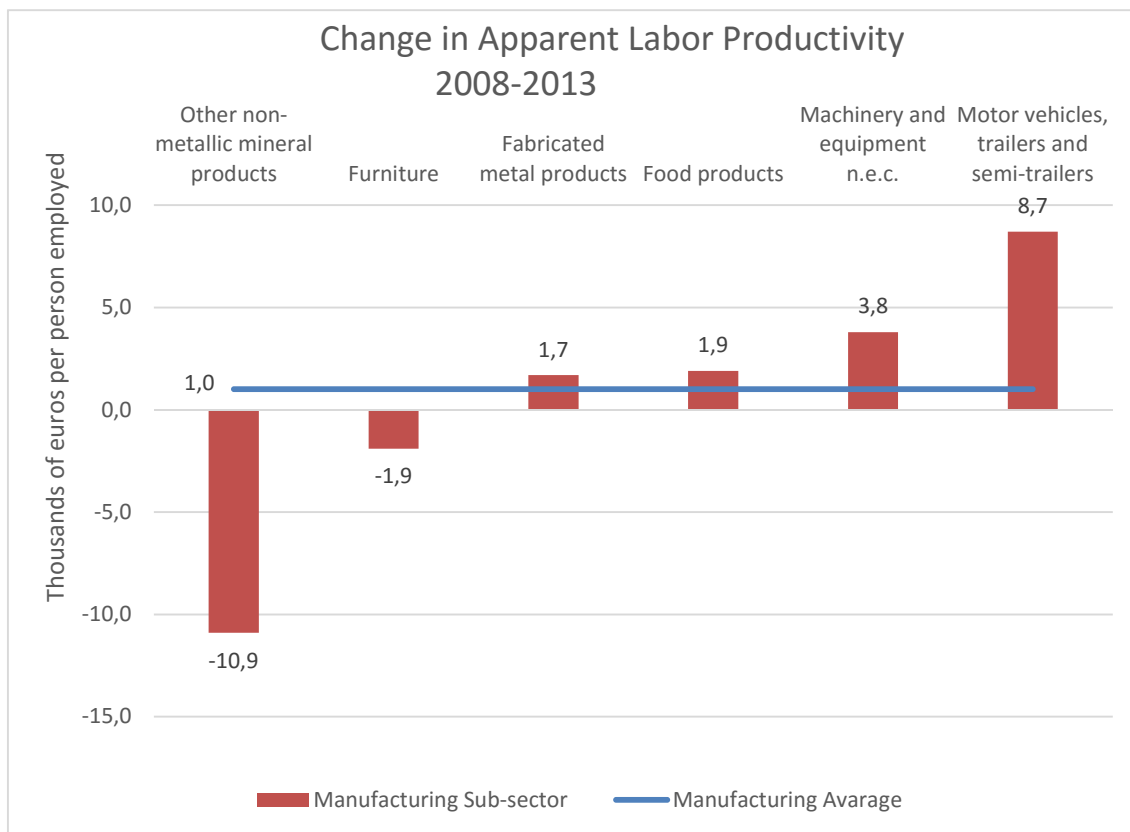


Figure XI: Change in Apparent Labor Productivity in Spain. 2000-2013. Source: EUROSTAT database.

Figure XII includes the variation in value added at factor cost and the number of persons employed in 7 representative sub-sectors of manufacturing.

Value added at factor cost measures the gross income obtained from operating activities. This variable adjusts its value for operating subsidies and non-direct fees and taxes.

This estimator can be obtained as the total sum of turnover, capitalized production, increases of stocks and other operating income. Later, it subtracts decreases of stocks, acquisition of goods and services and other taxes linked to the products or the production of them.

In Figure XII we can see how most of the sub-sectors and the manufacturing industry as a whole have experienced higher decreases in number of persons employed than in value added at factor cost. Manufacturing of food products have been the only sub-sector in the analysis showing a positive evolution of the value added in the period 2005-2013.

