Firm Heterogeneity, local externalities and Regional Business Cycles Differentials

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Abstract. *We use microeconomic information to analyze regional differences in business cycle fluctuations. Working with monthly Italy's firms data and estimating a random effects ordered probit model, we first document sizable asymmetries in Northern and Southern firms business cycles positively related to the intensity of the national cycle. Then, we explore the role of several firm-specific factors (firm size, export propensity, liquidity constraints, demand conditions, capacity utilization and expectations) and of local externalities in explaining regional disparities in business cycle fluctuations. Results suggest that North-South differences in sectoral composition scantly explain the diverging behaviour of Southern firms, while various firm specific variables and local externalities capture large part of regional business cycles differences.*

JEL classification: Regional business cycle, firm heterogeneity, local externalities, random effects ordered probit

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1. Introduction

Regional business cycle analyses traditionally emphasize the role of regional industrial structure as the major source of divergence in local business cycles. Following the export-based approach, many studies carried out for the United States and the United Kingdom argument that the region's link to the rest of the world is through its export-base activities so as income fluctuations in the rest of the world are transmitted to the region through a change in the latter's export (Domazlicky, 1980). Due to the high inter-industry heterogeneity in export propensity, regional differences in the industry mix are therefore the major responsible for regional differentials in business cycle intensity. The role of industry mix is also highlighted within the "interest rate channel view" of the monetary policy transmission theory (Carlino and DeFina, 1998; Dedola and Lippi, 2000): the output sensitiveness to a policy induced variation in the short term interest rate varies significantly across industries, so as the monetary policy may have asymmetric effects on regions with large differences in the industrial structure. It is puzzling that, after controlling for industrial composition, these studies find significant regional cyclical heterogeneity, so as the industry mix can only partially explain these differences.

More recent studies extend the analysis to European economies and question whether there is an asymmetric regional reaction to monetary policy shocks (Montoya and de Haan, 2007; Bradley *et al*., 2004). Some authors also use advanced time series techniques to analyze co-movements and synchronizations in regional business cycles and to identify regional specific turning points (see, e.g., Hess and Shin, 1997; Clark and Shin, 1998; Carvalho and Harvey, 2002; Chen, 2007). With regard to the Italian case, Mastromarco and Woitek (2007) use annual data for the period 1950-2004 to study the synchronization of Italian regions' business cycles. Their results show that regional co-movements vary considerably over time: they were strongest in the 1965–1975 period; after 1975, regional business cycles started to drift out of phase, with the North leading the South. The authors argue that North-South business cycle differentials can be explained with North-South differences in the economic activity (industry mix explanation) and with North-South differences in political business cycle. Using monthly data, Brasili and Brasili (2009) also analyze the characteristics and co-movements of Italian regions' business cycles to understand the consequences of the global crisis on the local economies. These authors interpret regional business cycles differentials in terms of regional product specialisation, regional financial markets development and regional research intensity.

We claim that all previous studies, focusing on macroeconomic data, disregard the effect of firm heterogeneity in business cycle behaviour and, thus, they do not clearly answer the question of why regional business cycles differ. Thus, we suggest to use microeconomic information in order to distinguish between *sector-*, and *firm-specific* factors in determining regional differences in industrial firms' business cycle behavior. To this end, we build up a micro-econometric model so as to assess whether Northern and Southern firms show significant differences in cyclical behaviour, after having controlled for structural factors that alter the transmission mechanism of exogenous shocks.

Working with monthly Italy's firms data and estimating a random effects ordered probit model, we first document sizable asymmetries in Northern and Southern firms business cycles positively related to the intensity of the national cycle: firms located in the South are more likely to reduce production levels than firms located in the North in periods of business cycle expansion and *viceversa* (Section 2). Results also suggest that North-South differences in sectoral composition scantly explain the lower volatility of

Southern firms' industrial output. Then, we discuss some theoretical hypotheses on the role of firm specific variables (firm size, export propensity, liquidity constraints, idiosyncratic demand shocks, capacity utilization and expectations) in business cycle behaviour and reports the list of microeconomic variables available from business cycle surveys in Italy (Section 3). According to our assumptions, firm heterogeneity has a role in explaining regional business cycle differentials only if some spatial contagion is at work. Empirical evidence corroborates the hypothesis that firm specific variables (mainly firm size, liquidity conditions and demand conditions) and local externalities capture large part of regional business cycle differences (Section 4). Section 5 concludes.

2. North-South differences in business cycle: evidence from micro data

2.1 Modelling firms' business cycle behaviour

To analyse regional differences along the cycle using firm-level information we first specify an empirical micro-econometric model of firms' business-cycle behaviour. We rely on monthly microeconomic data drawn from the business survey carried out by the Italian National Institute of Statistics (ISTAT). Data are longitudinal and regard 6,629 firms on the period April 2003-December 2010; total number of observations is 308,042. Qualitative assessment made monthly by each suveyed firm on its level of production is the dependent variable of the model. We label it as y_{it} for firm $i = 1,...,N$ at time $t = 1,...,T$; it takes values 1, 2 and 3 according to firm's evaluation of production as 'low', 'normal' and 'high', respectively. In addition to their self-reported evaluation of the production levels, the data set includes many individual characteristics for each monthly survey, some of which will be used as explanatory variables in our analysis.

Given the qualitative nature of the response variable, we use the Ordered Probit Model with individual random effects (RE-OPM). The basic notion underlying this model is the existence of a latent continuous variable, y_{it}^*, ranging from -∞ to +∞, related to a set of explanatory variables by the standard linear relationship:

$$y_{it}^* = \beta' x_{it} + \gamma' z_i + u_{it} = \beta' x_{it} + \gamma' z_i + \nu_i + \varepsilon_{it} \qquad (1)$$

where x_{it} is a vector of time-varying regressors, z_i is a vector of time-invariant covariates, β and γ are the associated parameter vectors and $u_{it} = \nu_i + \varepsilon_{it}$ is a random error term including both time-invariant, ν_i, and time-varying, ε_{it}, unobserved factors. In model (1) both error components are normally distributed and orthogonal to the set of predictors. Since the underlying variance of the composite error, $\sigma_u^2 = \sigma_\nu^2 + \sigma_\varepsilon^2$, is not identified, we set $\sigma_\varepsilon^2 = 1$, so that the residual correlation term is $\rho_{u_{it},u_{is}} = \sigma_\nu^2(\sigma_\nu^2 + \sigma_\varepsilon^2)^{-1} = \sigma_\nu^2(\sigma_\nu^2 + 1)^{-1}$ and $\sigma_\nu = [\rho/(1-\rho)]^{1/2}$.

Although y_{it}^* is unobserved, the integer index y_{it} is observed and related to y_{it}^* by the following relationship: $y_{it} = j$ (with $j = 1, 2, 3$) *iff* $\mu_{j-1} \le y_{it}^* \le \mu_j$ where μ_j are unobserved standardized thresholds defining the boundaries between different levels of y_{it}. In particular, we assume that $\mu_0 = -\infty$ and $\mu_J = \infty$. Given the relationship between y_{it} and y_{it}^*, conditional cell probabilities are expressed as:

$$\begin{aligned}\Pr(y_{it} = j \mid x_{it}, z_i) &= \Pr\left(\mu_{j-1} \le y_{it}^* \le \mu_j\right) \\ &= \Pr\left(\frac{\mu_{j-1} - \beta' x_{it} - \gamma' z_i}{\sqrt{1-\sigma_\nu^2}} \le \frac{\nu_i + \varepsilon_{it}}{\sqrt{1-\sigma_\nu^2}} \le \frac{\mu_j - \beta' x_{it} - \gamma' z_i}{\sqrt{1-\sigma_\nu^2}}\right) \qquad (2)\end{aligned}$$

Estimations are performed using maximum likelihood. Individual heterogeneity is unobserved; therefore to obtain the unconditional log-likelihood we need to integrate the conditional log-likelihood. The integration is done with the Gauss-Hermite quadrature (25 points were chosen) (Greene, 2005). Since the parameters of a latent model do not have a direct interpretation *per se*, we refer to marginal probability effects (*mpe*) evaluated at the sample average of the predictors. For inference purposes, we also compute standard errors of *mpe* using the delta method.

