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Economic integration and industrial sector fluctuations: evidence from Italy

Tatiana Cesaroni
Italian Ministry of Economy and Finance

Abstract

This paper investigates the underlying sources of the Italian industrial sector fluctuations. It concentrates in particular on the role of different shocks on the manufacturing business cycle. To this end, it considers both domestic shocks (to hours worked and to technology) and external shocks (i.e. real exchange rate and world trade shocks). The former concern internal conditions such as labour market and productivity dynamics; the latter relate to the effects of economic integration, globalization and the world economy scenario on the manufacturing sector performance. The findings show evidence that the cyclical fluctuations are mainly determined by technology shocks,however,the hours worked and world trade shocks also contribute significantly to explaining the manufacturing business cycle.

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Contact: Tatiana Cesaroni - tatiana.cesaroni@tesoro.it.
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1 Introduction

In recent decades, important changes have occurred in the European macroeconomic scenario. Various events, such as the introduction of the common market in 1992, the adoption of a currency union in 1998 and the Euro area enlargement to Eastern European countries in 2005, have created more interconnections among economies. In the context of world and European economic integration, the Italian industrial sector has been characterized by specificities in its production processes and its internal macroeconomic conditions. The Italian manufacturing industry based on traditional specialization sectors (representing the so–called "made in Italy") has been more exposed to competition by emerging markets, such as the Asian and Chinese economies, than have other European countries. The early millennium world economy slowdown, mainly determined by a fall in world demand, generated a negative cyclical phase in almost all European industrialized countries. The Italian GDP accordingly deteriorated in 2001-05, with an average growth rate close to zero, while industrial production experienced a stagnation/recession. However, the intensity and duration of this cyclical phase appeared atypical in Italy with respect to the experience of the main European countries (European Commission, 2007).

Various studies have tried to analyze the recent "industrial economy slowdown" and the latest transformations which have occurred in the Italian industry and have come out with various explanations. Daveri and Jona Lasinio (2005) for example, attribute the decline in the italian economy path to a labour productivity slowdown mainly driven by a total factor productivity decline. Analogously, De Nardis (2007) examines the Italian industry structural changes which occurred at the beginnings of 2000s and concludes that the observed decline could be attributed to a staticity of the firm's specialization model and to a deterioration of labour productivity due to institutional labour market reforms and selective firms processes caused by the international competitiveness.

In this article we try to shed further light on the Italian industry changes and analyze the main sources of Italian manufacturing sector fluctuations in the context of European and world economic integration. To this end, we quantify the response of the industrial production to domestic and external shocks. The former reflect the effects of changes in internal economic conditions, due to the labour market and productivity dynamics. The latter reflect the effects on the industrial sector. For this purpose, we estimate a four variables structural vector autoregressive model (SVAR) with long run restrictions (i.e. Blanchard and Quah, 1989). This structural approach allows an economic interpretation to be given to shocks because the identification is carried out using restrictions which derive from economic theory. More in detail, we examine the effects of four structural innovations on manufacturing business cycle: technology, hours worked, world trade and real exchange rate shocks.

Following the Blanchard and Quah (1989) seminal paper, several empirical studies have examined the causes of aggregate fluctuations using long run restrictions. To this end Bayoumi and Eichengreen (1992), Karras (1994), Bergman (1996) and Galì (1999) use SVAR with long run restrictions to inspect the sources of macroeconomic fluctuations in some European countries and US. Gavosto and Pellegrini (1999) employ a three variables SVAR to quantify the effects of different shocks on Italian industrial output using total orders, national accounts hours worked and industrial production in their model. More recently Peersman (2006) uses a four variables VAR to analyze the effects of different shocks (monetary, oil, aggregate demand and aggregate supply shocks) on the early millennium slowdown.To this end, he compares the U.S. and the Euro Area economies by using both short and long run restrictions and sign restrictions. In his findings, the early millennium world economy slowdown seems to be caused by an important role of negative aggregate spending and by the effect of a negative supply shocks.

Negative effects of restrictive monetary policy in 2000 as well as the negative impact of oil price increases in 1999 have played a role although with a different magnitude that depends on the identification approach.

With respect to the existing literature we contribute by introducing the following innovations:

Firstly, we focus on a small open economy model for the Italian manufacturing sector allowing the integration process to be taken into account explicitly.We believe that globalization and the international environment can significantly contribute in order to explain the Italian industrial sector performance in the last few decades. To this end the effects of international shocks (on world trade and real exchange rate) in addition to traditional macroeoconomic internal demand and supply shocks are evaluated.