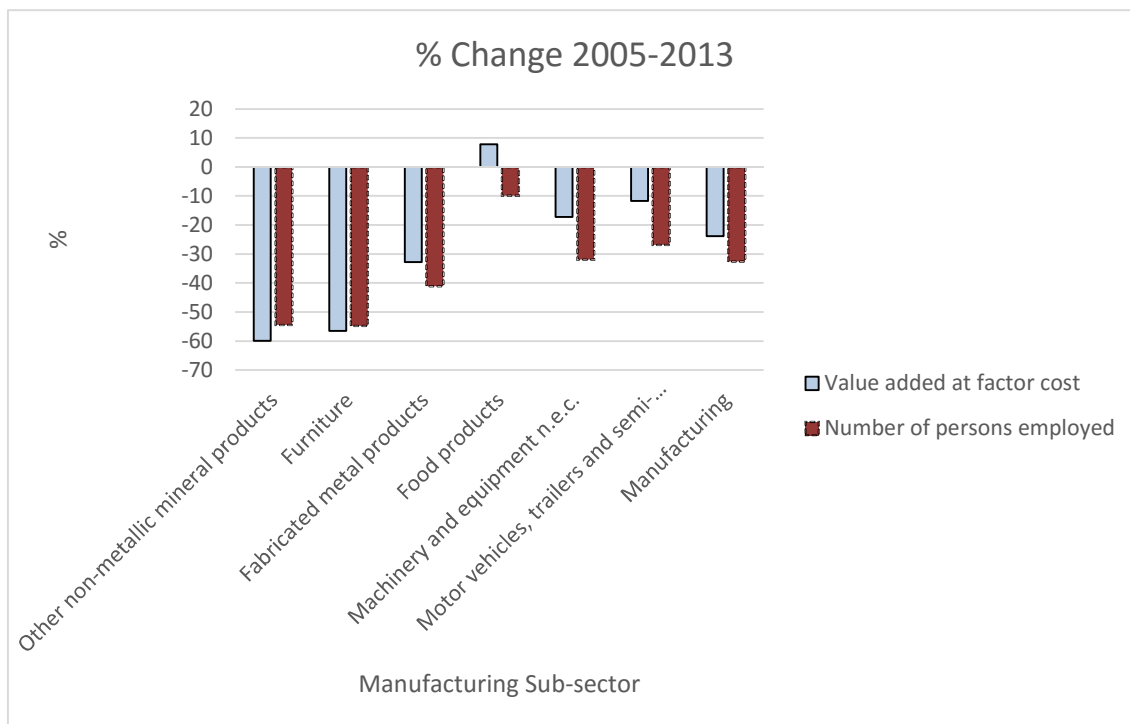


Figure XII: Value Added and Employment Evolution. Period: 2005-2013. Source: EUROSTAT database.

Finally, our work make us believe that productivity gains are not the main cause of current levels of unemployment. Our analysis shows that increases in productivity are not consistent within all or at least a considerable part of the industries in manufacturing. It is complicated to state that productivity is causing job losses in the sector when it exists such a high level of disparity among each sub-sector. Besides, our analysis demonstrate that Spanish manufacturing sector can have important troubles to keep its competitiveness in international markets because of the predominance of low-value-added firms.

## 5. Conclusion.

The aftermath of the Global Financial Crisis has originated a debate about what type of economic policies should be carried out by governments. For this purpose, a correct analysis of how economic system works should be elaborated.

In our work, we aimed to shed some light on the performance of Spanish manufacturing industry after the crisis. We began with a multi countries analysis of the industry. We found out the considerable size of low-value-added industries in the economy. As different economists state, this fact can be detrimental to the country's competitiveness in international markets. Besides, it may be difficult for the industry to recover pre-crisis levels in terms of employment and production growth. However,

Spain does not seem to be restructuring its manufacturing sector, since the percentage of low and medium-low-value-added firms is still predominant in our economy.

Another argument used to undermine the current state of manufacturing sectors in employment levels is that full-time jobs losses can be explained as a conversion into part-time jobs. Our analysis shows that the mentioned process has not taken place in Spanish manufacturing sector. However, we can find this transfer or conversion of jobs in the economy as a whole.

Manufactory sector in Spain seems to be suffering from a lack of output demand rather than an incredibly productivity raise. On one hand, productivity indexes shed some confusing signals about the performance of manufacturing. Value added at factor cost in most of the sub-sectors of the industry has decreased. Change of apparent labor productivity index shows a disparity among different industries. This makes more difficult to state that productivity is the main cause behind unemployment increases when a general pattern in the sector does not exist.

On the other hand, total hours worked have experienced a steady decrease since the beginning of the Global Financial Crisis. There has been a constant destruction of enterprises with no forecast of changing. Production value has barely fluctuated in comparison to other European countries.

For future works, we should analyze Spanish manufacturing sector more in deep. An analysis of productivity indexes in inflation-adjusted terms should be taken into account since prices variations can bias the final results. Besides, the evolution of the competitiveness of each sub-sector should be analyzed in order to point out the weak industries and look for specific measures to heal them.