2.2 Capturing national business cycle

We first apply the RE-OPM to monthly firm-level qualitative data to draw estimates of the quarterly national business cycle. Specifically, we include in the set of regressors only quarterly dummies. The marginal effects of these dummies on $\Pr(y=3)$ (the probability that the level of production is 'high'), on $\Pr(y=2)$ ('normal') and on $\Pr(y=1)$ ('low') change over time according to business-cycle movements. They are plotted in **Figure 1** (continuous red lines) along with the confidence intervals. For comparison purposes, this figure reports also the cyclical component of the quarterly index of Italian industrial production (black line) (source: ISTAT) extracted through the Baxter e King (BK, 1999) filter. This is the so-called deviance business cycle and is used as benchmark to track business cycle turning points (peaks and troughs) (see also Figure A1).[1] The contemporaneous correlation between the series is rather high (0.67), although the *mpe* on $\Pr(y=3)$ tend to lead the cyclical component of industrial production as the correlation peak is at lead 1 (**Table 1**). Overall, these results encourage us in using the *mpe*'s of quarterly dummies as good proxy of the deviance business cycle.

[1] It is worthwhile observing that the chronology used here may differ from the one based on the classical approach to dating the business cycle. The latter considers the levels of the time series to identify the dates of peaks and troughs that frame economic recession or expansion.

Figure 1 and Table 1

Figure 1 shows that the business cycle stagnated up to the 2005:3 (*trough*) before experiencing a real expansion up to 2008:3 (*peak*). This period represents the first expansionary phase in the considered time span. The following period is characterized by a diminishing activity up to 2009:4 (*peak to trough*). This trough terminates the marked decline caused by the global financial crisis and inaugurates a recovery.

2.3 Measuring the Southern effect

In order to identify the North-South difference in firms' business cycle behaviour, we include in the RE-OPM the interactions between the dummy variable $South$, indicating whether the firm is located in one of the Southern regions,[2] and each quarterly dummy, $South \times q_t$ (Model 1). The two lines in **Figure 2a** indicate the marginal effect of each variable $South \times q_t$ on $\Pr(y=1)$ and $\Pr(y=3)$ respectively. For example, the marginal effect on $\Pr(y=1)$ computed for the interaction term $South \times q_{2009-3}$ would indicate the increase/decrease of the probability of a low level of production in 2009:3 for the firms located in the South with respect to Northern firms: it estimates the difference in business cycle amplitude between North and South.

Figure 2

On average, over the whole sample period, the marginal effect of $South$ on $\Pr(y=1)$ is positive (2.3 per cent), while that on $\Pr(y=3)$ is negative (-0.8 per cent). Therefore, on average, being located in the South influences more the probability of having a low level of production. However, the deviation of Southern firms' business

[2] Namely, Abruzzo, Campania, Apulia, Basilicata, Molise, Calabria, Sicily and Sardinia.

cycle behaviour varies greatly during the period, confirming that the degree of regional "cohesion" along the cycle changes over time (Brasili and Brasili, 2009): standard deviations of the marginal effect of *South* on $\Pr(y=1)$ and on $\Pr(y=3)$ are indeed much higher than the mean (4.5 and 2.0, respectively). These findings do not change significantly if estimated over the period 2005:3-2010:4 (**Figure 2b**), signaling the poor informative content (in terms of business cycles frequencies) of the initial part of the sample. Estimates presented below are therefore carried out over the time-span 2005:3-2010:4, including a well-defined characterization of business-cycle phases.

More specifically, **Figures 2a-2b** show that the South effect on $\Pr(y=1)$ is negligible (-0.3 percent on average) over the period from 2003:2 to 2005:3, while it is highly positive (6.9 percent on average, see **Table 2** first row) in the expansion period 2005:4-2008:3, indicating a difficulty of Southern firms to participate to the recovery. During the recession period (2008:4-2009:4), the marginal effect of *South* on $\Pr(y=1)$ becomes strongly negative (-3.7 percent on average), indicating a lower penalization of Southern firms with respect to Northern ones. Finally, in the upturn started on 2010:1 the *South* effect on $\Pr(y=1)$ is again highly positive (7 percent on average), confirming the lower capacity of Southern firms to join the positive cycle.

Table 2

It is worth noticing that if regional business cycles were not synchronized, a significant marginal effect of *South* could not be correctly interpreted as evidence of regional difference in business cycle amplitude. However this is not the case: evidence on the high degree of regional cyclical co-movements is provided in terms of cross-correlations between the relative frequencies of firms' assessment on production levels to be low (*y*=1), normal (*y*=2) or high (*y*=3) in the North and in the South (**Table 3**).

Table 3

2.4 The role of industry mix

In this section we discuss the results of an analysis aimed to test whether North-South differences over the cycle depend on heterogeneous specialization of the two regions. Among the regressors of the model we include sector dummies (using the 2-digit NACE Rev. 1 classification), besides the quarterly dummies and the interaction variables $South \times q_t$ (Model 2).[3] **Table 4** shows the contribution of sector heterogeneity in explaining firms' business cycle behavior: the log-likelihood moderately increases with respect to Model 1 (including only quarterly dummies and $South \times q_t$); the AIC slightly decreases, while the BIC does not change and the goodness of fit does not considerably improve.

Table 4

Figure 2c displays the marginal effects of $South \times q_t$ while Table 2 reports their mean values and test for their statistical difference against Model 1. The effect of *South* on $\Pr(y=1)$ is again highly positive for both expansion periods (2005:4-2008:3 and 2010:1-2010:4) and highly negative in the recession period (2008:4-2009:4). However, with respect to Model 1, the marginal effects of *South* on $\Pr(y=1)$ in expansion periods increase contrary to the assumption of the industry mix view (see t-tests in parenthesis in Table 2). This means that if North and South had the same industrial structure, the regional difference in business cycle amplitude would be higher. A slight improvement

[3] All manufacturing sectors, defined according to the international standard classification NACE_rev1 (Subsections 15-36), are included.

against Model 1 is observed for the marginal effects of $South \times q_t$ on $\Pr(y=3)$ (1 against 1.3) and on $\Pr(y=1)$ (-2.9 against -3.7) during recession, although this difference is not significantly different from zero. Similar findings are obtained using more detailed sector specification (3 *digit* level) (**Figure A2.1**). This evidence suggests that the industry mix does not help explain regional differences in business cycle. More inspection is therefore needed taking stocks of the rich firm-level information characterizing the dataset.

3. Working hypotheses

In 1966 Siegel posed a relevant issue: "The really interesting question … is whether or not regions differ from each other in cyclical performance for reasons other than industry mix" (Siegel, 1966, p. 44). Results discussed so far show that this is still an open issue and an effort is required to explain regional business-cycle differences in terms of entrepreneurial composition (*firm heterogeneity*). Various strands of literature act as guide for selecting the firm-specific variables able to affect, in our model, the ordinal indicator for the level of production. In what follows, we describe them, with brief discussion of theoretical underpinnings.

3.1 Borrowing constraints (firm size)

The role of microeconomic heterogeneity along the cycle has been firstly emphasized in theories of monetary transmission. Specifically, firm size may be responsible for the transmission of monetary shocks through the so called "balance-sheet" and the "bank-lending" channels (Bernanke and Gertler, 1995; Carlino and DeFina, 1998; Guiso *et al*, 2000; Ehrmann, 2000; Dedola and Lippi, 2000). In the balance-sheet view, given asymmetric information, access to credit depends on the value of firms' assets, acting as collateral. A monetary tightening can reduce the latter by deteriorating balance sheets. Firms of different size are differently exposed to credit squeeze: given lower value of assets and higher amount of required collateral, small firms are likely to be more credit constrained than large ones.

