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## Are Small Firms more cyclically Sensitive than Large Ones? National, Regional and Sectoral Evidence from Brazil.

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# Are Small Firms more cyclically Sensitive than Large Ones? National, Regional and Sectoral Evidence from Brazil<sup>1</sup>

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## Abstract

An important issue facing policymakers is the degree to which fluctuations in economic activity affect employment in large and small businesses across sectors and regions. These issues are particularly relevant for developing countries, as they matter for the understanding of the labour market dynamics, and for devising national, sectoral, and regional labour policies. The unique data used in this paper was constructed using the CAGED database, which is a comprehensive administrative dataset collected monthly by the Ministry of Labour in Brazil covering the formal sectors of the economy. Thus, monthly employment data for small and large establishments across regions and industries were constructed from 2000:1 to 2009:6, resulting in a total of 115 observations for each state and industry across the two-digit sectoral classification. This paper draws on the work of Moscarini and Postel-Vinay (2009) who analyse the correlations between measures of relative growth rate of employment by size class and business cycle conditions. As in their work, this paper uses the detrended difference in employment growth rates between large and small firms as a measure of the relative performance of firms in different size bins. The empirical evidence suggests that in Brazil small firms are more sensitive to business cycles conditions, a result that contradicts Moscarini and Postel-Vinay (2009). The differential growth of employment between large and small establishments is negatively correlated with measures of business cycles, indicating that SMEs shed proportionally more jobs in recessions and create more in booms. This pattern is also observed in most of the Brazilian States; however, there is a substantial variation in the manner the difference in employment growth rates correlates with business cycles at the regional level. Besides, the sectoral analysis supports the evidence that formal small businesses are more sensitive than large ones in all sectors but in commerce. This finding is important and might be related with the fact that the commerce sector relies heavily on informal workers that are the first ones to be hired or made redundant over the business cycles. Therefore, the evidence from this paper suggests that in a developing country context small establishments are more sensitive than large ones to business cycle conditions.

*Keywords:* Firm size, jobs flows, business cycles, market structure.

*JEL Classification:* J21, J40, E32

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<sup>1</sup> I would like to thank Rosângela Farias and Simone Mansour Taouk for their valuable help in the construction of the data used in this paper. Finally, I would like to thank the Brazilian Ministry of Labour for providing access to RAIS database.

## Introduction

The output of economies does not grow smoothly towards their steady-state, and movements about the trend in output, or business cycles, in any country can be characterized by a stochastic disturbed difference equation of very low order (Lucas, 1977). Since the early days of the study of business cycles in the U.S to more recent times, it has been an empirical regularity that the pattern of total employment is pro-cyclical and follows the fluctuation of real GDP very closely (e.g. Burns and Mitchell 1946; Moore 1961; Kydland and Prescott 1990; Hodrick and Prescott 1997; Veracierto 2008). Theoretically but for different reasons, different traditions, such as, Real Business Cycle (RBC) models and new Keynesian models also predict that employment variation is pro-cyclical in the short run<sup>2</sup>. However, little is known about the behaviour of the level of employment in small businesses (SMEs) during business cycles and further studies could provide valuable information about the best policy to be followed in order to dampen employment and economic fluctuations. The paucity of evidence on the behaviour of SMEs during business cycles is surprising given that the SME sector employs the majority of the labour force, both in developed or in developing countries<sup>3</sup>.

Brock and Evans (1989), for instance, argue that research on the role of SMEs in the labour market during business cycles can provide critical information for the sensible formulation of government policy. They conjecture that a different behaviour of SMEs during cycles is likely to be related with stronger financial liquidity constraint that they face. However, to date, the literature on the sensitivity of SMEs to business cycles is still scarce. In a rare and very influential paper on this subject, Gertler and Gilchrist (1994) provide evidence that suggests that small firms are more sensitive to cyclical conditions and to monetary shocks. They show that SMEs contract substantially more relative to large firms after tight money events and account for a significantly disproportionate amount of the resultant decline in manufacturing. On the other hand, a recent paper by Moscarini and Postel-Vinay (2009) appears to contradict this view regarding the sensitivity of small firms to cyclical conditions. Using employment series they present new empirical evidence for a set of countries (and extensive evidence at regional and sectoral level for the U.S) that suggests that large firms or establishments are more sensitive than small ones to business cycle conditions.

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<sup>2</sup> See Stadler (1994) for a review of Real Business Cycle models and Gordon (1990) for an extensive review of New-Keynesian economy.

<sup>3</sup> See Ayyagary et al. (2007) and Beck et al. (2005).

According to their evidence, larger employers shrink faster, or expand more slowly, during and after a typical recession, and create more of their new jobs late in the following expansion.

The limited attention paid to the analysis of the behaviour of SMEs during the cycles is also expressed by scant evidence for developing countries. Hence, more attention to the documentation of the sensitivity of SMEs to cycles, particularly in terms of employment, is also needed in developing countries. This is because the existing literature has documented that business cycle fluctuations and labour market conditions differ significantly in developing and developed countries. Rand and Tarp (2002), Neumeyer and Perri (2005) and Aguiar and Gopinath (2007), for instance, point out some important differences in the pattern of the business cycles in developing economies. Developing countries tend to be prone to sudden crises, often making it difficult to discern economic regularities. Their economies are substantially more volatile when compared with developed countries because the volatilities of output, real interest rates, and net exports are higher. Developing countries are often characterized by frequent regime shocks due to dramatic reversals in fiscal, monetary, and trade policies observed in these economies and the evidence indicates that economic activity observed at business cycle frequencies in emerging markets is driven by shocks to a stochastic trend, unlike developed economies that have relatively stable trends. Regarding the labour dynamics, Harrison (1997) points out some distinctive characteristics of labour market adjustments in developing countries and calls for more research on these countries.

Hence, the evidence drawn from a developing country data might also be important to construct theoretical models that take into account features of the SME sector that are particularly important for the business cycles in developing countries. In addition, this evidence might also be important to devise social public policies to deal with higher levels of unemployment during a downturn.

The aim of this paper is to address this gap in the literature by providing an analysis of the behaviour of SMEs' employment during the business cycles in a developing country. In particular, this paper seeks to document if the employment growth in SMEs is more sensitive to cycles than employment growth in larger firms in Brazil. It follows Moscarini and Postel-Vinay (2009) and analyses the behaviour of the difference in growth rates between large and small firms during business cycles. Besides, this paper investigates the pattern of this growth difference across states and sectors. This is important because developing countries present wider disparities in wealth than developed countries. Therefore, the study of different SME sector's employment sensitivity across regions is important to determine the

appropriate labour market and social public policy focus across regions. Depending on how firms of different size bins respond to cyclical fluctuations, policy makers might need to take a different decision concerning the stabilization of employment at regional level during the economic cycles.

This paper intends to contribute to the literature by documenting extensively the relative behavior of the employment series of establishments in different size bins across regions and sectors in Brazil and the remainder of the paper is as follows. Section 2 presents the basic framework to check how sensitive are small businesses relatively to larger ones and describes the unique data used in this paper. Section 3 presents the procedures used to detrend the series and extract the cyclical component of interest of our analysis. Section 4 discusses the results at national, regional and sectoral levels. Lastly, the final section concludes.

## 2. Basic Framework and Data

### 2.1 Basic Framework

This section presents the framework used to shed some light on how sensitive are small and large firms to business cycle fluctuations in Brazil. We draw on the work of Moscarini and Postel-Vinay (2009), who analyse the correlations between measures of relative growth rate of employment by size class and business cycle conditions. They suggest the use of the difference in employment growth rates between large and small firms as a measure of the relative firm's performance that can be expressed as:

$$GD_t^j = \left[ \frac{(L_t^j - L_{t-1}^j)}{L_{t-1}^j} \right] - \left[ \left( \frac{(S_t^j - S_{t-1}^j)}{S_{t-1}^j} \right) \right] \quad (1)$$

where  $L$  is the employment level of large firms (LEs) ,  $S$  the employment level in SMEs,  $j$  is an index for each region and sector, and  $t$  denotes time. Consequently,  $GD$  is the difference in employment growth rates between LEs and SMEs. Following Postel-Vinay (2009), the aim now is to observe how the deviation from the trend of this difference correlates with business cycle conditions in Brazil as whole, in its states, and across sectors.

The main measure of business cycle conditions used in this paper is based on the detrended real wholesale revenue index. The main reason for using this indicator is the

availability of this measure for every Brazilian state, which allows us to perform a more comparable regional analysis using a local measure of business cycle. Alternative measures of business cycle conditions will be employed for the case of the country as a whole, since we have a broader range of measures available.

As will be discussed in the next section, we use the band-pass filter developed by Christiano and Fitzgerald (2003), and the Hodrik-Prescott (HP) filter to extract the cyclical component of the series.