## 6. Reference List.

- Atkinson, R. D., 2013. Innovation Economics: How a New Theory Casts Light on an Old Problem of the Budget Deficit. [online] Available at: <<http://www2.itif.org/2013-innovation-economics-new-theory-old-problem-budget.pdf>> [Accessed 02 June 2016].
- Atkinson, R.D., Stewart, L. A., Andes, S. M. and Ezell, S. J., 2012. Worse than the great depression: what experts are missing about American manufacturing decline.
- Blanchard, O., 2014. Neoclassical Synthesis. [pdf] MIC Economics. Available at: <<http://economics.mit.edu/files/677>> [Accessed 20 May 2016].
- Bureau of Economic Analysis, 2014. *Frequently Asked Questions* [online] Available at: <[http://www.bea.gov/faq/index.cfm?faq\\_id=1034](http://www.bea.gov/faq/index.cfm?faq_id=1034)> [Accessed 5 May 2016].
- Bureau of Labor Statistics, 2008. *Involuntary Part-Time Work on the Rise* [online] Available at: <<http://www.bls.gov/opub/ils/pdf/opbils71.pdf>> [Accessed 5 May 2016].
- Calleja, A., 2016. Unleashing Social Justice through EU Public Procurement. *Critical European Studies*. Oxon: Routledge.
- Chew, B., 1988. No-Nonsense Guide to Measuring Productivity. *Harvard Business Review*, [online] Available at: <<http://hbr.org/1988/01/no-nonsense-guide-to-measuring-productivity>> [Accessed 15 May 2016].
- Delli Gatti, D., Gallegati, M., Greenwald, B. C., Russo, A. And Stiglitz, J. E., 2012. Mobility constraints, productivity trends, and extended crises. *Journal of Economic Behavior & Organization*. 83, pp.375-393.
- Greenwald, B., Stiglitz, J. E., 1987. Keynesian, New Keynesian and New Classical Economics. *Oxford Economic Papers*, 39, pp.119-132.
- Instituto Nacional de Estadística, 2010. *Panorámica de la industria*. [pdf] Madrid: Instituto Nacional de Estadística. Available at: <<http://www.ine.es/ss/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition&blobheadervalue1=attachment%3B+filename%3DINDcap06.pdf&blobkey=urldata&blobtable=MungoBlobs&blobwhere=637%2F236%2FINDcap06%2C0.pdf&ssbinary=true>> [Accessed 9 June 2016].

- Jahan S., Saber A., and Papageorgiou C., 2014. What Is Keynesian Economics? *Finance and Development*, [online] Available at: <<https://www.imf.org/external/pubs/ft/fandd/2014/09/pdf/fd0914.pdf>> [Accessed 02 June 2016].
- Keynes, J. M. *The General Theory of Employment, Interest and Money*. London: Palgrave Macmillan.
- Kirman, A. P., 1992. Whom or What Does the Representative Individual Represent? *The Journal of Economic Perspectives*, Vol. 6, No. 2 (Spring), pp. 117-136. New York: American Economic Association.
- Levin, J., 2006. *General Equilibrium*. [PDF] Available at: <<https://web.stanford.edu/~jdl Levin/Econ%20202/General%20Equilibrium.pdf>> [Accessed 16 June 2016].
- Organisation for Economic Co-operation and Development, 2001. *Measuring productivity*. Paris: Organisation for Economic Co-operation and Development.
- O'Sullivan, A., Sheffrin, S. M., 2003. *Economics: Principles in Action*. New Jersey: Pearson Prentice Hall.
- Pierce, A., 2008. The Queen asks why no one saw the credit crunch coming. *The Telegraph*, 5 Nov. Available at: <<http://www.telegraph.co.uk/news/uknews/theroyalfamily/3386353/The-Queen-asks-why-no-one-saw-the-credit-crunch-coming.html>> [Accessed 15 June 2016].
- Rittenberg, L., Trigarthen, T., 1996. *Principles of Microeconomics*. Chapter 6. pp. 2 Available at: <<http://www.saylor.org/site/wp-content/uploads/2012/06/ECON101-3.1.pdf>> [Accessed 16 June 2016].
- Samuelson, P. A., 1955. *Economics: An Introductory Analysis*. 3rd ed. New York: McGraw-Hill.
- Schumpete, J..A., 1942. *Capitalism, Socialism and Democracy*, 3rd ed. London: George Allen and Unwin, 1976.
- SPRING Singapore, 2011. *A Guide to Porductivity Measurament*. Singapore: SPRING Singapore.
- Stewart, H., 2009. This is how we let the credit crunch happen, Ma'am... *The Guardian*, 26 Jul. Available at: <<https://www.theguardian.com/uk/2009/jul/26/monarchy-credit-crunch>> [Accessed 15 June 2016].

The Economist, 2005. Manufacturing employment: Industrial Metamorphosis (Editorial comments). *The Economist*, 1 Oct.

## 7. Appendix.

APPENDIX 1:  
Employment change per sub-sector. Period: 2008-2016.