Size matters in monetary transmission also for the bank-lending view. A tighter monetary policy reduces the amount of credit for borrowers when the central bank has a leverage over the volume of intermediated credit. Small firms, more dependent on intermediated credit, are adversely affected; large firms can instead rely on easier access to other forms of external finance (Christiano *et al*., 1996; Ehrmann, 2000; Dedola and Lippi, 2000).[4] Moreover, Carlino and DeFina (1998) have found evidence for the US that asymmetric spatial distribution of small firms is partially responsible for different output effects of monetary policy shocks across regions. This is relevant for our investigation as it is possible to hypothesize that *North-South differences in firm size composition are partly responsible for North-South business cycle differentials (H.1).*

[4] The analyses of the effect of firm size on the transmission of monetary policy shock quoted above are based on the use of Structural VAR approaches. They first identify either sectoral or regional differences in the output effect of unanticipated monetary policy shocks by means of impulse response functions and then use aggregated size composition measures (either at sectoral or regional level) as determinants of the monetary policy impacts. The spirit of our analysis is partially different from these studies since we are essentially interested in assessing the existence of regional disparities in business cycle fluctuations after controlling for most of the firm level factors affecting the mechanism of real and monetary shocks transmission. Moreover, we want to exploit all firm heterogeneity, avoiding to use aggregated size composition measures.

We use the logarithm of the number of employees ($\ln emp$) as proxy for capital market access (ability to borrow), so as we expect a positive effect of firm size on the probability to produce a high level of output, $\Pr(y=3)$, and a negative effect on the probability to produce a low level of output, $\Pr(y=1)$. Uncertainty remains as for the probability to produce a normal level of output, $\Pr(y=2)$. We might also expect time heterogeneity in the influence of firm size, as suggested by the studies quoted above. Thus, we include in our model interactions between firm size and temporal dummy variables indicating whether the economy is in boom or recession. We also control for possible nonlinearities by introducing the square term of $\ln emp$. **Table 5** reports descriptive statistics of the firm-level variables included in our models: on average Southern firms are smaller than Northern ones.

Table 5

3.2 Liquidity constraints

Liquidity constraints are a further possible cause of firm heterogeneity over the cycle. With borrowing limitations, entrepreneurs must finance their investments partly from selling their holdings of money and equity. In this case, different liquidity degrees of equities may affect differently entrepreneurs' investment (Kiyotaki and Moore, 2008).[5]

It is reasonable to assume that the effect of firms' liquidity constraints on the real economy are not randomly diffused over space, at least for two reasons: *first*, firms

[5] An example of a liquidity shock which reduces re-saleability of equity persistently is represented by the recent financial turmoil that made assets that used to be liquid scantly re-saleable. Naes *et. al.* (2010) also document that, in the US case, measures of stock market liquidity contain leading information on the real economy at least since 2nd World War.

located nearby have relatively denser vertical input-output linkages than those located further apart, so as an adverse liquidity shock on an entrepreneur propagate to short-run output of other firms with a distance decay effect; *second*, adverse liquidity conditions may have a regional dimension to the extent they are induced by specific difficulties of the local banking sector. On the grounds of these considerations one may hypothesize *firms' liquidity conditions as possible source of regional business cycle differentiation (H.2).*

Liquiditity conditions are captured by two dummy variables indicating whether the firm considers its liquidity as *good*, *mediocre* or *bad* (reference category). We expect a positive (negative) effect of good liquidity conditions on $\Pr(y=3)$ ($\Pr(y=1)$). Table 5 shows that the percentage of firms with good liquidity conditions is higher in the North than in the South.

Since firms' production decisions are forward looking, it is important to take expectations into account in our analysis. Business opinion surveys collect considerable information on firms' expectations about liquiditiy conditions. We exploit this information by introducing dummy variables indicating, respectively, whether the firm expects for the next period *better*, *equal* or *worse* (reference cateogory) liquidity conditions.

3.3 Export propensity

Even in the export-based view it is not reasonable to assume that regional differences in industry mix properly capture regional differences in export propensity. This is because, as shown by a broad literature (e.g., Basile, 2001; Bernard and Jensen, 2004; Melitz and

Ottaviano, 2008), also within homogeneous industries there is huge firm heterogeneity in export propensity.

Obviously, if exporters were randomly distributed over space, intra-industry firm heterogeneity in export propensity would not help explain regional differentials in the diffusion of international business cycle. Yet, there is evidence of asymmetric spatial distributions of exporters reflecting substantial local spillovers: individual decisions to export are influenced by the presence of nearby exporters (Koenig *et al*., 2010).

We test the *effect of firms' export propensity to explain divergences in North-South business cycles (H.3)*, by including in our model incidence of firm's exports on total turnover (available only at a quarterly base). We expect a positive impact of this variable on $\Pr(y=3)$ and a negative effect on $\Pr(y=1)$: in a small open country like Italy, where the domestic cycle has a close link with the world one, to be an intense exporter gives more opportunities to raise production in booming time and provides more possibilities to smooth production fall in recession (courtesy of market diversification). Again, we allow for the possibility of time heterogeneity by interacting export propensity with temporal dummy variables for booms and recessions. As indicated in Table 5, Northern firms are, on average, more intense exporters than Southern ones.

3.4 Idiosyncratic demand shocks

Heterogeneity of firms along the cycle may also be caused by idiosyncratic demand shifts (Foster *et al*. 2008). Different factors may cause demand variations across producers. Vertical and horizontal product diversifications are a possible cause: negative aggregate demand shocks may distribute unevenly across varieties and different-quality goods for the mere fact that consumers with different tastes experiment heterogeneous demand variations.

Firm-level idiosyncratic demand shifts may induce regional differences in the business cycle if agglomeration is at work. The latter favours spatial concentration of firms producing similar varieties (e.g. industrial districts) or of firms that are tied by vertical input-output links. Moreover, within spatial clusters of small firms it is more likely the formation of persistent customer-supplier relationships. In all these cases a variety-specific demand shock may end up by diffusing to a whole territory with a distance decay effect.

These considerations lead us to *introduce in empirical testing firm-level demand conditions as a further potential source of regional differentiation of business cycle (H.4).* Specifically, we control for the cyclical demand conditions at home and abroad, proxing them by domestic and foreign orders. Firms are asked to indicate whether the domestic and foreign demand level is *high*, *normal* or *low* over the reference period. Thus, we introduce four dummy variables (low levels are used as reference categories) and expect a positive effect of these dummies on the dependent variable. We also exploit information on demand expectations and introduce dummy variables indicating, respectively, whether the firm expects for the next period an *increase*, a *stationarity* or a *decrease* (reference cateogory) of its demand level. Table 5 signals that the percentage of firms with high demand conditions is, on average, higher in the North than in the South.

3.5 Capacity utilization

The issue of firm heterogeneity is also remarked in recent contributions to the real business cycle literature analyzing the role of idle productive capacities in propagating technological shocks (Fagnart et al., 1999). Given limited input substitution in the short run, uncertainty at the time of capacity choices can explain why the installed productive equipments of the economy are usually underutilized in equilibrium. Moreover, idiosyncratic demand uncertainty can explain why some firms produce at full capacity while others face excess capacities. In these models, the proportion of firms with excess capacity plays an important role in magnifying and propagating aggregate technological shocks.

We observe that firm heterogeneity in capacity utilization may also cause regional differences in the business cycle when spatial externalities in firm-level idiosyncratic demand uncertainty are at work. These arguments suggest to test the *role of capacity utilization as another potential source of regional differentiation of business cycle (H.5).* Information on firm's capacity utilization are captured in the survey through three dummy variables indicating if over the reference period firms's productive capacity is in *excess*, *normal* and *below normal* levels (reference category). We expect a negative effect of *excess capacity* on $\Pr(y=3)$ and a positive effect of this variable on $\Pr(y=1)$. As pointed out by Table 5, the percentage of firms with excess capacity utilization is higher in the North than in the South.