## 2.2 Data

To analyse whether SMEs are more sensitive to business cycle conditions than LEs, a dataset of the aggregate results for the employment level of individual establishments to account for the employment levels at different size bins at national, regional, and sectoral levels was constructed. The employment series used in this paper were constructed using CAGED (*Cadastro Geral de Empregados e Desempregados*) database. This is a comprehensive administrative census data set collected monthly by the Ministry of Labour. CAGED covers the main type of formal employment link, "*celetistas*", covering approximately 32.5 million workers in the formal sector on 31/07/2009. Every month, establishments are obliged to report any employment variation to the Ministry of Labour, in this sense CAGED is a dataset of job flows<sup>4</sup>. If an establishment fails to report this variation, it faces automatic fines proportional to the length of the delay and the number of declarations omitted. However, because the severance payment is based on CAGED records, employers and workers have a strong incentive to fulfil CAGED records.

This database covers the formal sector of the economy providing information pertaining to employment variation that can be retrieved according to various regional and sectoral levels. The series were constructed by means of a two step procedure used by the Ministry of Labour. At the beginning of each year, the stock of workers across sectors and regions is provided by the Ministry of Labour. Subsequently, we use CAGED database to retrieve the monthly net employment variation across sectors and regions backwards to construct the series. We used this procedure to construct the employment series for SMEs and

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<sup>4</sup> CAGED stands for General Register of Employed and Unemployed and it is similar to the American Business Employment Dynamics (BED) dataset in the sense that it is a dataset of job flows.

LEs nationally, regionally, and sectorally<sup>5</sup>. The initial employment stock is based on its values in 01/01/2009; therefore, we also used net employment variation forward until 07/2009 to construct the series. The software SGT micro, provided under request to the Ministry of Labour was used to retrieve the net employment variation from CAGED. The monthly employment data is split into 27 federal units and classified according to the 2-digit sectoral classification of the IBGE (*Instituto Brasileiro de Geografia e Estatística*)<sup>6</sup>. We were able to construct monthly employment data across states and sectors from the first point available in time with information disaggregated by size bin 1:2000 to 7:2009, which includes the last recession. Therefore, we have 115 observations for each state and for the 2-digit IBGE's sectoral classification<sup>7</sup>. The series constructed from the information retrieved from CAGED are not seasonally adjusted, therefore, all series were seasonally adjusted before extracting the cyclical components<sup>8</sup>.

It is worth noting that the classification of SMEs varies across and within countries. Ayyagari et al. (2007), for instance, provide a thorough discussion about the difficulties of collecting SMEs data and of finding a common measure of SMEs. They show that the most common criterion used to classify SMEs is based on employment information, using a cut-off to define SMEs that generally varies between 100 and 500 employees, with a large number of sources using 250 employees as a cut-off. For instance, the European Union and Beck et al. (2005) adopt 250 employees as a cut-off to classify SMEs. Therefore, the cut-off of 250 employees seems to be a reasonable choice based on exiting classifications and is also in line with the literature on SMEs. Alternatively, as a sensitivity analysis, we follow Moscarini and Postel-Vinay (2009) who suggest cut-offs of < 50 and > 500 employees to classify SMEs and LEs, respectively. Therefore, we have two series for the difference in employment growth rates between large and small firms. The first is the difference in employment growth rates between employment growth rates in establishments with more than 250 and less than 250 employees, and the second is the same difference but in establishments with more than 500 and less than 50 employees.

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<sup>5</sup> The Ministry of Labour provides access only to the figures for the country as a whole. To obtain the stock of workers (not the series) for states and sectors in specific size bins a special request should be made to the Ministry of Labour. We thank Rosangela Farias and Simone Mansour Taouk that kindly provided the stock of workers necessary to construct the series used in this paper.

<sup>6</sup> Brazilian Institute of Geography and Statistics.

<sup>7</sup> According to the Ministry of Labour, for public administration, agriculture and construction sectors there are some problems with data quality stemming from inaccurate responses in small business and small municipalities. Please refer to Appendix A for the definition of the 2-digit sectoral classification and denomination of Brazilian states.

<sup>8</sup> All data is correspondingly seasonally adjusted using the multiplicative ARIMA X-12 procedure.

Complementarily, various measures regarded as coincident with business cycles were collected, at monthly and quarterly frequency. For the variables available at monthly frequency, the seasonally adjusted real wholesale revenue index for Brazil and every Brazilian state were retrieved from IBGE, these series are only available from 1:2000 onwards and matches the availability of the employment series. The seasonally adjusted industrial production in manufacturing index is also obtained from IBGE. Finally, we also used lagged unemployment as a measure of business cycle conditions as in Moscarini and Postel-Vinay (2009). Unfortunately, due to methodology changes, the official series of unemployment for Brazil before and after the year of 2002 are not compatible<sup>9</sup>. As an alternative, we use the unemployment rate in the most important metropolitan regions of Brazil calculated by Dieese (*Departamento Intersindical de Estatística e Estudos Socioeconômicos*)<sup>10</sup>. A limitation of the data at monthly frequency is the paucity of information on GDP per capita at this frequency. To overcome this limitation and provide a sensitive analysis, we collect the current quarterly data of GDP and deflated it by domestic price index, both were obtained from IBGE. The real GDP series was then seasonally adjusted before extracting its cyclical component.

One important element of any data specification is the choice of the data frequency. The analysis performed in this paper is mainly based on results using monthly data. The use of this frequency offers some advantages over lower frequency data. It offers the computational advantage that more degrees of freedom are available, especially in our context of a limited time span of 10 years. Finally, given that the Brazilian business cycle is characterised by a high degree of volatility (e.g. Kanczuc, 2004; Ellery et al, 2002), working with monthly data also has the advantage in that it reduces the risk of major structural changes in the estimated relationships. Moreover, the quarterly analysis is also reported and provides similar qualitative results.

### **3 Detrending the Series**

In order to analyse the relationship between the deviations from the trend of the difference in employment growth rates between large and small firms and the business cycle conditions, the first task is to detrend the series.

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<sup>9</sup> Moscarini and Postel-Vinay (2009) do not explicitly describe what series of unemployment they used for their results about Brazil in their study.

<sup>10</sup> Unemployment rate of the metropolitan areas of Belo Horizonte, Porto Alegre, Recife, Salvador, São Paulo, and Distrito Federal. Dieese stands for Inter-Union Department of Statistics and Socio-Economic Studies.



Hodrick and Prescott (1981, 1997), for instance, propose a procedure for representing a time series as the sum of a smoothly varying trend component and a cyclical component. Their procedure is based on the prior knowledge that the growth component varies smoothly over time and that a time series  $y_t$  is the sum of a growth component  $\tau_t$  and a cyclical component  $c_t$ <sup>11</sup>:

One important issue related with the HP filter is the selection of the smoothing parameter,  $\lambda$ . Hodrick and Prescott suggest  $\lambda = 1,600$  as a value for the smoothing parameter using quarterly data. While the value of  $\lambda = 1,600$  seems to be the consensus in the literature, there is less agreement when we move to other frequencies. Despite this dispute, Ravn and Uhlig (2002) consider that it is likely that the HP filter will remain one of the standard methods for detrending series. They study how the Hodrick-Prescott filter should be adjusted when changing the frequency of observations, and suggest that the smoothing parameter should be adjusted accordingly to the fourth power of a change in the frequency of observations. Therefore for  $\lambda = 1600$  using quarterly data, this imply that for annual data  $\lambda = 1600/4^4 = 6.25$ , and for monthly data  $\lambda = 1600 (3^4) = 129600$ .

However, the HP filter has some limitations. Baxter and King (1999) argue that the detrending and smoothing techniques to carry out trend-cycle decomposition in the spirit of the HP filter require only that the detrending procedure produce a stationary business-cycle component but do not explicitly specify the statistical characteristics of business cycle. In this sense, they ignored the definition of a business cycle. Additionally, they also point out that the Hodrick-Prescott filter performs badly near the ends of the samples and allow high-frequency components to be passed by through the filtering procedure. In the same line, Pollock (2000) argues that whereas the HP filter is an excellent device for representing the broad trend of a time series, it often fails in the task of generating a detrended series.

Christiano and Fitzgerald (2003) consider the HP filter as a good device for extracting the business cycle and higher-frequency components in quarterly data. However, they suggest the use of a band-pass filter, which performs better when we have annual or monthly data. Besides, the band-pass filter can explicitly specify the statistical characteristics of business cycles. We follow Burns and Mitchell's (1946) definition of business cycles as being the cyclical components of no less than six quarters (1.5 years) in duration, and that typically last fewer than 32 quarters (eight years). Therefore, the band-pass filter will pass through components of the time series with periodic fluctuations between six and 32 quarters, while

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<sup>11</sup> For more details on the HP filter see Appendix B.

removing components at higher and lower frequencies<sup>12</sup>. Christiano and Fitzgerald (2003) show that HP filter performance near the end points is relatively poor compared with their band pass random walk filter, and that it also outperforms the HP filter outside the tail areas. Therefore, Christiano and Fitzgerald's (2003) band-pass filter is our preferred device to extract the cyclical component, especially for our data at monthly frequency<sup>13</sup>. Nevertheless, results for the HP filter will also be provided in the Appendix C and provide similar picture.

## 4 Results

This section presents the results for the correlations of the detrended series based on equation (1) and the business cycles using Christiano and Fitzgerald's (2003) band-pass filter. Initially, the results for the monthly data will be presented but the latter part of this section provides alternative results using quarterly data.