Secondly this study takes the labour-market indicator to be the qualitative hours-worked data provided by business tendency surveys, rather than the usual hours worked reported by national accounts. This kind of data are directly collected from manufacturing firms business surveys, and indeed they are more suitable for analysis of the industrial sector. Furthermore, since they are built as balance between percentage of positive and negative answers provided by firms on the total amounts of hours worked, they are bounded by contruction and show a strong cyclical pattern.

Thirdly we make identification assumptions based on long run restrictions, that distinguish between domestic and foreign shocks allowing for the long run zero effect of domestic shocks on world trade.

All the shocks included in the model have been chosen on the basis of their theoretical relevance in explaining the industrial business cycle. The productivity shock (i.e. to technology) is traditionally regarded as being a source of business cycle fluctuations. The hours-worked shock takes into account macroeconomic internal conditions and enables us to take into consideration the labour-market dynamics which also play a central role in the business cycle theory debate (see, Ravn and Simonelli, 2008 and Pissarides, 2000). The real exchange rate shock (i.e. to competitiveness) may play an important role in explaining the manufacturing sector's performance, since one would expect real exchange rate dynamics to affect trade balance. Finally, the world trade shocks reflect both changes in the integration process and in world demand conditions on Italian manufacturing sector performance. Over the last decades indeed world trade growth significantly accelerated as a result of the international trade boost (see, Dean and Barriel, 2004). Since Italian economy is interdependent on the rest of the world for the acquisition of intermediate goods and the allocation of its production, consideration of shocks to this variable, helps to explain industrial fluctuations.

The rest of this paper is organized as follows: in section 2 we introduce the structural VAR model for Italy, the identifying assumptions and the economic meaning of the shocks, in section 3 we describe the data and discuss the empirical results. Section 4 reports conclusions.

2 The SVAR model

In this section we introduce the SVAR stationary model and show the structural shocks identification strategy based restrictions in the long-run. The model can be considered as an extention of Blanchard and Quah (1989) which allows for long run effects of technology shocks and world trade shocks (i.e. to integration process) on output.

2.1 A small open economy model

Since the Italian economy appears to be strongly interdependent with the rest of the world for the acquisition of intermediate goods and the allocation of its production, we shall consider a small open-economy model in which international phenomena (commerce/integration, real exchange rate/competitiveness) are important, as well as internal supply and domestic demand conditions[1]. To this end, the model includes industrial production, hours worked, real exchange rate and world trade[2].

The usual unit root tests show that, while hours worked are stationary, the remaining variables display a stochastic trend[3]. Furthermore, preliminary cointegration tests on the variables did not reveal the existence of equilibrium relations in the long-run[4]. The moving average representation of the structural form is thus:

$$x_t = K + S(L)v_t \tag{1}$$

where $x_t = [hw, \Delta rer, \Delta y, \Delta wt]$ represents the vector of the endogenous variables given by hours worked (hw) in levels, log differences of real effective exchange rate (Δrer), log differences of the industrial production index (Δy), world trade in log differences (Δwt), K is a constant, $S(L)$ is a polynomial in the lag operator L and $v_t = [v_{HW}, v_{RER}, v_{AS,}, v_{WT}]$ represents the vector of structural shocks with variance and covariance matrix $E[v_t v_t^{'}] = I_n$. In greater detail: v_{HW} is the hours worked shock (reflecting domestic labour conditions), v_{RER} represents a real exchange rate shock (i.e. to competitiveness), v_{AS} is a technology shock (i.e. to domestic supply)[5], and v_{WT} represents the world trade shock (i.e. to integration process). In matrix form:

$$\begin{bmatrix} hw \\ \Delta rer \\ \Delta y \\ \Delta wt \end{bmatrix} = \begin{bmatrix} S_{11}(L) & S_{12}(L) & S_{13}(L) & S_{14}(L) \\ S_{21}(L) & S_{22}(L) & S_{23}(L) & S_{24}(L) \\ S_{31}(L) & S_{32}(L) & S_{33}(L) & S_{34}(L) \\ S_{41}(L) & S_{421}(L) & S_{43}(L) & S_{44}(L) \end{bmatrix} \begin{bmatrix} v_{HW} \\ v_{RER} \\ v_{AS} \\ v_{WT} \end{bmatrix}$$

The reduced form of the model is:

[1] The model does not include monetary aggregates because they were not found to be particularly significant in explaining manufacturing sector fluctuations.