3.6 Local Spillover effects

Up to now, we have considered the role of various microeconomic factors as potential determinants of regional business cycle differentials. In the definition of each theoretical assumption, we have mentioned the relevance of spatial contagion. We now explicitly introduce a further hypothesis concerning the role of local externalities, that is *we hypothesize that the individual decision to raise or to reduce the production level is influenced by the production decision of nearby firms* (*H6*). Specifically, we consider the possibility of local externalities at a fine geographical level corresponding to the province (103 in Italy).

Production externalities are not only very likely to be localized, but they are also very likely to depend on the degree of agglomeration of firms in the same area that is by the density of economic activity within the province. The agglomeration of firms in the same area may give rise to both market externalities (input-output linkages) and non-market (technological) externalities, but also to higher competition. An example of market externalities is the cost-sharing devices that allow firms to communicate together on their products to final consumers. Non-market externalities involve informal information transfers, which may benefit local firms through a decrease in variable or fixed costs. We therefore measure local externalities by multiplying the employment density in the province where firm *i* is located and the balance of the production level in the same province, i.e. the difference between the percentage of firms (excluding firm *i*) which evaluate the production level as 'high' and the percentage of firms (excluding firm *i*) which evaluate the production level as 'low'.

Combining *H.1-H.6*, we can say that *regional differences in the entrepreneurial mix (in terms of size, liquidity conditions, export intensity, demand shifts, capacity utilization and expectations) may contribute to explain regional differences in business cycles along with the industry mix and local externalities*.

4. Evaluating the effects of firm heterogeneity in explaining North-South business cycle differentials

4.1 Econometric issues

In section 2.4 we have discussed the role of sectoral composition in capturing North-South business cycle differentials. The model was specified by including sectoral and time dummies and the interactions between the dummy South and time dummies. We now progressively extend that model by including the firm level variables listed above. The aim is to verify whether controlling for the firm-specific variables leads to an abatement of regional disparities in business cycle fluctuations. Before presenting the results of this analysis, however, some methodological issue have to be discussed.

In describing the RE-OPM in section 2.1 we have assumed orthogonality between error components and the set of predictors. However, if the explanatory variables and the individual specific effects are correlated, the RE-OPM may lead to inconsistent estimates. According to Wooldridge (2002), a possible route to overcome this issue consists of including time averages of the time-varying variables ($\bar{x}_i$) as additional time-invariant regressors. Modelling the expected value of the firm-specific error as a linear combination of the elements of $\bar{x}_i$ - $E(\nu_i \mid x_{it}, z_i) = \psi'\bar{x}_i$ - so that $\nu_i = \psi'\bar{x}_i + \xi_i$, we may recast model (1) as:

$$y^*_{it} = \beta'(x_{it} - \bar{x}_i) + (\psi + \beta)'\bar{x}_i + \gamma' z_i + \xi_i + \varepsilon_{it} \qquad (3)$$

where ψ is a conformable parameter vector and ξ_i is an orthogonal error with respect to $\psi'\bar{x}_i$. Also, we assume both errors ξ_i and ε_{it} to be normally distributed conditionally on x_{it}'s and z_i's. In (3), the deviations from the averages per individual capture *shock* effects (*within*-effect), while the means identify *level* effects (*between* effects). Including within and between effects aims at introducing dynamics in the model, because the mean value changes gradually when months pass by (Van Praag et al., 2003).

A further issue is a possible endogeneity problem affecting equation (3). While the information provided by the survey possess the desirable property of being internally consistent (it is the "same" individual firm providing all the requested information on its activity), it is likely to expect that the variables involved may be "intrinsically" endogenous. For example, an entrepreneur anticipating positive (or negative) demand shocks on either domestic or foreign markets could hire (or lay off) employees to adapt its supply capacity to demand. We thus face a reverse causality and a simultaneity issue relative to firm characteristics variables. Moreover, higher production levels raise ex-post employment growth rates. Direction of causality between firms' size and their production behavior is consequently not clearly determined. Parallel issues can be raised on the spillover variable. If firm *i*'s production behavior depends on the surrounding firms' behavior, the latter is itself impacted by firrm *i*'s production performance, which induces a reverse causality problem. Further, simultaneity may be an issue, since unobserved supply-side or demand-side shocks could affect both the production performance of firm *i* and the performance of its neighbors. To control for the potential circularity and simultaneity problems, we lag all right-hand side variables one period.

4.2 Estimation results

We have estimated six nested specifications of equation 3 progressively introducing firm size (Model 3), export intensity (Model 4), liquidity conditions and their expectations (Model 5), demand conditions and their expectations (Model 6), capacity utilization (Model 7) and agglomeration externalities (Model 8). **Table 4** shows that the full specification (Model 8) encompasses all the others, as the AIC and BIC measures reach their lowest values, while R^2 measures achieve their highest values. However, the most consistent improvements in the goodness of fit are observable when the role of ***firm size, liquidity conditions and demand conditions*** are included (in Models 3, 5 and 6; see respectively 3rd, 5th and 6th row of Table 4).

Table 6 reports marginal probability effects (*mpe*) of the firm-specific variables for the full Model (8).[6] As mentioned above, we have estimated both the "Shock effect" and the "Level effect": the first refers to *mpe* of the deviations from the individual average, while the *mpe* for the "Level effect" denote the differences between individuals (a sort of between effect). In the discussion of the results we focus on the "Shock effects", as they mimic the within firm effects obtained from a fixed effects estimation.[7]

Table 6

Firm size has a positive and significant effect in all three sub-periods, while its squared term is significant and enters negatively, depicting an inverted U-shaped relationship, only in the third period. The *mpe* indicate that for an increase of 1% in firm size, the predicted probability of having a low level of production, $\Pr(y_{it} = 1)$, lowers by 13-15% in the expansion periods, while it decreases by 8% in the recession period. Conversely, the probability of having a high level of production, $\Pr(y_{it} = 3)$, increases by 4% in the expansion periods and by 2.5% in the recession period. We can therefore conclude that the effect of firm size is higher in the expansion periods rather than in recession. Moreover, firm size affects more the probability that the level of production is low, rather the probability that is normal or high. Considering that interest rates move in the upside during a boom (and downside in a recession), these results are in line with the theoretical underpinnings depicted above.[8]

[6] The results of the other intermediate models are available upon request.

[7] The fixed thresholds, μ_1 and μ_2, are statistically significant at the 1 percent level and different from 1, pointing out that the three ordinal categories are not equally spaced, refraining us to use OLS techniques.

[8] Imagine, for example, an intervention of the Central Bank that raises the interest rate during an expansion period. According to both the balance-sheet and bank-lending views, the monetary policy shock is likely to

Export intensity has a positive impact on the response variable in all three sub periods: the *mpe* on $\Pr(y_{it}=3)$ are positive and the *mpe* on $\Pr(y_{it}=1)$ are negative both in the expansion and recession periods. This suggests that the greater is firm's export intensity the better is its resilience during downturns (the firm can smooth production exploiting different-market business cycles) and the higher is its capacity to raise production in the upturn (it can benefit from a larger expanding market).[9] These effects have been increasing over time, signalling the driving role of world recovery in shaping the exiting from last recession.

Domestic and foreign demand conditions affect positively firms' production levels confirming the role played by firm-level idiosyncratic demand shocks. A high (either domestic or foreign) demand reduces the probability to have a low production level and increases the probability to have a high production level with respect to the reference variable (firms with low demand). However, the *mpe* associated to $\Pr(y_{it}=1)$ are substantially larger (by a factor of three according to the point estimates) than those

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increase more the probability of a low level of production in the case of small-size firms than in that of the larger ones. The opposite would happen when the Central Bank loosens monetary policy in a downturn. Notice that Italian lending rates to non-financial companies actually rose by about 200 and 100 basis points during the expansion phases 2005:4-2008:3 and 2010:1-2010:4, while they fell by more than 300 basis points during the recession period 2008:4-2009:4. Following theory suggestions, interest rate shifts adversely affected small firms more than large ones in the two expansion periods (and benefited small firms more than large ones in the recession).