### 4.1 Monthly Analysis

To provide a preliminary insight into the behaviour of the employment series of establishments of different sizes, Figure 1 presents the detrended employment growth rates (normalized) for SMEs and LEs plotted with a measure of business cycle represented by the detrended real wholesale series, from Jan/2000 to July/2009<sup>14</sup>. The figure also presents the shades to identify the periods of contractions experienced by the Brazilian economy dated by the Brazilian Economic Cycle Dating Committee (CODACE) of the Fundação Getúlio Vargas (FGV)<sup>15</sup>. This dating of peaks and troughs is similar to that found by Issler et al. (2009) for the monthly coincident index of the Brazilian economy for the overlapping period of analysis. Both business cycles dating of the Brazilian economy are reported in Table 1.

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<sup>12</sup> For more details on the Christiano and Fitzgerald's (2003) band-pass filter see Appendix B.

<sup>13</sup> They also show that their filter also outperforms the Baxter and King (1999)'s band-pass filter.

<sup>14</sup> All series are normalized as deviation from the average divided by the standard deviation. The alternative version of this figure using the raw growth rates (instead of detrended series) is presented in the Appendix D and provides a similar insight.

<sup>15</sup> As the NBER cycle dating committee, CODACE defines cycles with a considerable delay. Therefore, the last shaded area that starts in the third quarter of 2008 ends when the official GDP measured by IBGE presented positive growth compared with previous quarter, a technical indication of the end of the recession in Brazil.

**Table 1 - Brazilian Business Cycles Dating**

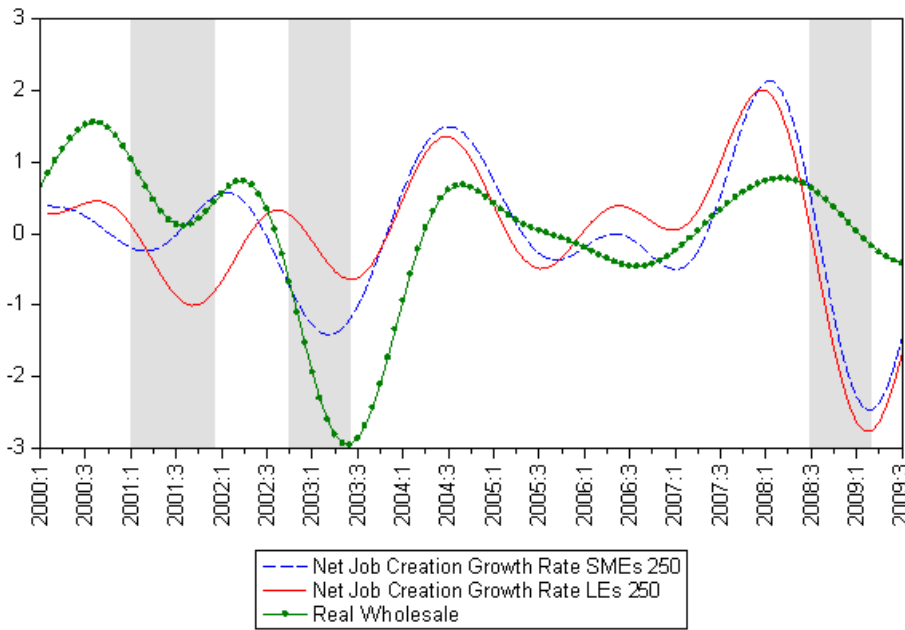
CODACE		Issler et al. (2009)	
Quarterly Data		Monthly Data	
Peaks	Troughs	Peaks	Troughs
1980:Q4	1983:Q1	1980:M10	1981:M09
		1982:M07	1983:M02
1987:Q2	1988:Q4	1987:M02	1988:M10
1989:Q2	1992:Q1	1989:M06	1990:M04
		1991:M07	1991:M12
1995:Q1	1995:Q3	1994:M12	1995:M07
1997:Q4	1999:Q1	1997:M10	1999:M02
<b>2001:Q1</b>	<b>2001:Q4</b>	<b>2000:M12</b>	<b>2001:M09</b>
<b>2002:Q4</b>	<b>2003:Q2</b>	<b>2002:M10</b>	<b>2003:M06</b>
<b>2008:Q3</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

Note: In italics and bold are the dates within the time period of our analysis

As we can see in Figure 1, it is noteworthy that our measure for cycles (real wholesale) presents sharp decline at about the beginning of the shaded area and show the improvement of business cycle conditions after the recessions. This is an indication that real wholesale index performs well as our indicator of business cycle conditions.

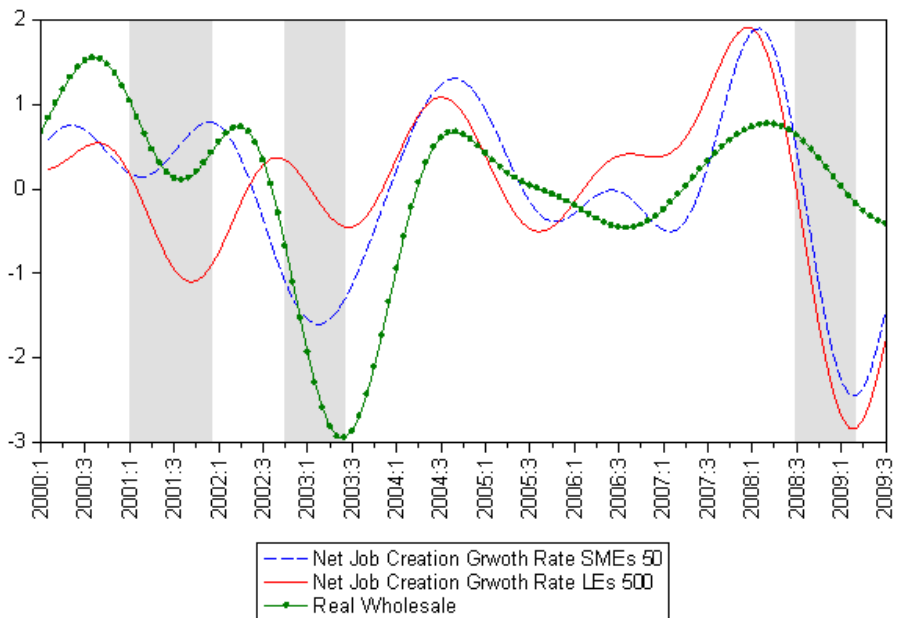
Turning to the pattern of the employment series, the first thing to note is that overall both series seem to present a pro-cyclical behaviour. This is in line with the well documented fact that employment series are pro-cyclical and that when an economy is in a downward (upward) phase of a business cycle, changes in employment are negative (positive) (Liu and Spector, 2005). However, from this picture, it is difficult to observe a clear pattern of the sensitivity of the employment series in SMEs and LEs. The first recession of the decade, which started in 2001, reflected a sum of factors such as the collapse of the Argentinean Peso, electricity shortage in July<sup>16</sup>, and the September 11<sup>th</sup> episode at the end of the year. In this period, the employment growth rates in LEs seems to be hit harder, suggesting that LEs were more sensitive to business cycles fluctuations. It is also important to bear in mind that the 2001's recession might have imposed higher constraints on LEs that are more electricity intensive. On the other hand, in the subsequent recession in 2003, SMEs seem to suffer much more than LEs and their employment growth rate present a steeper relative decline during this recession. Finally, the last recession of the period of analysis shows that SMEs and LEs were hit hard by the financial crisis. Therefore, this picture provides mixed evidence on which firm size is more sensitive to business cycle conditions.

<sup>16</sup> In 2001, Brazil experienced an energy shortage that led to rationing for 9 months, from June 2001 to March 2002 caused by lower levels of investment in the energy sector together with an adverse climate conditions that led to the 2001 drought that provided less rain to the Brazilian Dams (see Carvalho 2006).



**Figure 1 – Employment Growth Rates in LEs and SMEs (detrended)**

Following Postel-Vinay (2009)’s definition of firm size, the alternative version of Figure 1 using the cut-offs of < 50 employees for SMEs and >500 employees for LEs is presented in Figure 2. This alternative classification of size presents very similar patterns, and seems to exacerbate the patterns in the behaviour of the LEs and SMEs’ employment series when comparing with Figure 1.