[2] This variable usually represents a proxy of the world economic integration process.

[3] The results of ADF test are reported in the appendix.

[4] The results of the co-integration test are reported in the appendix.

[5] To be noted is that in this framework, as Blanchard and Quah (1989), we interpret all technology shocks as having a permanent effect on output.

$$x_t = \Phi_0 + \Phi_1(L)x_{t-1} + \varepsilon_t \tag{2}$$

where Φ_0 and Φ_1 are the parameter matrices of the model and $\varepsilon_t = [\varepsilon_{1t} \quad \varepsilon_{2t} \quad \varepsilon_{3t} \quad \varepsilon_{4t}]'$ represents the vector of the residuals. The moving average representation of the VAR reduced form is:

$$x_t = K + Z(L)\varepsilon_t \tag{3}$$

where $K = (I - \Phi_1)^{-1}\Phi_0$ is the constant and $Z(L) = (I - \Phi_1(L)L)^{-1}$ is a polinomial matrix in the lag operator L. In order to give a structural interpretation of the shocks, from the correlated reduced form innovations ε_t we must recover the orthogonal shocks of the structural form (v_t). Equating (1) and (3), for $L=0$ we obtain:

$$S(0)v_t = \varepsilon_t \tag{4}$$

where $S(0)$ is the matrix of the contemporaneous effects of the structural shocks on the macroeconomic variables. The variance and covariance matrix of the vector of reduced-form innovations is given by:

$$E(\varepsilon_t\varepsilon_t^{'}) = \begin{bmatrix} \mathrm{var}(\varepsilon_{1t}) & \mathrm{cov}(\varepsilon_{1t},\varepsilon_{2t}) & \mathrm{cov}(\varepsilon_{1t},\varepsilon_{3t}) & \mathrm{cov}(\varepsilon_{1t},\varepsilon_{4t}) \\ \mathrm{cov}(\varepsilon_{2t},\varepsilon_{1t}) & \mathrm{var}(\varepsilon_{2t}) & \mathrm{cov}(\varepsilon_{2t},\varepsilon_{4t}) & \mathrm{cov}(\varepsilon_{2t},\varepsilon_{4t}) \\ \mathrm{cov}(\varepsilon_{3t},\varepsilon_{1t}) & \mathrm{cov}(\varepsilon_{3t},\varepsilon_{2t}) & \mathrm{var3}(\varepsilon_{3t}) & \mathrm{cov}(\varepsilon_{3t},\varepsilon_{4t}) \\ \mathrm{cov}(\varepsilon_{4t},\varepsilon_{1t}) & \mathrm{cov}(\varepsilon_{4t},\varepsilon_{2t}) & \mathrm{cov}(\varepsilon_{4t},\varepsilon_{3t}) & \mathrm{var}(\varepsilon_{4t}) \end{bmatrix} = \Sigma \tag{5}$$

Since $$S(L)v_t = Z(L)\varepsilon_t \tag{6}$$

and $$S(0)v_t = \varepsilon_t \tag{7}$$

we have: $$S(L) = Z(L)S(0) \tag{8}$$

Cumulating the effects of the shocks we obtain impact matrix in the long- run $S(1)$ which describes the impact of the shocks in the long- run on the variables.

2.2 Identifying assumptions

In order to recover the structural shocks we need to know the coefficients of $S(0)$ matrix. The system can thus be just identified by imposing 16 restrictions. The first 10 restrictions can be recovered from the reduced form residuals variance and covariance matrix.