[9] It is worth noticing that in an intermediate specification of the model (specified with firm size, sectoral dummies and export intensity), we observe a negative between (level) effect of export intensity for the recession period, indicating that more international market oriented firms tend to suffer heavily from the deteriorated economic climate in the world economy during the last years. In the full model, the coefficient associate to this variable turns out to be not significant.

related to $\Pr(y_{it}=3)$ suggesting that firm-specific demand shocks differentiate the business-cycle behaviour between high- and low-demand firms mainly through the modality of 'low production'. Notice that firm-specific demand captures idiosyncratic shocks: this means that even for firms of the same sector, facing the same aggregate demand, there are more or less opportunities to change production, with respect to other producers, according to the variety they produce, the market where they sell and, possibly, the long-run relationship the have with their clients. Estimation results also point out that production levels are affected by ***expectations*** on future demand in a similar, although less intense, way as for current demand.

Liquidity conditions turn out to be statistically significant in explaining output dynamics for Italian manufacturing firms. In line with expectations, the *mpe*'s of good liquidity conditions on $\Pr(y_{it}=1)$ is negative and the one on $\Pr(y_{it}=3)$ is positive. Again the negative probability effect on the 'low production' is larger (in absolute terms) than the positive marginal effect on 'high production', signalling also for this effect that the 'low production' modality is the one that mainly discriminates firm-by-firm cyclical behaviour. Interestingly, ***expectations*** on future liquidity conditions seem to play a more relevant role than assessment on current conditions. Considering liquidity constraints on entrepreneurs' investment as a source of firm-level differentiation of the business cycle, these findings would indicate that it is the evaluation of liquidity on a long time span that affects current investment decisions and production levels.

Capacity utilization has proved to play a significant role in detecting individual production behaviour over the business cycle. As predicted on the ground of theory, excess capacity has a positive *mpe* on $\Pr(y_{it}=1)$ and a negative *mpe* on $\Pr(y_{it}=3)$, with the former effect (also in this case) being larger than the latter: firms with underutilized capacity are more likely to reduce production (and less likely to increase it) than firms with a normal rate of capacity utilization.

Finally, our results corroborates the hypothesis that ***agglomeration externalities*** affect short term firms' output decisions. Our measure of local externalities has indeed a positive and significant effect on $\Pr(y_{it}=1)$ and a negative *mpe* on $\Pr(y_{it}=3)$: firms located in provinces with higher employment density and diffused high production levels are more likely to increase production (and less likely to reduce it).

4.3 Firm heterogeneity and the North-South divide

To check whether the consideration of firm-specific variables reduces the North-South difference in business-cycle amplitude, we have to control for changes in the dimension of the marginal effects of $South \times q_t$ following the inclusion of such variables in the model. **Figure 2d** shows the marginal effects of $South \times q_t$ after having controlled for sectoral mix, firm heterogeneity and local externalities (Model 8). Comparing Figure 2d (Model 8) with Figures 2b (Model 1, where there are no other controls than quarterly dummies) and with Figures 3c (Model 2, where the only control for industry mix is added), it appears quite clear that North-South differences in firm composition (in terms of size and export propensity) and firm behavior (in terms of demand, liquidity conditions and capacity utilization) as well as in local externalities are mostly responsible for the deviation of Southern firms' from the cyclical behavior of Northern firms. Indeed, with Model 8 confidence intervals of the marginal effects contain the horizontal zero line 10 out 21 times.

From **Table 2** we also learn that the probability of a low level of production, $\Pr(y=1)$, is still higher when the firm is located in the South during the expansion period 2005:4-2008:3 (2.6 per cent, see last row of Table 2) and in the recent period of slow recovery (3 per cent). However, these percentages are much lower than those computed with Model 1 (6.9 and 7.0 per cent, respectively) and Model 2 (7.9 and 7.8 per cent, respectively), indicating that firm heterogeneity is responsible for more than 60 per cent of the deviation of Southern firms' from the cyclical behavior of Northern firms during the periods of boom. This value raises up 70 per cent when considering the probability of high level of production, $\Pr(y=3)$. When we consider instead the recession period 2008:4-2009:4, the negative effect of *South* on $\Pr(y=1)$ with model 8 (-1.8 per cent) is 50 percent lower than in Model 1, but only 37 percent lower than in Model 2, suggesting that sector composition has been responsible along with firm heterogeneity and local externalities in explaining the North-South divide during the downswing period. Moreover, the difference between the average marginal effects of *South* computed with Model 8 and those computed with Model 1 (used as the benchmark) turns out to be statistically significant in all sub-periods (see t-tests in square brackets in Table 2).

Going from Model 2 to 8, it is possible to learn from Table 2 and Figure A2 that during the expansion periods (2004:4-2008:3 and 2010:1-2010:4) the most influent firm-level variables in affecting the marginal effect of $South \times q_t$ are *firm size, liquidity conditions* and *demand conditions*. Specifically, testing more formally the statistical difference between the marginal effects of $South \times q_t$ computed with the eigth different nested models, it comes out that this group of variables is able to capture North-South differences during the expansion periods (see t-tests in parenthesis in Table 2). In recession, the regional difference in business cycle amplitude can only be explained by the joint effects of all the variables (see t-tests in square brackets in Table 2).

All in all, these findings suggest that microeconomic characteristics of Italian firms have considerable predictive power regarding North-South differences in cyclical fluctuations. However, these firm-level characteristics together with consideration of sector composition and local externalities do not help explain the entire observed amplitude divide, in particular over the two expansion periods identified in considered time span. In other words, despite the control for local externalities, firms with similar individual characteristics and belonging to the same industrial sector, but located in different regions, continue to show a different business cycle behaviour. This tells that the *regional institutional environment* (for example, a difference in regional financial institutions) is still important to explain regional business cycle differences.

5. Conclusions

This study represents a first attempt to empirically analyze the role of firm heterogeneity in regional business cycle behaviour. Previous studies based on macroeconomic data have tried to explain business cycle differentials across regions in terms of differences in the sectoral mix, disregarding the potential role of different firm level variables that various strands of business cycle theory have identified as mechanisms of transmission of real and monetary shocks (firm size, liquidity constraints, export orientation, firm specific demand conditions, capacity utilization and expectations).

Using business survey monthly data for a sample of Italy's manufacturing firms spanning the years from 2003 to 2010, we try to assess whether Southern firms' business cycle behaviour is different in amplitude from that of the rest of the country. The results obtained can be read subdividing the time span in four periods: the first one (from the second quarter of 2003 until the third quarter of 2005) is characterized by a stagnation of economic activity; the second one (from the fourth quarter of 2005 until the third quarter of 2008) is a period of boom; the third period (from the fourth quarter of 2008 to the fourth of 2009) is characterized by an economic recession; in the last period there are signs of recovery. Our results suggest that Southern firms are more likely to reduce production levels more than firms located in North in periods of business cycle expansion and *viceversa*. Finally, we assess whether, after controlling for several firm- and sectoral specific factors as well as for local externalities, there are still regional disparities in business cycle fluctuations. Results suggest that regional differences in the sectoral composition partly explain the diverging behaviour of Southern firms during the recession period, while various firm specific variables (specifically firm size, demand conditions and liquidity conditions) capture large part of regional business cycles differences both during periods of recession and boom.

The main contribution of the paper is three-fold. First, it offers a method to identify regional business cycle differentials (in terms of cyclical amplitude) in the absence of official regional statistical information. Secondly, this study represents a first attempt to empirically analyze the role of firm heterogeneity in regional business cycle behaviour based on micro-data. It allows to properly estimate the effect of different factors suggested by the theory. Finally, the relevance of the study stands also on its replicability in other European countries that collect the same kind of business cycle information through the European Commission harmonised questionnaire. The method proposed in the paper can also be extended to analyse inter-sectoral or even inter-country differentials in business cycle behaviour.