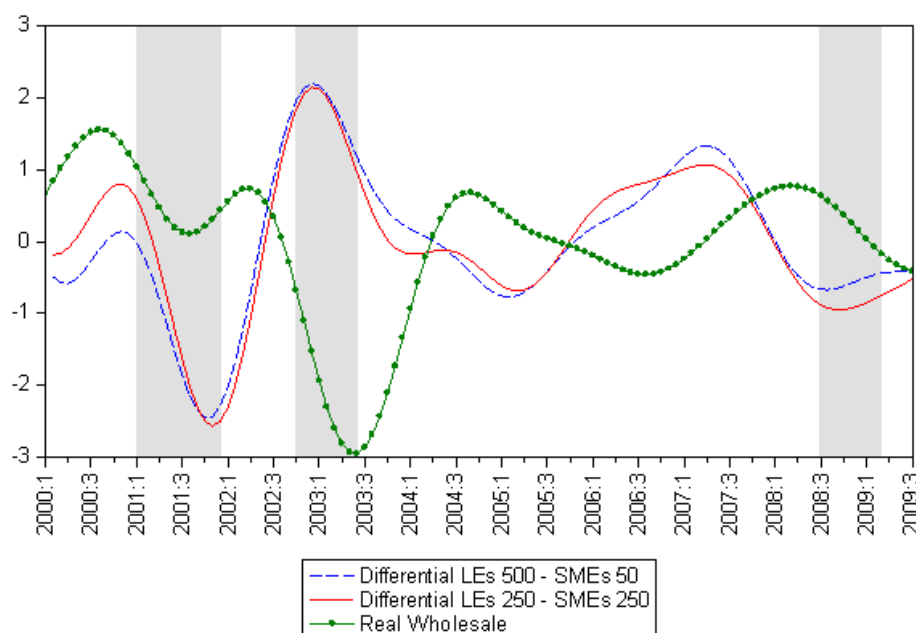


**Figure 2 – Employment Growth Rates in LEs and SMEs (detrended)**

In order to better visualise the relative behaviour of LEs and SMEs during the business cycles, we calculate the difference in employment growth rates between LEs and SMEs as in Equation (1), and then detrend these series. To contrast the pattern of these series with the behaviour of the business cycle conditions we plot it against the detrended series of the real wholesale index. If the difference in employment growth rates is counter-cyclical, then SMEs are more sensitive to business cycles than LEs. Figure 3 shows the difference in growth rates using the two alternative cut-offs ( $< 50$  and  $< 250$  for SMEs, and  $> 250$  and  $> 500$  for LEs) against the detrended real wholesale series. Using both cut-off criteria, the difference in growth rates seems to be counter-cyclical, indicating that SMEs shed proportionally more jobs in recessions and gain more in booms. The correlations between the differential growth series and real wholesale (Table 2) are negative and confirm the visual impression we get from this figure.

This evidence contradicts the results provided by Moscarini and Postel-Vinay (2009), who state that large firms are more sensitive to cycles than small ones. It also contradicts the predictions of Moscarini and Postel-Vinay (2008)'s theoretical model. They suggest a model based on heterogeneous firms competing for workers in the labour markets. Given that the level of productivity is positively associated with the size of the firms, their model is in line with the argument that LEs are more sensitive to business cycle conditions. Their basic idea is that after a recession and following a positive aggregate shock to labour demand, firms hire cheaply from unemployed workers. As the reservoir of unemployment dries out, more productive, LEs find it profitable to start raising wages to raid workers from less productive SMEs competitors. Wages rise as workers upgrade by quitting to higher paying employers. Workers quit mostly from small, low paying firms to large, high paying firms. Therefore, LEs can keep growing their employment through that channel and SMEs have their employment growth restricted in relative terms during expansions. Therefore, SMEs grow in size faster than LEs when the labour market is slack and vice versa when the labour market turns tight. Besides, Moscarini and Postel-Vinay (2009) also claim that the result that LEs are more sensitive to cycles is a regularity that is true not only for the U.S but also for countries in different stages of development such as France, Denmark, Brazil, Canada, and United Kingdom. It is noteworthy that Brazil is the only developing country in their analysis and still presents results in line with its developed counterparts. Conversely, our results are in line with the view of Gertler and Gilchrist (1994) that suggests that SMEs account for a significantly disproportionate share of the manufacturing decline during recessions. They argue that the difference in terms of behaviour across firm size bins is mainly due to financial

liquidity constraints on small firms and support the view that after tight money and at the onset of recessions, credit flows to small firms contract more relatively to credit flows to large firms. This also relates to the facts reported in Kydland and Prescott (1990) that shows that the non-transactions component (M2) leads the cycles and suggests that credit arrangements could play a significant role in business cycle theory. The fact that SMEs are financially constrained is well documented and Beck and Demirgüç-Kunt (2006) provide a rich literature review showing this fact<sup>17</sup>. Particularly, Beck et al. (2005a) and Beck et al. (2005b, 2006) provide evidence that financial constraint on SMEs are worse in developing countries. Hence, the claim of Moscarini and Postel-Vinay (2009) that large firms are more sensitive to cycles, even in a developing country context, deserves a better scrutiny.



**Figure 3 – Differential Employment Growth Rates and Cycles (detrended)**

The difference between our results and the evidence provided by Moscarini and Postel-Vinay (2009) for Brazil might be related to many issues. First, they use annual information from RAIS, instead, we use CAGED that allowed us to construct employment series at monthly frequency for a different period of analysis that also encompasses the recent financial crises. Second, they avoid the classification bias using a longitudinal panel from RAIS by allocating firms to their respective size class in 1995 and tracking the growth rates

<sup>17</sup> It is interesting to note that Moscarini and Postel-Vinay (2009) show that SMEs were hit harder in the U.S in the last recession originated in the financial sector. This is one exception in their results and indicates the importance of financial constraints for firms performance.

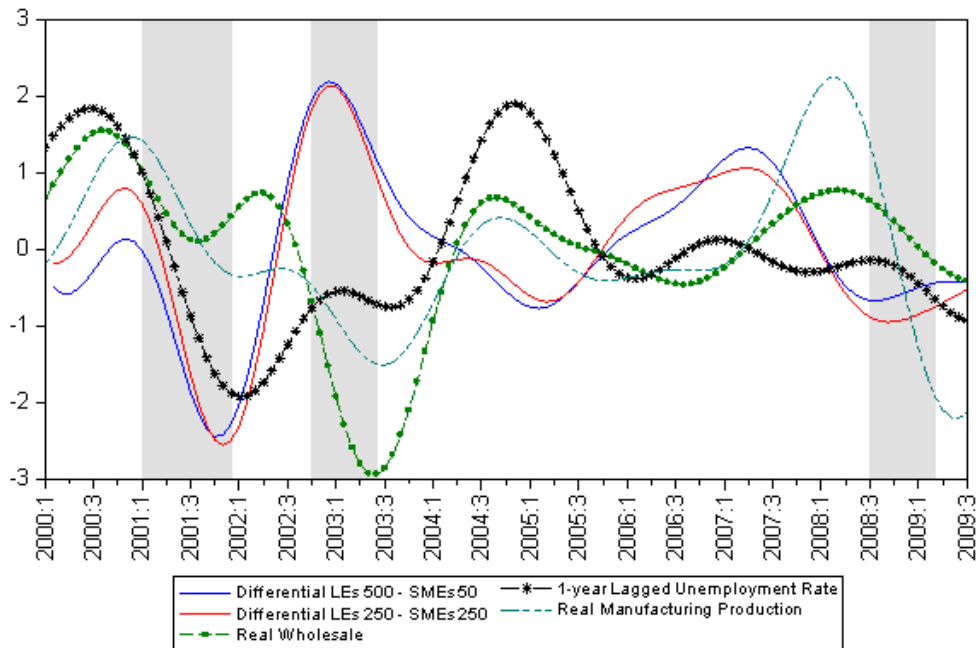
of employment in SMEs and LEs over the subsequent 10 years<sup>18</sup>. Alternatively, we used CAGED that uses job flows to calculate the stock of employment but are subjected to classification bias because the size class is redefined at the beginning of each year. However, as documented by Moscarini and Postel-Vinay (2009), the magnitude of the reclassification bias is small for the U.S case. They use different U.S datasets, compustat (longitudinal panel that is not subject to classification bias), Business Employment Dynamics and Business Dynamic Statistics (panel that is subject to classification bias) and show that both databases provide consistent results. Therefore, there is indication that reclassification bias is not a serious problem. Although the longitudinal panel based on RAIS data controls for the classification bias for the establishments present in the data in 1995, it is subject to another type of bias. During the nineties, RAIS benefited from important advances regarding data quality. A governmental campaign and improvements in the data collection process expanded RAIS coverage and quality. One main improvement occurred in 1997 (after the initial point in time of Moscarini and Postel-Vinay (2009)'s panel for Brazil), when the data started to be collected via internet, improving its quality and coverage. As noted in Saboia (2000), RAIS database improved substantially during the 1990's, however, it still presented patchy coverage in the states of the North, North-East and Centre-West regions, and in agriculture, construction, and extraction (mining and quarrying) sectors. Therefore, the panel used by Moscarini and Postel-Vinay (2009) to analyse the Brazilian economy maybe biased towards more structured firms that followed all administrative regulations at early times of RAIS and might not be representative of the economy as a whole. Third, they use 1-year lagged unemployment rate as indicator of business cycle conditions, while our results are mainly based on the use of real wholesale index. The use of unemployment rate series is problematic because IBGE altered its methodology and discontinued the former series in 2002<sup>19</sup>. Therefore, we use the aggregate unemployment rate series for the main Brazilian metropolitan areas instead. Besides, unemployment may not be an appropriate measure of business cycle condition for a country with rigid labour market regulations and where the cost of hiring and firing is high (e.g. World Bank 2002, Barros and Corseuil 2001).