$$\mathrm{var}(\varepsilon_{1t}) = s_{11}(0)^2 + s_{12}(0)^2 + s_{13}(0)^2 + s_{14}(0)^2$$
$$\mathrm{var}(\varepsilon_{2t}) = s_{21}(0)^2 + s_{21}(0)^2 + s_{23}(0)^2 + s_{24}(0)^2$$
$$\mathrm{var}(\varepsilon_{3t}) = s_{31}(0)^2 + s_{32}(0)^2 + s_{33}(0)^2 + s_{34}(0)^2$$
$$\mathrm{var}(\varepsilon_{4t}) = s_{41}(0)^2 + s_{42}(0)^2 + s_{43}(0)^2 + s_{44}(0)^2$$
$$\mathrm{cov}(\varepsilon_{2t,}\varepsilon_{1t}) = s_{21}(0)s_{11}(0) + s_{22}(0)s_{21}(0) + s_{23}(0)s_{31}(0) + s_{24}(0)s_{41}(0)$$
$$\mathrm{cov}(\varepsilon_{3t,}\varepsilon_{1t}) = s_{31}(0)s_{11}(0) + s_{32}(0)s_{21}(0) + s_{33}(0)s_{31}(0) + s_{34}(0)s_{41}(0)$$
$$\mathrm{cov}(\varepsilon_{4t,}\varepsilon_{1t}) = s_{41}(0)s_{11}(0) + s_{42}(0)s_{21}(0) + s_{43}(0)s_{31}(0) + s_{44}(0)s_{41}(0)$$
$$\mathrm{cov}(\varepsilon_{3t,}\varepsilon_{2t}) = s_{31}(0)s_{12}(0) + s_{32}(0)s_{22}(0) + s_{33}(0)s_{32}(0) + s_{34}(0)s_{42}(0)$$
$$\mathrm{cov}(\varepsilon_{4t,}\varepsilon_{3t}) = s_{41}(0)s_{13}(0) + s_{42}(0)s_{23}(0) + s_{43}(0)s_{33}(0) + s_{44}(0)s_{43}(0)$$
$$\mathrm{cov}(\varepsilon_{4t,}\varepsilon_{2t}) = s_{41}(0)s_{12}(0) + s_{42}(0)s_{22}(0) + s_{43}(0)s_{32}(0) + s_{44}(0)s_{42}(0)$$

The remaining 6 restrictions can be imposed on the long-run multipliers impact matrix $S(1)$ associated with the moving average representation of the structural form $S(L)$. In order to impose the remaining 6 long -run restrictions, we can make the following assumptions:
First, we assume that the long run real exchange rate depends on productivity, world trade and real exchange rate shocks:

$$\Delta rer = S_{22}(1)v_{RER} + S_{23}(1)v_{AS} + S_{24}(1)v_{WT}$$

In line with this setting we assume that all the shocks except those on the hours worked (i.e. a labour market demand shock), can permanently affect the level of the real exchange rate. In particular:

- we assume that the real exchange rate shock (i.e. the Chinese products competition for Italy's textile and machinery industries) can produce permanent effects on real exchange thus modifying the Italian competiveness (i.e through changes in the preferences for Italian products or through structural changes in the relative prices);
- we assume that world trade shock (i.e. removal of barriers to trade/deregulation of financial markets due to integration process) can produce permanent effects on real exchange rate according to the Obsfield (1984) model which considers long- run effects of barriers removal on real exchange rate;
- we assume that technology shock can also affect the long run real exchange rate according to Harrod (1933), Balassa (1964) and Samuelson (1964) effect. Indeed, through this effect technology shocks can modify productivity growth differentials and thus in the long run can affect the real exchange rate;
- we require no permanent effect of hours worked shock (i.e. a country specific demand shock) on real exchange rate.

The long run restriction will be given by:

$$S_{21}(1)=0$$

We also assume that in the short run all the shocks may have an impact on real exchange rate.

Secondly, we assume that the long-run industrial production path is not only affected by technology shocks but also by world trade shocks:

$$\Delta y_t = S_{33}(1)v_{AS} + S_{34}(1)v_{INT}$$

Different channels can determine effects of economic integration on output i.e. access to a greater number of product varieties (Krugman, 1979) or importing more high-quality foreign inputs (Grossman and Helpman, 1991). Although world trade is a typical demand indicator, in this setting we can assume that both world demand shocks (i.e. on net exports) and political/institutional shocks connected to the international integration process among economies, are mainly responsible for world trade fluctuations. We can interpret the latter as having a permanent effect on output in line with the small open economy hypothesis. The corresponding long-run restrictions will be given by:

$$S_{31}(1)=S_{32}(1)=0$$

In the short run, we can assume that, on the contrary, all the disturbances may have an impact on output.

Thirdly, we assume that the long-run pattern of world trade is only influenced by shocks on the integration process (i.e. institutional shocks) and that there is no permanent effect of hours worked (domestic demand shock), domestic technology and real exchange rate shocks on world trade according to the small economy hypothesis:

$$\Delta wt = S_{44}(1)v_{WT}$$

The corresponding long run restrictions for this variable will be given by:

$$S_{41}(1)=S_{42}(1)=S_{43}(1)=0$$

In the short run, we suppose that potentially, all the disturbances (domestic and foreign) may have an impact on world trade. By imposing all the above mentioned restrictions, the long run impact matrix will thus be lower triangular:

$$S(1)=\begin{bmatrix} S_{11}(1) & S_{12}(1) & S_{13}(1) & S_{14}(1) \\ 0 & S_{22}(1) & S_{23}(1) & S_{24}(1) \\ 0 & 0 & S_{33}(1) & S_{34}(1) \\ 0 & 0 & 0 & S_{44}(1) \end{bmatrix}$$

On the basis of the identifying assumptions in what follows we estimate a SVAR model and the corresponding impulse responses of the variables to the four structural shocks.