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Table 1

Cross correlations between the marginal probability effects (mpe×100) of quarterly dummies on $\Pr(y=3)$ *and the BK cyclical component. Period: 2003-2010*

	0	**1**	**2**	**3**	**4**
lead	0.67	0.67	0.57	0.45	0.34
lag		0.54	0.30	0.05	-0.19

Table 2

Marginal effects (×100) of $South \times q_t$ on $\Pr(y=1)$, $\Pr(y=2)$ and $\Pr(y=3)$

Mean values and t-statistics. Sub-period 2005:4 - 2010:4

Model	**Period**	$\Pr(y=1)$	$\Pr(y=2)$	$\Pr(y=3)$
1 = Quarterly dummies and $South \times q_t$ only	2005:4-2008:3	6.9	-4.5	-2.4
	2008:4-2009:4	-3.7	2.4	1.3
	2010:1-2010:4	7.0	-4.5	-2.4
2 = 1 + Sectoral dummies	2005:4-2008:3	7.9 (2.1)	-5.3 (-2.6)	-2.6 (-1.2)
	2008:4-2009:4	-2.9 (1.1)	1.9 (-1.0)	1.0 (-1.4)
	2010:1-2010:4	7.8 (1.0)	-5.2 (-1.2)	-2.6 (-0.5)
3 = 2 + Firm size	2005:4-2008:3	5.8 (-4.7) [-2.6]	-3.8 (4.9) [2.3]	-2.1 (4.3) [3.0]
	2008:4-2009:4	-3.6 (-1.3) [-0.2]	2.3 (1.2) [0.3]	1.3 (1.4) [0.0]
	2010:1-2010:4	6.3 (-2.1) [-1.1]	-4.1 (2.2) [1.0]	-2.2 (1.9) [1.4]
4 = 3 + Export intensity	2005:4-2008:3	5.7 (-0.2) [-2.8]	-3.8 (0.1) [2.5]	-1.9 (0.3) [3.3]
	2008:4-2009:4	-3.2 (0.8) [0.7]	2.1 (-0.8) [-0.6]	1.1 (-0.9) [-0.9]
	2010:1-2010:4	5.7 (-0.3) [-1.5]	-3.8 (0.3) [1.3]	-1.9 (0.4) [1.8]
5 = 4 + Liquidity conditions	2005:4-2008:3	4.9 (-1.8) [-4.6]	-3.3 (1.6) [4.1]	-1.6 (2.1) [5.4]
	2008:4-2009:4	-2.6 (0.8) [1.4]	1.8 (-0.7) [-1.3]	0.9 (-0.9) [-1.7]
	2010:1-2010:4	5.2 (-0.6) [-2.1]	-3.5 (0.6) [1.9]	-1.7 (0.8) [2.6]
6 = 5 + Demand conditions	2005:4-2008:3	3.0 (-4.4) [-9.1]	-2.1 (3.9) [8.1]	-0.9 (5.5) [11.2]
	2008:4-2009:4	-2.1 (0.7) [2.2]	1.5 (-0.5) [-1.8]	0.6 (-1.1) [-2.9]
	2010:1-2010:4	3.0 (-2.6) [-4.8]	-2.1 (2.4) [4.3]	-0.9 (3.2) [5.9]
7 = 6 + Capacity utilization	2005:4-2008:3	2.9 (-0.3) [-9.4]	-2.1 (0.3) [8.3]	-0.8 (0.3) [11.5]
	2008:4-2009:4	-2.0 (0.2) [2.4]	1.4 (-0.2) [-2.1]	0.6 (-0.3) [-3.2]
	2010:1-2010:4	3.1 (0.2) [-4.7]	-2.2 (-0.2) [4.1]	-0.9 (-0.1) [5.8]
8 = 7 + Agglomeration effect (Full model)	2005:4-2008:3	2.6 (-0.8) [-10.1]	-1.8 (0.8) [9.1]	-0.7 (0.8) [12.2]
	2008:4-2009:4	-1.8 (0.3) [2.7]	1.3 (-0.3) [-2.4]	0.5 (-0.3) [-3.5]
	2010:1-2010:4	3.0 (-0.2) [-4.9]	-2.1 (0.2) [4.3]	-0.9 (0.2) [6.0]

Notes: The table reports the average of *mpe* of *South* computed for each sub-period T, $m_j = \sum_t mpe_t \big/ T$, where $j = 1,...,8$ indicates a model specification. The variance of m_j is obtained as $V_j = \sum_t Var(mpe_t)_t \big/ T^2$. *t*-tests of the difference of the average marginal effects from two different models (*k* and *j*) is computed using the following statistics: $t = (m_k - m_j) \big/ \sqrt{V_k + V_j}$, as the covariance term is zero. *t*-statistics of the differences of marginal effects of each model with respect to the former one are reported in parenthesis; *t*-statistics of the differences of marginal effects of each model with respect to Model 1 are reported in square brackets.

Table 3

Cross correlations between the relative frequencies of assessment on production levels in the North-Center and South

Period		**0**	**1**	**2**	**3**	**4**
2003:2 – 2010:4	*lead*	0.94	0.85	0.69	0.54	0.41
	lag		0.85	0.72	0.60	0.49
2005:4 – 2010:4	*lead*	0.95	0.86	0.68	0.53	0.36
	lag		0.87	0.73	0.61	0.50

Table 4

Model comparison. Log-likelihood, AIC, BIC and R^2 measures. Sub-period 2005:4 - 2010:4

Model	Log-lik.	AIC	BIC	R^2_AN	R^2_M
1 = Quarterly dummies and $South \times q_t$ only	-161,077	322,243	322,693	0.088	0.093
2 = 1 + Sectoral dummies	-160,967	322,059	322,704	0.089	0.094
3 = 2 + Firm size	-160,359	320,868	321,636	0.094	0.099
4 = 3 + Export intensity	-160,234	320,630	321,460	0.095	0.100
5 = 4 + Liquidity conditions and expectations	-145,490	291,159	292,064	0.122	0.130
6 = 5 + Demand conditions and expectations	-135,011	270,225	271,252	0.199	0.220
7 = 6 + Capacity utilization	-134,617	269,445	270,513	0.201	0.223
8 = 7 + Agglomeration effects (Full model)	-132,409	265,033	266,119	0.202	0.224

Notes: R^2_AN is Aldrich and Nelson (1984) R^2 measure, R^2_AN is Maddala (1983) R^2 measure

Table 5

Descriptive statistics

Sub-period 2005:4 - 2010:4

North

	Min	Q(25%)	median	Q(75%)	Q(90%)	Max	mean	Std. dev.	Skew.
Firm size	5	10	20	55	170	20,048	85.3	333.1	20.3
Export intensity	0	0	0	33	70	100	19.0	27.8	1.3

South

	Min	Q(25%)	Median	Q(75%)	Q(90%)	Max	mean	Std. dev.	Skew.
Firm size	5	9	15	32	85	7,545	49.3	253.5	20.5
Export intensity	0	0	0	3	30	100	8.2	19.6	2.7

Percentage of firms

		North	South
Liquidity conditions	Good	30.7	23.5
	Mediocre	55.2	56.3
	Bad	14.0	20.3
Expectations on liquidity conditions	Better	11.6	14.8
	Equal	72.2	69.2
	Worse	16.2	16.0
Domestic demand conditions	High	9.7	8.4
	Normal	54.6	56.8
	Low	35.7	34.8
Foreign demand conditions	High	6.0	3.0
	Normal	28.7	17.3
	Low	19.9	12.5
Expected demand conditions	Increase	24.5	31.3
	Stationarity	60.0	54.8
	Decrease	15.5	13.8
Capacity utilization	Excess	32.6	30.8
	Around normal	60.8	62.4
	Below normal	6.6	6.9
Total number of firms		149,139	49,086