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<sup>18</sup> Classification bias in the sense that employers are reclassified into larger size bins as the economy grows.

<sup>19</sup> Moscarini and Postel-Vinay (2009) do not explicitly describe what series of unemployment they used for their results about Brazil in their study. Also, the non-accelerating inflation rate of unemployment might have changed in their period of analysis because this period encompasses some important reforms in Brazil (e.g. privatization process, commercial liberalization) and financial crises that could have contributed to changes in the NAIRU (e.g. Mexican, Asian, Russian and Argentina crises in 1994, 1997, 1998, 2001 respectively). Therefore, the use of the direct unemployment rate might uncover the true relationship between unemployment and the business cycles.

To check whether our results are sensitive to different business cycle measures we perform the same analysis using data on industrial production in manufacturing, and also the 1-year lagged unemployment as a measure of business cycle conditions as in Moscarini and Postel-Vinay (2009). Figure 4 mimics Figure 3 and adds the two series to the picture.



**Figure 4 – Differential Employment Growth Rates and Cycles (detrended)**

The real manufacturing production follows roughly the same pattern of the real wholesale series, an additional indication that small firms are more sensitive to business cycle fluctuations. On the other hand, and contrary to common sense, the unemployment series does not mirror the industrial production and wholesale series, supporting the idea that this measure might not be a good indicator of the Brazilian business cycle conditions, perhaps as a result of the rigidity of the labour market.

Table 2 reports the cross-correlations between all variables presented in Figure 4. The differential growth rate (500-50), is negatively related with the wholesale and manufacturing production, and is not correlated with unemployment. A similar pattern is observed for the differential growth rate (250-250). Turning to the lagged unemployment, we observe a weak association with the differential growth rates and a stronger positive correlation with real wholesale and manufacturing production. Hence, the table of correlations confirms the visual impressions from Figure 4, and suggests that the lagged unemployment is not counter-cyclical to the wholesale and manufacturing production.



**Table 2 - Correlations between Cycle Measures and Differential Firm Growth (States)**

	Differential Growth Rate(500-50)	Differential Growth Rate(250-250)	Real Wholesale	Unemployment (t-12)	Manufacturing Production
Differential Growth Rate(500- 50)	1.00	0.96	-0.52	0.01	-0.18
Differential Growth Rate(250- 250)	0.96	1.00	-0.38	0.19	-0.05
Real Wholesale	-0.52	-0.38	1.00	0.41	0.69
Unemployment (t-12)	0.01	0.19	0.41	1.00	0.38
Manufacturing Production	-0.18	-0.05	0.69	0.38	1.00

#### 4.2 State Level Analysis

The evidence for the country as a whole summarized in Table 2 might cover regional and sectoral specificities in a country marked by its regional asymmetries (e.g. Ferreira 2000; Laurine et al. 2005; Silveira-Neto and Azzoni 2006). These regional differences might well be related with the evidence reported in Cunha and Moreira (2006) and Martincus and Molinari (2007) that Brazilian regional business cycles are less synchronised than regional cycles in developed countries.

This section presents the results for 27 Brazilian states<sup>20</sup>, correlating the differential employment growth rates with the local state wholesale index. Table 3 reports the results for the two differential growth rates based on our two different size definitions. The first thing to note is that, overall, the difference in the growth rates becomes more counter-cyclical or more negatively correlated with the business cycles when we use the second criterion (Differential growth (500-50)). This suggests that smaller (larger) firms are more (less) sensitive to business cycles fluctuations. The pattern observed for the country as a whole is also observed in most of the Brazilian states. For instance, using the differential growth (500-50), two thirds of the Brazilian states support the evidence that SMEs are hit harder during business cycles. However, there is a substantial variation in the way the difference growth rates correlate with business cycles. For instance, the most important state, São Paulo, presents clearly the same pattern as the country as a whole, indicating that SMEs are more sensitive to cycles than LEs. On the other hand, the state of Pará presents a clear pro-cyclical behaviour of the growth differences, suggesting that LEs are more sensitive to cycles.

<sup>20</sup> Brazil is divided into 27 Federal Units including the Federal District of Brasília, for the sake of simplicity we use states instead of Federal Units.

**Table 3. Correlations between Real Wholesale and Differential Firm Growth (States)**

<b>States</b>	<b>Differential (250-250)</b>	<b>States</b>	<b>Differential (500-50)</b>
Sao Paulo	-0.50	Rondonia	-0.65
Goiás	-0.43	Bahia	-0.59
<b>Brazil</b>	<b>-0.38</b>	<b>Brazil</b>	<b>-0.52</b>
Bahia	-0.37	Sao Paulo	-0.50
Rondonia	-0.29	Rio de Janeiro	-0.40
Mato Grosso	-0.29	Goiás	-0.30
Paraíba	-0.28	Ceará	-0.28
Rio Grande do Sul	-0.18	Rio Grande do Sul	-0.25
Ceará	-0.17	Pernambuco	-0.21
Rio de Janeiro	-0.14	Acre	-0.21
Mato Grosso do Sul	-0.13	Mato Grosso	-0.18
Alagoas	-0.09	Paraíba	-0.16
Sergipe	-0.07	Piauí	-0.15
Espirito Santo	-0.05	SantaCatarina	-0.14
Pernambuco	-0.04	Espirito Santo	-0.09
Tocantins	-0.02	Alagoas	-0.07
Rio Grande do Norte	0.00	Tocantins	-0.07
Acre	0.02	Sergipe	-0.06
SantaCatarina	0.02	Paraná	-0.04
Paraná	0.03	Amazonas	0.00
Amapá	0.10	Minas Gerais	0.05
Amazonas	0.11	Mato Grosso do Sul	0.08
Roraima	0.13	Distrito Federal	0.17
Minas Gerais	0.17	Amapá	0.17
Distrito Federal	0.18	Maranhao	0.19
Piauí	0.18	Rio Grande do Norte	0.28
Maranhao	0.24	Roraima	0.39
Pará	0.81	Pará	0.77

Hence, SMEs tend to be more cyclically sensitive but the pattern is not uniform and some states present the opposite result. These different patterns observed in Table 3 might be related to the industry composition in each state. Therefore, the sectoral analysis can shed extra light on the regional results.

### 4.3 Sectoral Level Analysis

In order to analyse the sectoral behaviour of the employment series of establishments in different size bins we use data from eight broad sectors that represent the 2-digit level sectoral classification in the IBGE's sectoral classification. Table 4 presents the results for the differential growth rates in each sector. Results show that in all sectors, but commerce, the small businesses are more sensitive to business cycles than large one. Clearly, the difference in growth rates in the manufacturing sector presents the most counter-cyclical behaviour, suggesting that the SMEs in this sector are highly sensitive to business cycles fluctuations.

On the other hand, commerce presents the opposite result, indicating that LEs are more sensitive to cycles in this sector.

**Table 4. Correlations between Cycles and Differential Firm Growth (Sectors)**

<b>Panel A</b>		
<b>Differential (250-250)</b>	<b>Real Wholesale</b>	<b>Manufacturing Production</b>
Manufacturing (IND)	-0.77	-0.39
Extraction (EXT)	-0.33	-0.22
Construction (COT)	-0.29	-0.21
Services (SER)	-0.14	0.00
Agriculture – (AGR)	-0.13	-0.07
Public Services - (SUP)	-0.10	-0.09
Public Administration - (ADP)	-0.07	-0.20
Commerce - (COM)	0.30	0.32
<b>Panel B</b>		
<b>Differential (500-50)</b>	<b>Real Wholesale</b>	<b>Manufacturing Production</b>
Manufacturing (IND)	-0.73	-0.43
Extraction (EXT)	-0.31	0.05
Services (SER)	-0.28	-0.10
Construction (COT) <sup>a</sup>	-0.12	0.05
Public Services - (SUP)	-0.10	-0.16
Agriculture - (AGR)	-0.08	-0.17
Public Administration - (ADP)	-0.05	-0.26
Commerce - (COM)	0.28	0.30

Notes: a) The series of construction in panel B must be interpreted with caution because the quality of the construction series for establishments with less than 50 employees is problematic.

Overall, the sectoral analysis also provides evidence that SMEs are more sensitive to cycles than LEs. Besides, Table 4 indicates that this finding is not uniform and that in the Commerce sector large firms are more sensitive to cycles than small ones. This might suggest that the industry composition in each state might be partially responsible for the heterogeneous results found in Table 3. If the heterogeneous results of Table 3 are generated by sectoral differences, it would be expected that a state with higher share of employment in the commerce sector would tend to present a result where LEs are more sensitive than SMEs. Conversely, a higher share of employment in the manufacturing sector would be associated with a more pro-cyclical behaviour of the differential growth rates. However, the employment distribution of commerce across states, presented in Table 5, does not change much (representing about 20% to 30% of the states' formal employment) to explain the heterogeneity of the results in Table 3. Additionally, states with an important share of formal sectoral employment in manufacturing, such as AM and PR, still present a counter-cyclical

pattern. Hence, the variety of results of the Brazilian states can be possibly related to states' individual characteristics rather than to the sectoral composition alone.