3 Data and empirical analysis

On the basis of the Schwartz information criteria we estimated a second order VAR length. The model passed the usual residual diagnostics. In the following sub paragraphs we describe the data used the analysis, we examine the impulse response functions and the industrial production error variance decomposition.

3.1 Data set description

Quarterly data seasonally adjusted on output, hours worked, exchange rate and world trade over the period 1981Q3 2006Q3 were used. All the variables were taken from the OECD database except for the hours worked (source: ISTAT).[6]

Industrial output allows us to consider the production process dynamics. The hours worked data enable us to take into account internal labour demand conditions[7], the real exchange rate allows us to consider the effects of competitiveness changes on the industrial sector and world trade enables us to assess the impact of shocks on integration process among economies and on the conditions of world demand which affects industrial performance.

The labour market indicator used in this study is not the usual hours worked coming from national accounts but a qualitative hours worked indicator derived from italian business tendency surveys on manufacturing firms. This kind of indicator appears to be highly pro-cyclical and accordingly it is able to convey accurate information on the industrial sector business cycle. A detailed descriptions of the data and sources is reported in the table below.

[6] The ISTAT Business Tendency Survey on manufacturing firms is conducted into the Joint Harmonized Business Tendency Surveys of the European Commission.

[7] Since information on hours worked used is collected from firms and not from workers, as in the case of official labour force survey, in our opinion it is more appropriate to consider this variable as a labour demand indicator rather then a labour supply indicator.

Data definitions and sources

Output	Italian Industrial production index base 2000 seasonally adjusted. Source OECD.
Hours worked	Qualitative hours worked coming from italian Business Tendency Surveys. The questionnaire of the survey, furnished to manufacturing firms, asks them to provide information on the Number of hours worked in the last three months. The question is" In the last three months the number of your firm's total hours worked was: + increased = remained unchanged – decreased. The qualitative data are quantified through the balance that is the difference between the weighted percentage of positive and negative answers provided by firms. Source: ISTAT Italian Business Tendency Surveys on Manufacturing firms. Details concerning the concept of balance and the aggregation procedure of qualitative (multiple choice) questions can be found in the OECD (2003) Handbook on Business Tendency Surveys. See references for details.
Real effective exchange rate	Chain-linked index with base period 2000. Percentage changes in the index are calculated by comparing the change in the index based on consumer prices for Italy to a weighted average of changes in its competitors indices. Source OECD.
World trade	The measure of world trade is calculated as an arithmetic average of the volume of OECD countries imports and exports of goods and services in billions of 2000 US dollars seasonally adjusted. Source OECD. OECD import (export) goods and services volumes are constructed as weighted averages of the growth rates of the volume of imports (exports) of individual countries, with the country weights based on shares of global goods and services import (export) values in 2000, expressed in US dollars.