Table 6

mpe (×100) of "shock and level effects" RE-ORM (Full Model 8). Sub-period 2005:4 - 2010:4

		y	Level effect	se	Shock effect	Se
Firm size	Ln emp (2005:4-2008:3)	1	-4.399***	0.665	-12.701***	2.331
		2	3.132***	0.474	9.044***	1.661
		3	1.266***	0.192	3.656***	0.672
	Ln emp^2 (2005:4-2008:3)	1	0.520***	0.083	0.001	0.334
		2	-0.370***	0.059	-0.001	0.238
		3	-0.150***	0.024	0.000	0.096
	Ln emp (2008:4-2009:4)	1	-1.173	0.924	-8.821***	2.933
		2	0.836	0.658	6.282***	2.089
		3	0.338	0.266	2.540***	0.845
	Ln emp^2 (2008:4-2009:4)	1	0.344***	0.117	-0.020	0.420
		2	-0.245***	0.083	0.014	0.299
		3	-0.099***	0.034	0.006	0.121
	Ln emp (2010:1-2010:4)	1	-2.599**	1.002	-15.139***	3.150
		2	1.851**	0.714	10.781***	2.245
		3	0.748**	0.289	4.358***	0.908
	Ln emp^2 (2010:1-2010:4)	1	0.441***	0.125	1.400***	0.431
		2	-0.314***	0.089	-0.997***	0.307
		3	-0.127***	0.036	-0.403***	0.124
Export intensity	2005:4-2008:3	1	-0.055***	0.010	-0.072***	0.012
		2	0.039***	0.007	0.051***	0.009
		3	0.016***	0.003	0.021***	0.003
	2008:4-2009:4	1	-0.011	0.013	-0.088***	0.019
		2	0.008	0.009	0.063***	0.013
		3	0.003	0.004	0.025***	0.005
	2010:1-2010:4	1	-0.073***	0.014	-0.105***	0.020
		2	0.052***	0.010	0.075***	0.014
		3	0.021***	0.004	0.030***	0.006
Liquidity conditions	Good	1	-3.730***	0.956	-6.332***	0.418
		2	2.656***	0.681	4.509***	0.299
		3	1.074***	0.276	1.823***	0.121
	Mediocre	1	-3.615***	0.994	-3.645***	0.337
		2	2.574***	0.708	2.595***	0.241
		3	1.041***	0.287	1.049***	0.097
Expectations on liquidity conditions	Better	1	-6.246***	1.682	-17.214***	0.413
		2	4.448***	1.199	12.259***	0.309
		3	1.798***	0.485	4.956***	0.127
	Equal	1	-1.776	1.262	-11.517***	0.307
		2	1.265	0.899	8.201***	0.228
		3	0.511	0.363	3.315***	0.093

		y	Level effect	se	Shock effect	se
Domestic demand conditions	High	1	-122.404***	1.783	-35.370***	0.431
		2	87.165***	1.434	25.188***	0.362
		3	35.238***	0.602	10.183***	0.154
	Normal	1	-61.296***	1.045	-18.915***	0.267
		2	43.631***	0.817	13.469***	0.216
		3	17.638***	0.339	5.445***	0.092
Foreign demand conditions	High	1	-26.309***	2.045	-15.978***	0.562
		2	18.735***	1.463	11.378***	0.409
		3	7.574***	0.593	4.600***	0.167
	Normal	1	1.696**	0.748	-5.779***	0.342
		2	-1.208**	0.533	4.116***	0.245
		3	-0.488**	0.215	1.664***	0.099
Expected demand conditions	Increase	1	-4.619***	1.725	-9.597***	0.348
		2	3.289***	1.229	6.834***	0.254
		3	1.330***	0.497	2.763***	0.103
	Stationarity	1	-6.908***	1.626	-10.445***	0.308
		2	4.919***	1.159	7.438***	0.226
		3	1.989***	0.469	3.007***	0.093
Capacity utilization	Excess	1	-6.860***	1.521	0.951**	0.461
		2	4.885***	1.084	-0.677**	0.329
		3	1.975***	0.438	-0.274**	0.133
	Around normal	1	-8.834***	1.579	-5.236***	0.438
		2	6.291***	1.125	3.729***	0.313
		3	2.543***	0.455	1.507***	0.127
Agglomeration effects		1	-0.359**	0.166	-0.806***	0.133
		2	0.255**	0.118	0.574***	0.095
		3	0.103**	0.048	0.232***	0.038
	ρ		0.059*** (0.002)			
	μ_1		1.303*** (0.056)			
	μ_2		3.668*** (0.056)			

Note. The table reports marginal effects of “Shock and level effects”. *, ** and *** indicate significance at the 10, 5 and 1 percent levels, respectively. Standard errors are (in parentheses) are computed using the Delta method. μ_1 and μ_2 are the estimated thresholds defining the boundaries between different classes of the response variable. The model also included a full set of sectoral dummies, quarterly dummies and interactions between the dummy *South* and quarterly dummies.

Figure 1 - *Cyclical component of the industrial production index and marginal probability effects of quarterly dummies*