**Table 5 - Total Employment Shares across Brazilian States and Sectors (2009)**

	EXT	IND	SUP	COT	COM	SER	ADM	AGR	TOTAL
RO	0.44	18.50	1.53	6.94	34.27	29.30	3.28	5.74	100.00
AC	0.30	9.73	1.59	14.10	30.10	29.99	10.10	4.09	100.00
AM	0.23	31.55	1.58	7.68	19.28	37.75	0.99	0.94	100.00
RR	0.13	6.95	2.69	17.11	31.64	36.90	0.63	3.95	100.00
PA	1.79	16.51	1.38	9.16	27.08	33.56	2.93	7.59	100.00
AM	2.95	5.56	2.13	8.90	32.14	45.22	0.51	2.60	100.00
TO	0.77	11.87	2.65	12.29	30.38	27.11	0.94	13.99	100.00
MA	0.22	10.65	1.81	12.17	28.47	36.32	3.78	6.58	100.00
PI	0.33	12.38	2.10	10.11	28.82	36.41	6.38	3.46	100.00
CE	0.29	26.01	0.79	6.34	19.44	39.74	4.33	3.06	100.00
RN	2.12	20.13	1.52	8.63	24.54	36.35	1.73	4.98	100.00
PB	0.42	24.04	2.67	7.43	23.32	33.12	3.93	5.06	100.00
PE	0.21	20.86	1.58	7.07	22.45	40.60	1.83	5.40	100.00
AL	0.28	36.71	1.52	4.70	20.23	30.12	2.62	3.82	100.00
SE	1.36	15.86	1.36	8.91	21.10	41.78	3.80	5.82	100.00
BA	0.87	14.52	1.17	7.59	23.83	41.63	3.49	6.89	100.00
MG	1.41	22.16	0.91	7.88	21.51	36.22	1.75	8.15	100.00
ES	1.91	17.80	1.19	8.04	24.73	39.75	1.39	5.21	100.00
RJ	0.65	12.78	1.59	6.15	21.88	51.63	4.47	0.86	100.00
SP	0.15	25.33	0.85	4.88	20.63	41.70	2.50	3.96	100.00
PR	0.25	28.18	1.11	5.06	23.40	34.94	1.58	5.49	100.00
SC	0.50	37.60	1.09	4.32	21.01	31.12	1.31	3.04	100.00
RS	0.40	31.66	1.05	3.94	22.18	35.40	1.42	3.95	100.00
MS	0.53	18.81	0.74	5.67	23.97	32.67	1.05	16.55	100.00
MT	0.49	18.87	0.84	6.46	27.67	26.59	1.91	17.17	100.00
GO	0.78	22.24	1.07	6.96	24.33	34.42	1.26	8.94	100.00
DF	0.06	5.59	1.26	7.37	22.46	61.53	0.76	0.97	100.00
Total	0.54	23.11	1.11	6.04	22.12	39.79	2.43	4.87	100.00
<b>Sdt</b>	<b>0.72</b>	<b>8.84</b>	<b>0.56</b>	<b>3.05</b>	<b>4.21</b>	<b>7.43</b>	<b>2.08</b>	<b>4.18</b>	<b>0.00</b>

It is a noticeable surprise that the commerce sector presents the most pro-cyclical behaviour, with large firms being more sensitive to cycles than small ones. Regarding this fact, an important fact should be brought to the attention. It is important to bear in mind that generally speaking, the small-scale, informal, often low productivity, frequently family-based enterprise continues to employ between 30% and 70% of the urban work force in Latin America (Maloney 2004). Specifically for the Brazilian case, about 50% of the occupied workers in Brazil resort to informality according to IPEADATA (Instituto de Pesquisa

Econômica Aplicada Database)<sup>21</sup>. Also, Henley et al. (2008) provide evidence showing that the informal sector accounts for a significant share of employment in Brazil. Using data from Pesquisa Nacional por Amostra de Domicílios (PNAD)<sup>22</sup>, which is a large scale annual household survey, they suggest three different measures of informality and found that it ranges from 50% to 55% according to the definition used<sup>23</sup>. In this context of significant informality, the commerce sector might have a significant share of the informal sector and therefore any variation in the level of employment in this sector is not captured by CAGED. For instance, a detailed survey undertaken by SEBRAE and IBGE (Economia Informal Urbana 2003) indicates that 13.86 million workers in urban areas were employed by informal enterprises in 2003, and the commerce sector is the largest informal sector, responsible for 34.9% of urban informal employment.

This expressive share of informal workers, particularly in the commerce sector, might be related with the fact that these workers are not productive enough to match a formal job vacancy and that severance and income tax might be too high relatively to the productivity level of the commerce sector. Albretch et al. (2009), for instance, build a search and matching model with an informal sector that resembles the Latin America labour market. They show that a given level of workers productivity is necessary to match a formal job vacancy and that higher severance and income taxes reduces the rate at which workers find formal sector jobs<sup>24</sup>. Complementarily, as can be noted in Table 6, panel 2, businesses in the commerce sector are smaller than those in other sectors. This sector presents a higher share of formal employment in the first size bin of our data, and has 73.10% of its workforce employed by establishments in the size class with less than 50 employees<sup>25</sup>. This might also discourage redundancy because any job shed is a threat to the existence of the establishment given the small numbers of workers.

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<sup>21</sup> Institute of Applied Economic Research Database

<sup>22</sup> Annual National Domestic Survey.

<sup>23</sup> It is interesting to note that, if one considers the overlaps between all measures of informality, 63% of economically active workers are classified as informal in Brazil.

<sup>24</sup> Information for Brazil provided by La Porta and Shleifer (2008) and De Paula and Scheinkman (2009) support the view that formal firms are more productive than informal ones.

<sup>25</sup> Unfortunately, we are not able to disaggregate the size bins to check for the share of employment in smaller establishments because we were not provided with the stock of employment for smaller size bins. For instance, it will be more useful to have information for establishments with less than 9 (or even 4) workers. The fact that the commerce sector is dominated by small firms is also related to the fact that this sectoral classification considers not only wholesale but retail sales together.

**Table 6 – Employment Stock and Shares Across Different Size Bins (2009)**

<b>Panel 1 – Employment Stock</b>									
<b>Size Class</b>	<b>EXT</b>	<b>IND</b>	<b>SER</b>	<b>COT</b>	<b>COM</b>	<b>SER</b>	<b>ADP</b>	<b>AGR</b>	<b>TOTAL</b>
<b>0-50</b>	58233	2336219	50303	615169	5172204	5406446	40889	944997	14624460
<b>50-250</b>	34774	1904075	70262	579798	1384921	2661362	119692	286886	7041770
<b>250-500</b>	13612	884981	39132	245058	337335	1174101	102689	92942	2889850
<b>+500</b>	66250	2267994	194306	491219	180881	3489048	513951	233573	7437222
<b>Total</b>	172869	7393269	354003	1931244	7075341	12730957	777221	1558398	31993302
<b>Panel 2 – Employment Shares</b>									
<b>Size Class</b>	<b>EXT</b>	<b>IND</b>	<b>SER</b>	<b>COT</b>	<b>COM</b>	<b>SER</b>	<b>ADP</b>	<b>AGR</b>	<b>TOTAL</b>
<b>0-50</b>	33.69	31.60	14.21	31.85	73.10	42.47	5.26	60.64	45.71
<b>50-250</b>	20.12	25.75	19.85	30.02	19.57	20.90	15.40	18.41	22.01
<b>250-500</b>	7.87	11.97	11.05	12.69	4.77	9.22	13.21	5.96	9.03
<b>+500</b>	38.32	30.68	54.89	25.44	2.56	27.41	66.13	14.99	23.25
<b>Total</b>	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