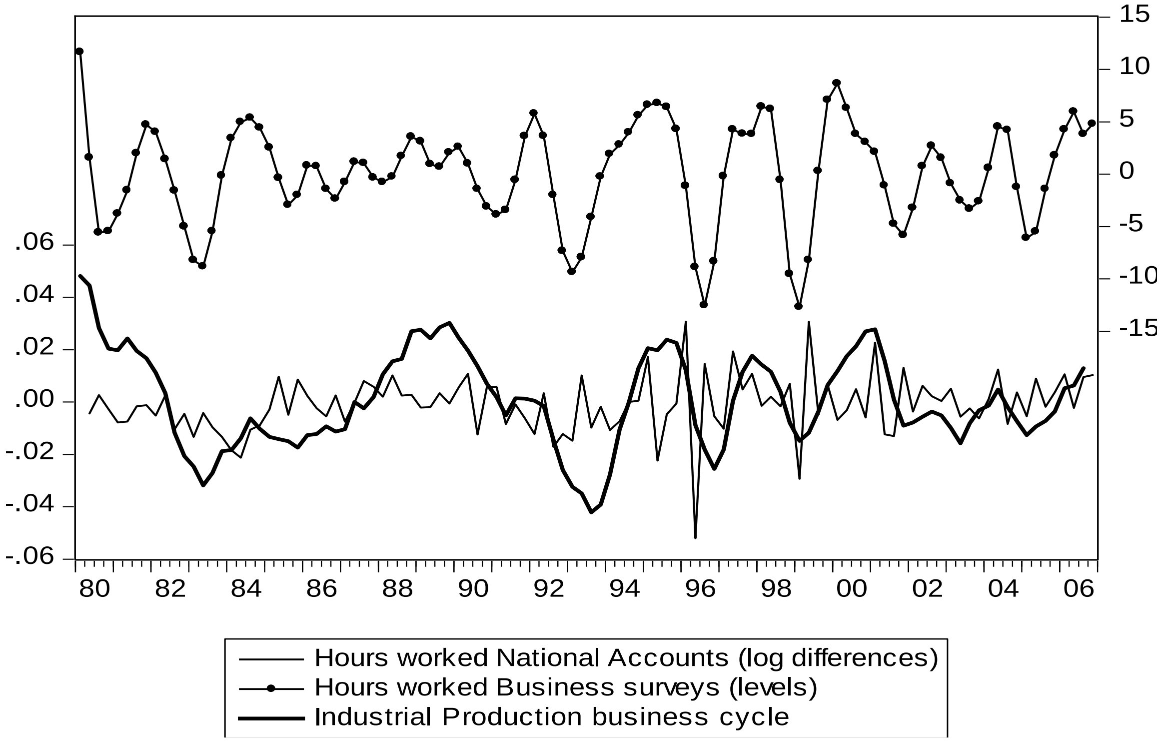
As a preliminary analysis we evaluated the correlations of the standard hours worked measure from National Accounts and the hours worked measure coming from Business Tendency Surveys with industrial production business cycle.

The former were considered both in levels and in first differences. The hours worked Business Surveys measure, stationary by construction, was considered directly in levels.

This latter indicator showed the highest correlation with industrial production business cycle (0.53). On the opposite, the correlation of national accounts hours worked data (both in levels and in first differences) with industrial production resulted to be very low.

Figure 1 shows a comparison between the qualitative hours worked data coming from Business Tendency Surveys (in levels) and hours worked data from national accounts (in first differences). Looking at the graph we can notice that the hours worked data from industrial sector national accounts are more volatile than those coming from Business Tendency Surveys. This latter variable, built aggregating qualitative data coming from questions concerning the hours worked of Italian manufacturing firms displays a marked cyclical profile and seems able to match the industrial business cycle more than national accounts hours worked data. This is the reason because we used it in the SVAR instead of the national accounts hours worked.

Figure 1 Comparison between qualitative hours worked indicator from business tendency surveys (in levels) and hours worked from national accounts data (first differences).