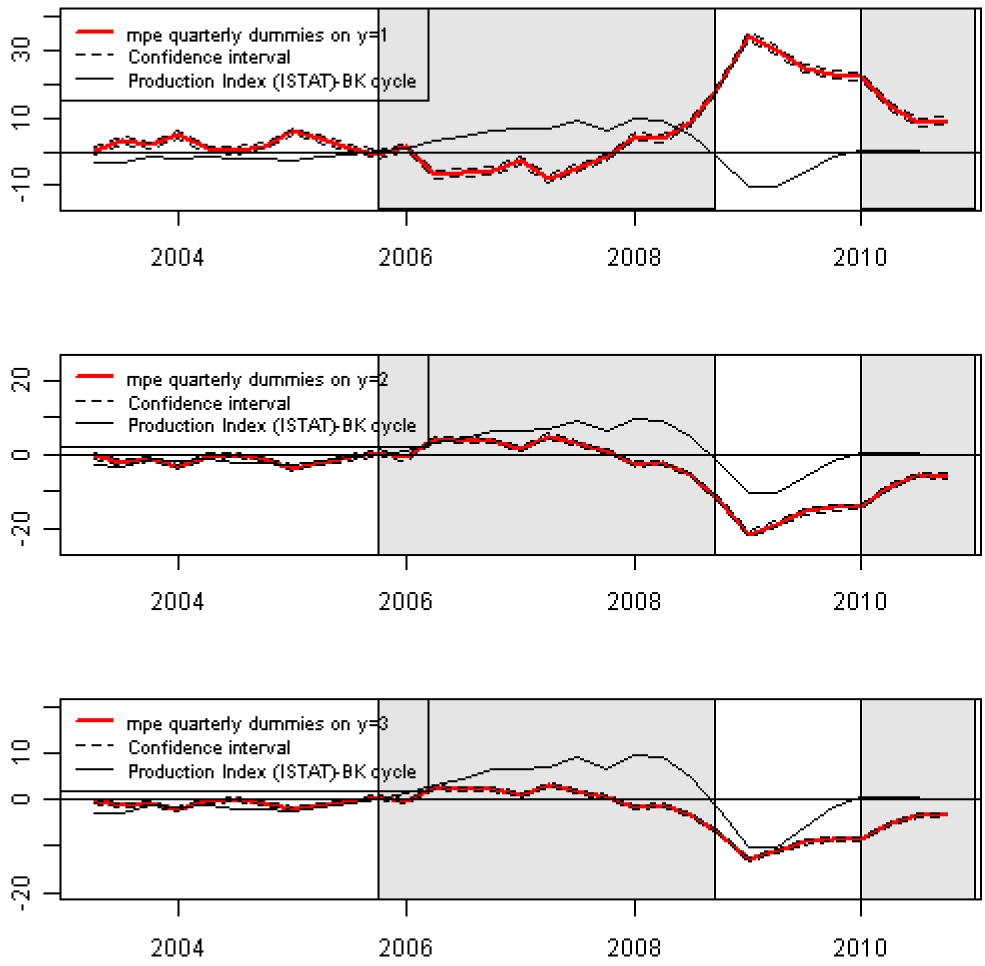

Figure 2 - *Marginal effects of South*

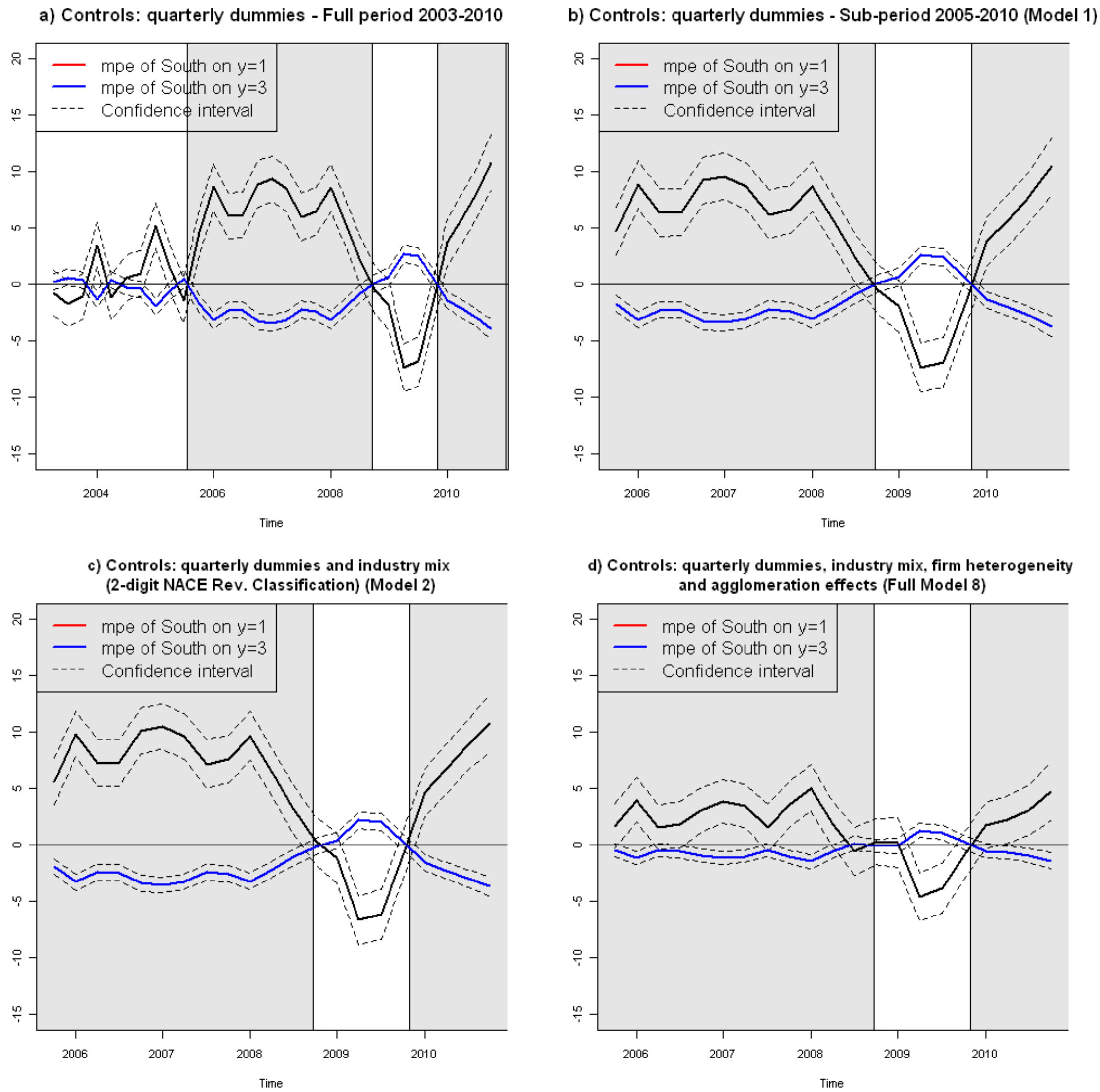

Figure A1 - *Italy's Industrial Production index*

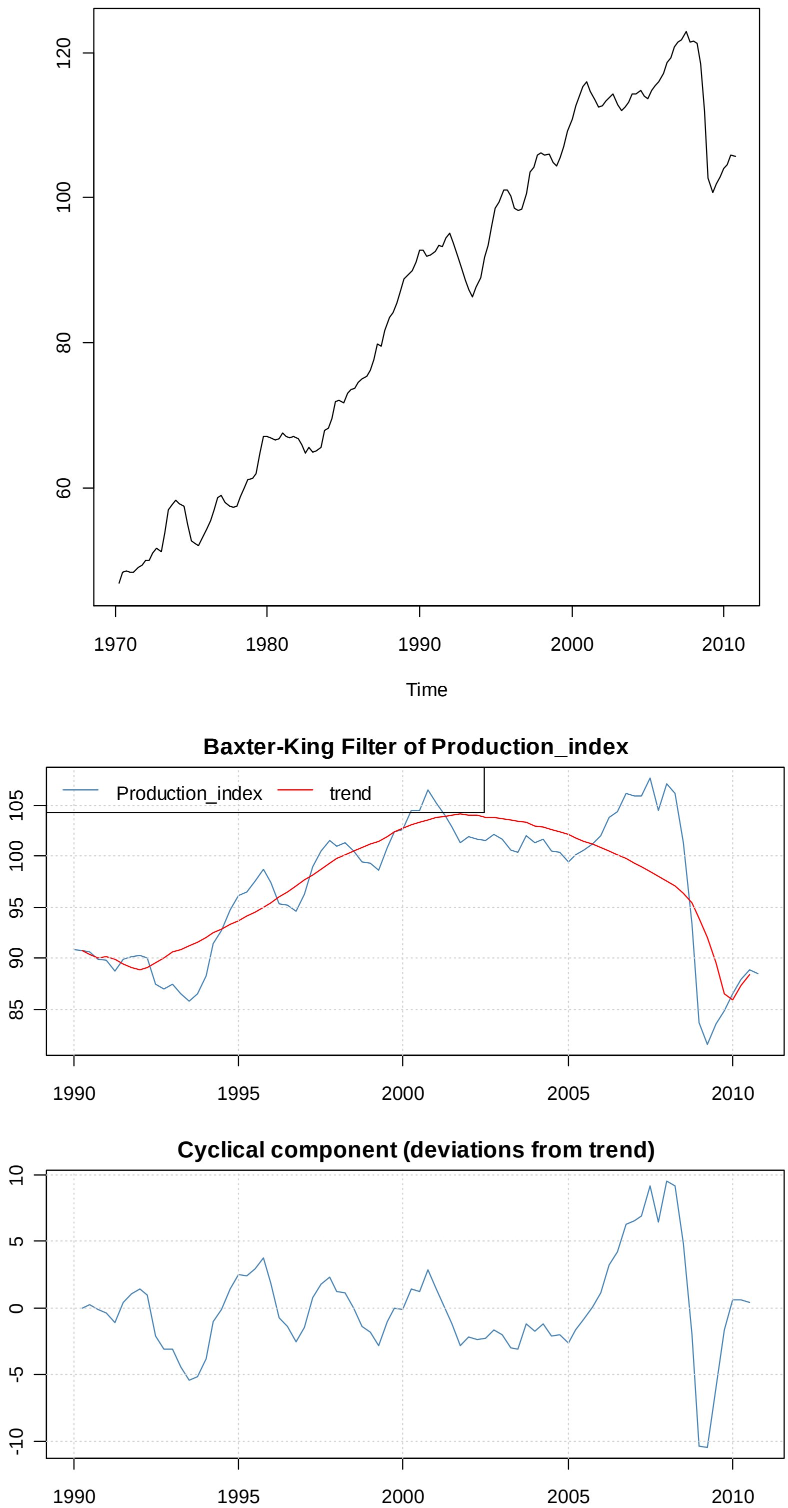

Figure A2 - *Marginal effects of South*