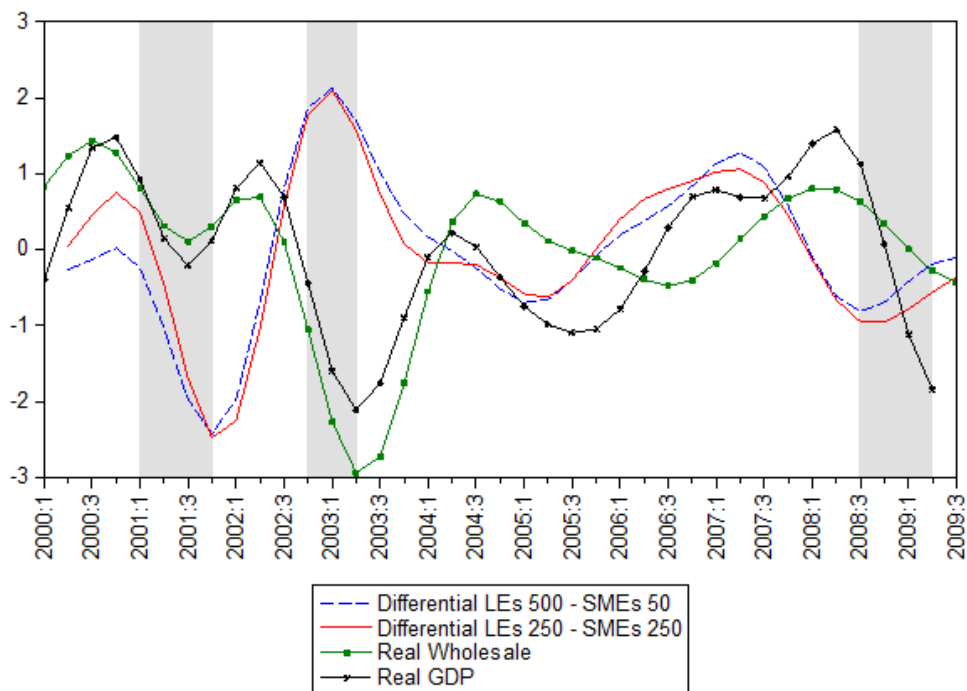
Therefore, the evidence from monthly data supports the view that SMEs are more cyclically sensitive than LEs. Moreover, there is a substantial variation in the regional patterns but this heterogeneity does not seem to be determined by the sectoral composition. Besides, the sectoral evidence reinforces the view that SMEs are more sensitive to cycles than LEs in Brazil. The marked difference is the pro-cyclical behaviour of the difference growth rate of the commerce sector; however, this is likely to be affected by the fact that an important part of this sector resorts to informal workers (that is not taken into account in our data), possibly because its workers are not productive enough to match a formal sector job vacancy in a environment of rigid labour markets and high levels of severance and income taxes. In this sense, the size of the informal sector in each state might have influenced our regional results as well and is possibly an important states' characteristic to be considered when analysing formal employment behaviour during economic fluctuations. Another important point to note is that the evidence from monthly data is based mainly on measures that are believed to be coincident with the economic activity; however, for this frequency we cannot observe the series of GDP.

#### **4.1 Quarterly Analysis**

A drawback in the analysis when using monthly data is the paucity of GDP data. Lucas (1977), for instance, defines business cycles as movements about trend in GDP. In addition, as argued in Stock and Watson (1998), although the business cycle is technically defined as co-movements across many sectors and series, fluctuations in aggregate output are

at the core of a business cycle. Therefore, the cyclical component of real GDP is a useful proxy for the overall business cycle and is a useful benchmark for comparisons. Therefore, it would be important to check the robustness of the results presented in the previous sections for the country as a whole when the GDP series are used as a measure of business cycles.

The GDP series for Brazil are available quarterly; therefore, using data at this frequency provides a good robustness check for the relationship between the growth difference of employment and business cycles. Figure 5 replicates Figure 3 including the detrended real GDP using Christiano and Fitzgerald's (2005) band-pass filter for the two alternative cut-offs (< 50 and <250 for SMEs, and >250 and >500 for LEs)<sup>26</sup>. Also in this figure, the difference in growth rates seems to be counter-cyclical, indicating that SMEs shed proportionally more jobs in recessions and gain more in booms. The pattern of the real GDP is very similar to the real wholesale, indicating that the latter performs well as an indicator of business cycle conditions.



**Figure 5 – Differential Employment Growth Rates and Cycles at Quarterly Frequency (detrended)**

The correlations between the differential growth series and various measures related with the business cycles are summarized in Table 7. When we change the frequency of the data, the

<sup>26</sup> Alternative results using the HP filter to detrend the series at quarterly frequency are reported in the Appendix C.2 and provide similar interpretation.

negative relationship between the differential growth and all series but lagged unemployment is confirmed again. Noticeably, real GDP is strongly positively correlated with the real wholesale series and the manufacturing production index, an additional indication that small firms are more sensitive to business cycle fluctuations. Besides, the unemployment series is also positively correlated with real GDP, indicating that the unemployment rate is not counter-cyclical and therefore might not be a good indicator of the Brazilian business conditions, possibly as a result of the rigidity of the labour market discussed earlier.

**Table 7. Correlations between Cycle Measures and Differential Firm Growth at Quarterly Frequency**

	<b>Differential Growth Rate(500-50)</b>	<b>Differential Growth Rate(250-250)</b>	<b>Real Wholesale</b>	<b>Unemployment (t-12)</b>	<b>Manufacturing Production</b>	<b>Real GDP</b>
<b>Differential Growth Rate(500)</b>	1.00	0.96	-0.57	0.08	-0.20	-0.22
<b>Differential Growth Rate(250)</b>	0.96	1.00	-0.46	0.23	-0.06	-0.14
<b>Real Wholesale</b>	-0.57	-0.46	1.00	0.37	0.70	0.74
<b>Unemployment (t-12)</b>	0.08	0.23	0.37	1.00	0.38	0.13
<b>Manufacturing Production</b>	-0.20	-0.06	0.70	0.38	1.00	0.81
<b>Real GDP</b>	-0.22	-0.14	0.74	0.13	0.81	1.00

The use of quarterly data also offers the possibility to verify the robustness of the sectoral pattern of the difference growth series of establishments in different size bins using the real GDP in Table 8. Results confirm that in all sectors, but commerce, SMEs are more sensitive to business cycles than LEs. Clearly, the difference in growth rates in the manufacturing sector presents the most counter-cyclical behaviour, suggesting that the SMEs in this sector are highly sensitive to business cycles fluctuations. On the other hand, commerce presents the opposite result, indicating that LEs are more sensitive to cycles in this sector. Therefore, the use of quarterly data made possible to confirm that SMEs are more sensitive to business cycle conditions when using the GDP series and also confirms that real wholesale and industrial production index are good proxies of business cycles. Unfortunately, quarterly GDP data is not available at state level and we could not perform the same exercise using the detrended local GDP to proxy for the local business cycle.



**Table 8. Correlations between Cycles and Differential Firm Growth at Quarterly Frequency (Sectors)**

<b>Differential (250-250)</b>	<b>Real Wholesale</b>	<b>Manufacturing Production</b>	<b>Real GDP</b>
Manufacturing (IND)	-0.76	-0.40	-0.42
Extraction (EXT)	-0.39	-0.32	-0.29
Construction (COT)	-0.34	-0.25	-0.30
Agriculture - (AGR)	-0.22	-0.07	-0.14
Services (SER)	-0.22	-0.05	-0.01
Public Services - (SUP)	-0.15	-0.09	-0.06
Public Administration - (ADP)	-0.12	-0.26	-0.02
Commerce - (COM)	0.21	0.26	0.06

<b>Differential (500-50)</b>	<b>Real Wholesale</b>	<b>Manufacturing Production</b>	<b>Real GDP</b>
Manufacturing (IND)	-0.71	-0.47	-0.43
Extraction (EXT)	-0.37	-0.07	-0.05
Services (SER)	-0.36	-0.17	-0.12
Construction (COT)	-0.34	-0.21	-0.28
Agriculture - (AGR)	-0.14	-0.13	-0.10
Public Services - (SUP)	-0.13	-0.14	-0.07
Public Administration - (ADP)	-0.04	-0.30	0.10
Commerce - (COM)	0.25	0.33	0.17

## Conclusion

This paper has provided evidence for a developing country showing that smaller employers are more cyclically sensitive than large ones. Small businesses shed proportionally more jobs in recessions and gain more in booms. This pattern is robust to various business cycle measures and different data frequency, and the pattern observed for the country as a whole is observed in most of the Brazilian States. However, there is a substantial variation in the manner the difference growth rates correlate with business cycles but this heterogeneity does not seem to be determined by the sectoral composition. Besides, the sectoral evidence reinforces the view that SMEs are more sensitive to cycles than LEs in Brazil.

The fact that SMEs are more sensitive to cycles in Brazil does not mean that the arguments put forward in Moscarini and Postel-Vinay (2008, 2009) should be refuted for the case of developed countries. Instead, our empirical evidence suggests that their model cannot be applied directly to think about labour market dynamics in a developing country and the fact that large businesses are more sensitive to cyclical conditions is not an empirical regularity for countries at different stages of development. To be applied to a developing country and for the sake of the model's generalization, their model needs to incorporate other

aspects that might influence labour markets differently in a developing country, such as, financial constraints and labour market legislations.

Therefore our results provide indirect evidence and support the view that SMEs are more sensitive to cycles possibly because these firms face a tougher financial constraint. Consequently, policies designed to dampen employment shocks during business cycles should aim at easing financial constraints to small firms. Also, the fact that regional and sectoral results vary substantially suggest that there might be different regional and sectoral labour market policies to moderate formal employment fluctuations efficiently. Finally, it is important to note that our results do not incorporate the informal sector and further research incorporating this sector might improve our understanding about the behaviour of employment growth series in businesses of different sizes during the economic cycles.