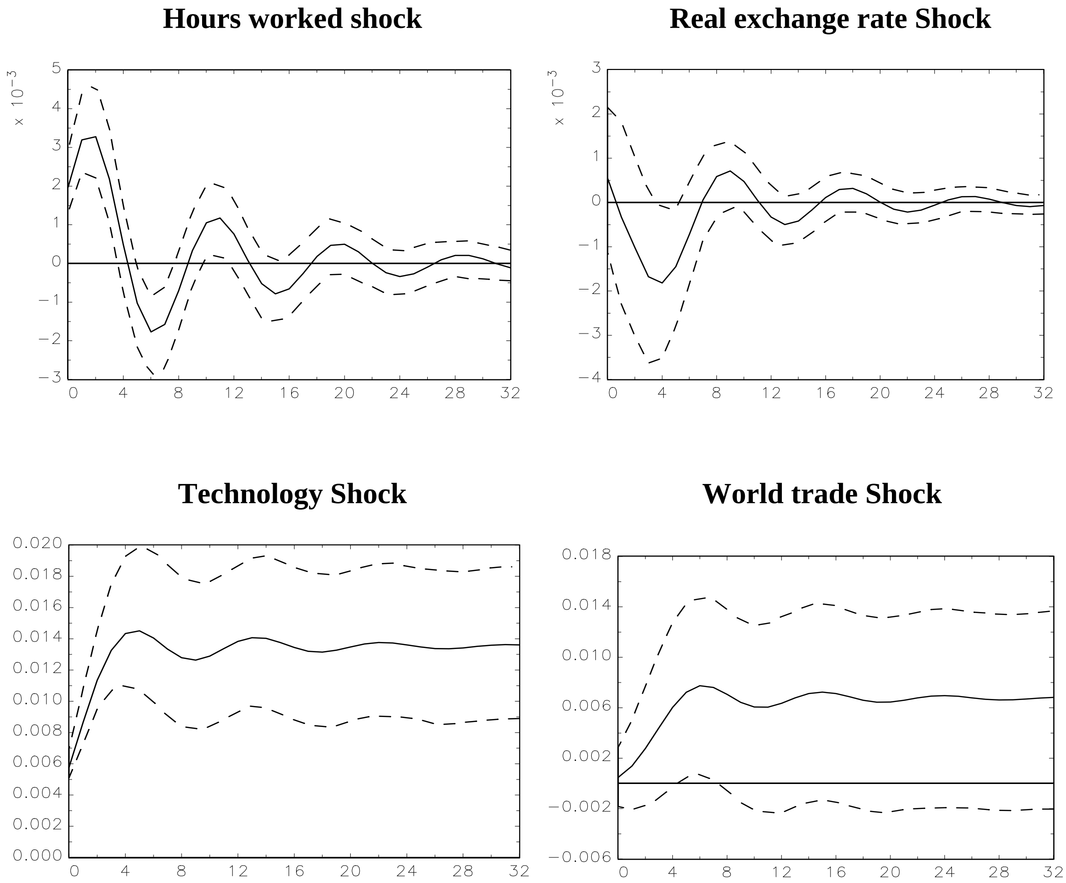
3.2 Impulse response analysis

The impulse responses of the industrial production to different orthogonal shocks are reported in Figure 2. The confidence bands intervals of standard errors were calculated by using a bootstrapping procedure with 2000 repetitions.

Inspection of the graphs in figure 2 shows that the response to a domestic demand shock (an increase of hours worked) is significant and immediately determines a rise in the industrial production in the first two quarters. The impulse slightly decreases, becomes negative after two quarters, it starts to go up again in the fourth quarter and dies out after roughly 4.5 years. Overall, this result indicates that the labour market played a significant role in the manufacturing sector's performance in the period considered. This finding appears to be in line with the analysis of Gavosto and Pellegrini (1999) in that it is based on the use of national accounts hours worked.

The real exchange rate shock (loss of competitiveness) produces, as expected, a decrease in the industrial production that becomes negative after one quarter. However the response appears to be statistically significant only in the third quarter. The effect fully disappears after about 4.5 years.

Figure 2 **Impulse response of industrial production. Period 1982-06 (95% interval confidence bands: black dashed line: Hall-percentile)**



The technology shock (i.e. a positive domestic supply shock) is statistically significant and determines as expected a rise in output.

The world trade shock, which reflects, to a large extent, positive changes in the institutional framework (such as the removal of trade barriers),[8] appears to be statistically significant (after six quarters) and produces a permanent rise in the industrial production within the first year.

3.3 Forecast error variance decomposition

In order to evaluate the relative contribution of each shock on the variance of the industrial production growth rate, table 1 reports the corresponding forecast error variance decomposition derived from the structural VAR. This kind of decomposition shows how much of a variable variation (i.e. industrial production) is explained by different structural shocks. More in detail, the numbers contained in the table illustrate the percentage of the forecast error variance of industrial production attributed to particular shocks on various horizons.

[8] We seek to capture the idea that institutional reforms, such as the removal of barriers to trade, can produce a favourable permanent effect on integration and trade among economies, with implications for the level of economic activity.

Table1 Forecast Error Variance decomposition Industrial production growth rate (in % of variable variance)

Forecast Horizon (in quarters)	Std error	Hours worked shock	Real exchange rate shock	Technology shock	World trade shock
1	0.006146	10.3	0.8	88.3	0.6
2	0.007008	11	2.2	84.7	2.1
3	0.007670	9.2	2.6	83.1	5.1
4	0.008176	9.8	3.1	78.7	8.5
5	0.008574	12.9	2.7	73.1	11.3
6	0.008797	15.2	2.8	69.5	12.6
7	0.008886	15.6	3.4	68.3	12.7
8	0.008951	15.4	4.1	68	12.5
9	0.009043	16.0	4.4	67	12.6
10	0.009126	17.1	4.3	65.8	12.9
15	0.009291	18.3	4.6	64.1	13.0
20	0.009352	18.6	4.8	63.5	13.1

The results show that, after one period, hours worked and technology shocks, explain more than 95% of the total variance. Technology shock predominates at all time horizons although its contribution decreases over time (from 88% after one quarter to 64% after five years). After six quarters, the contribution of hours worked shock slightly increases (from 10% to 15%). The integration process, which initially explains 2-5% of variability, becomes more important after five years and accounts for 13% of the total variance. By contrast, the competitiveness shock plays a minor role in explaining total variance at all time horizons (roughly from 1 to 5 %).

Overall, our findings show that the world trade shock, which here is considered as a proxy of economic integration process, significantly contributes to explaining the Italian manufacturing sector's performance over the last twenty five years. This period roughly corresponds to the years in which integration and globalization among countries have been increasing. As expected, the technology shock plays an important role in explaining the cyclical fluctuations in line with other studies on Italian industry (i.e. Gavosto Pellegrini, 1999). By contrast, whereas hours worked (and thus labour market) also represent a significant source of manufacturing business cycle, the real exchange rate shock seems to have played a minor role in explaining the Italian manufacturing growth rate dynamics in the period in consideration.

Although technology shocks appears to be relevant in both studies, some remarkable differences can be noticed concerning the amount of explained variance to be attributed to them. In particular Gavosto and Pellegrini have found find that technology shock accounts for 40% of output variability at the beginning and becomes more relevant in the long run (56%). They have also found evidence of an appreciable contribution of labour supply shock that accounts for 26% at the beginning and reaches 41% in the long- run and of a significant impact of demand shock in the short run (33% in the first quarter) that strongly decreases in the long run (3%). Apparently, our results seem to differ from Gavosto's and Pellegrini's findings. However, it is important to emphasize that the finding of high contribution of technology shock in the analysis, is in part due to the inclusion of the eighties in the sample period estimates.To this purpose it is well known that during the '80s the Italian macroeconomic scenario was very different from '90s. In particular ,throughout the '80s the output fluctuations were mainly driven by supply side sources due to the catching up process of Italian firms whereas from the beginning of ‘nineties ,demand side[9] factors became more important. This view is in addition confirmed by making estimates on the reduced sample 1990-06; in this latter case the variance decomposition is indicated ,as expected , as a higher role of demand shocks and a lower role of technology shocks. The discrepancies of our results also depend on the investigation of a different set variables (in particular the inclusion of world trade as a proxy of international scenario changes) and on the examination of a different sample period. In fact, while Gavosto and Pellegrini estimates their VAR over the period 1965-94, we concentrate on the more recent sample 1982-06 providing evidence of significant changes in the role of shocks affecting business cycle dynamics with respect to the past.

4 Concluding Remarks

In this study we have analyzed the sources of cyclical fluctuations in the Italian industrial sector. We have sought to interpret the effects of different kinds of impulses on the Italian manufacturing performance in the context of world economic integration. To this end, we have considered both domestic shocks related to internal macroeconomic conditions (i.e. technology and labour market shocks) and international shocks (real exchange rate and world trade), taking into account the Italian economy’s interdependence from other countries.

Assessment of the impulse response functions in the 1982-06 sample has demonstrated that the Italian manufacturing sector has reacted positively to integration process and competitiveness shock as well as to the technology and hours worked shock.

The variance decomposition shows that manufacturing fluctuations are driven mainly by technology shocks. Domestic demand and world trade shocks also play a very important role. In particular, the integration process, and hence the international scenario, seems to be a very important positive factor in explaining the industrial production growth rate dynamics in the last 25 years.

However, the overall effect of the integration process on output in the last two decades includes also a period of stagnation experimented by the Italian industry at the beginning of 2001 as we can see looking at industrial production data in the appendix. This episode, as documented in the Nardis (2007), was in part due to a restructuration process of the Italian manufacturing firms that, together with labour market institutional reforms, have generated a fall in the labour productivity.

9 i.e. currency shocks.

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Appendix

Dickey-Fuller test of stationarity - Period 1981:Q4-2006Q4

Variable	Intercept levels lag	First Differences	Intercept and trend levels lag	First Differences
Ind. production	(1) -1.23	-4.40***	(1) -2.51	-4.39***
Word trade	(4) 1.90	-5.74***	(4) -3.64**	-6.29***
Hours worked	(3) -5.34***		(3)-5.33***	
Real Exc.rate	(0) -1.08	-8.01***	(0) -1.65	-8.35***
*significant at 10% level **significant at 5% level *** significant at 1% level				
Note: the lags in the tests were estimated through the Swartz information criterion				

Cointegration test - Period 1981:Q2-2006Q2

Test	Value	5% Critical value	1% Critical value
Johansen eigenvalue test	11.03488	20.97	25.52
Johansen trace test	17.10893	29.68	35.65
Variables: industrial production, world trade, real exchange rate			