## **Appendix A – Industries and States**

### ***Industries***

Extraction (Mining and Quarrying) (EXT)

Manufacturing (IND)

Public Services (SUP)

Construction (COT)

Commerce (COM)

Services (SER)

Public Administration (ADP)

Agriculture (AGR)

### ***Federal Units (States)***

Distrito Federal (DF); Mato Grosso (MG); Mato Grosso do Sul (MS); Goiás (GO); Rio Grande do Sul (RS); Santa Catarina (SC); Paraná (PR); Rio de Janeiro (RJ); São Paulo (SP); Minas Gerais (MG); Espírito Santo (ES); Sergipe (SE); Bahia (BA); Pernambuco (PE); Rio Grande do Norte (RN); Ceará (CER); Paraíba (PB); Alagoas (AL); Piauí (PI); Maranhão (MA); Amazonas (AM); Amapá (AP); Rondônia (RO); Acre (AC); Roraima (RR); Pará (PA); Tocantins (TO)

## Appendix B – HP filter and Christiano Fitzgerald Band Pass Filter

### B.1. The HP Filter

The HP Filter is based on the prior knowledge that the growth component varies smoothly over time, and that a time series  $y_t$  is the sum of a growth component  $\tau_t$  and a cyclical component  $c_t$ :

$$y_t = \tau_t + c_t \quad \text{for } t = 1, \dots, T.$$

In this conceptual framework the average of  $c_t$  over long time periods is assumed to be near zero. Therefore, the problem for determining the growth components is given as follows:

$$\min_{\tau_t} \sum_{t=1}^T ((y_t - \tau_t)^2 + \lambda((\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1}))^2)$$

where the parameter  $\lambda$  is a positive number which penalizes variability in the growth component series. The larger the value of  $\lambda$ , the smoother is the solution for the cyclical component series. As argued in Section 3, we use  $\lambda = 1,600$  as a value for the smoothing parameter using quarterly data, and  $\lambda = 1600 (3^4) = 129600$  for monthly data<sup>27</sup>.

### B.2. The Christiano-Fitzgerald Band-Pass Filter

If we want to isolate fluctuations of a given periodicity in a series  $y_t$ , the filtered series should be given by:

$$y_t^* = B(L)y_t$$

where the ideal band-pass filter  $B(L)$  has the following structure:

$$B(L) = \sum_{j=-\infty}^{\infty} B_j L^j, \text{ with } L^l y_t \equiv y_{t-l}$$

and the  $B_j$ 's are given by:

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<sup>27</sup> We detrended our series through the HP filter using EViews.

$$B_j = \frac{\sin(jb) - \sin(ja)}{\pi j}, \quad j \geq 1$$

$$B_0 = \frac{b-a}{\pi}, \quad \text{where } a = \frac{2\pi}{p_u}, \quad b = \frac{2\pi}{p_l}$$

However, to computer  $y_t^*$  using  $B(L)$  requires an infinite number of observations on  $y_t$ . Hence, Christiano and Fitzgerald (2003) suggest the estimation of  $y_t^*$  using  $\hat{y}_t^*$ , a linear function of the available data and therefore:

$$\hat{y}_t = \hat{B}^{p,f}(L)y_t, \quad \text{with } f = T - t \text{ and } p = t - 1$$

where the ideal band-pass filter  $\hat{B}^{p,f}(L)$  using a linear approximation to generate an infinite series has the following structure:

$$\hat{B}_j^{p,f}(L) = \sum_{j=-f}^p \hat{B}_j^{p,f} L^j, \quad \text{where } L^h y_t \equiv y_{t-h}$$

and selecting the filter weights  $\hat{B}_j^{p,f}$  solving:

$$\min_{\hat{B}_j^{p,f}, j=-f, \dots, p} \int_{-\pi}^{\pi} \left| B(e^{-i\omega}) - \hat{B}^{p,f}(e^{-i\omega}) \right|^2 f_y(\omega) d\omega$$

where the  $f_y(\omega)$  is the spectral density of  $y_t$  at frequency  $\omega$ , which measures the contribution of each frequency component to the overall variance of  $y_t$ <sup>28</sup>.

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<sup>28</sup> We tested extensively for the stationarity of the series used in our analysis before detrending them. The series of the difference in employment growth rates between SMEs and LEs, and unemployment were treated as  $I(0)$ . Alternatively, the remaining series were treated as  $I(1)$  with drift adjustment. This is because when applying Christiano and Fitzgerald filter, the stochastic or deterministic trends of a data series must be removed. Christiano and Fitzgerald (2003)' filter was applied to our data using EViews.

## Appendix C - Alternative from HP Filter

### C.1. Alternative Results for Monthly data Using HP filter

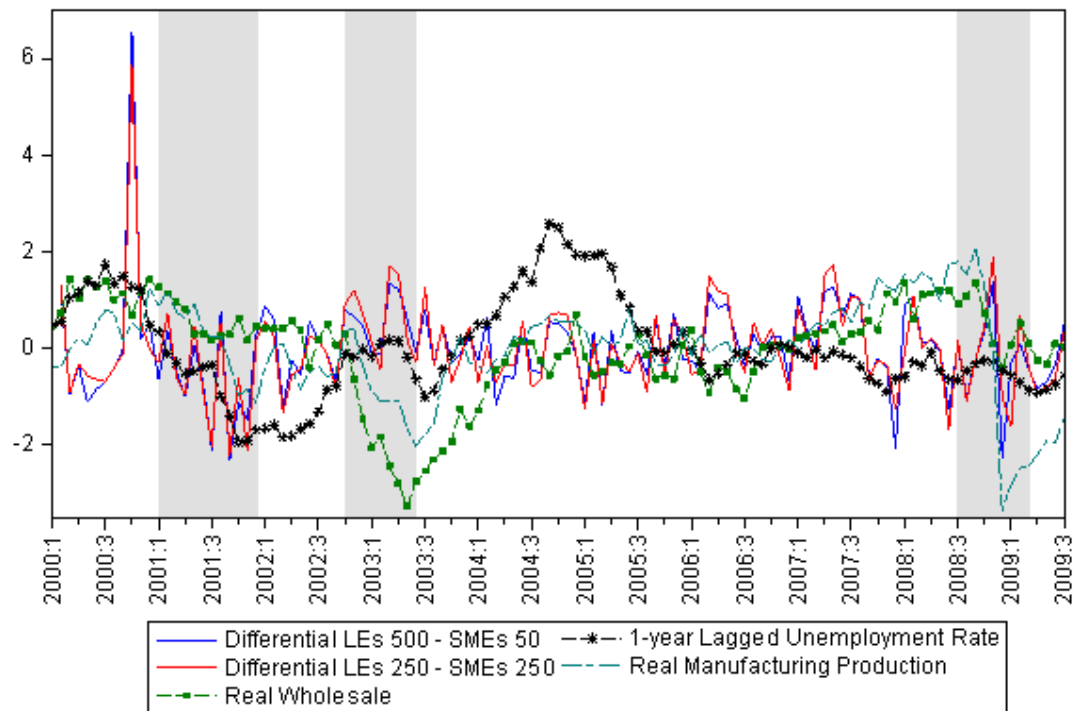


Figure 6 – Monthly Differential Employment Growth Rates and Cycles (detrended using HP)

Table 9 - Correlations between Cycle Measures and Differential Firm Growth at Monthly Frequency (HP Filter)

	Differential Growth Rate(500-50)	Differential Growth Rate(250-250)	Real Wholesale	Unemployment (t-12)	Manufacturing Production
Differential Growth Rate(500)	1.00	0.94	-0.14	0.10	0.08
Differential Growth Rate(250)	0.94	1.00	-0.14	0.12	0.08
Real Wholesale	-0.14	-0.14	1.00	0.03	0.54
Unemployment (t-12)	0.10	0.12	0.03	1.00	0.26
Manufacturing Production	0.08	0.08	0.54	0.26	1.00

**Table 10. Correlations between Real Wholesale and Differential Firm Growth at Monthly Frequency (States) – HP Filter**

<b>States</b>	<b>Differential (250-250)</b>	<b>States</b>	<b>Differential (500-50)</b>
Rio Grande do Sul	-0.22	Rio Grande do Sul	-0.25
Sao Paulo	-0.15	Bahia	-0.20
Bahia	-0.14	Sao Paulo	-0.14
<b>Brazil</b>	<b>-0.14</b>	<b>Brazil</b>	<b>-0.14</b>
Mato Grosso do Sul	-0.13	Pernambuco	-0.10
Mato Grosso	-0.11	Goiás	-0.09
Ceará	-0.11	Amapá	-0.09
Pernambuco	-0.07	Ceará	-0.08
Goiás	-0.07	Rondonia	-0.07
Rondonia	-0.07	Mato Grosso do Sul	-0.07
Alagoas	-0.06	Mato Grosso	-0.06
Acre	-0.05	SantaCatarina	-0.06
Espirito Santo	-0.04	Espirito Santo	-0.05
Amapá	-0.04	Alagoas	-0.05
SantaCatarina	0.00	Acre	-0.04
Paraíba	0.01	Paraná	-0.03
Paraná	0.02	Rio de Janeiro	-0.03
Rio de Janeiro	0.02	Piauí	-0.01
Minas Gerais	0.03	Paraíba	-0.01
Distrito Federal	0.03	Minas Gerais	0.01
Rio Grande do Norte	0.03	Sergipe	0.03
Piauí	0.04	Distrito Federal	0.05
Sergipe	0.06	Tocantins	0.05
Amazonas	0.06	Rio Grande do Norte	0.06
Tocantins	0.06	Maranhao	0.06
Roraima	0.08	Amazonas	0.07
Maranhao	0.08	Roraima	0.16
Pará	0.31	Pará	0.30

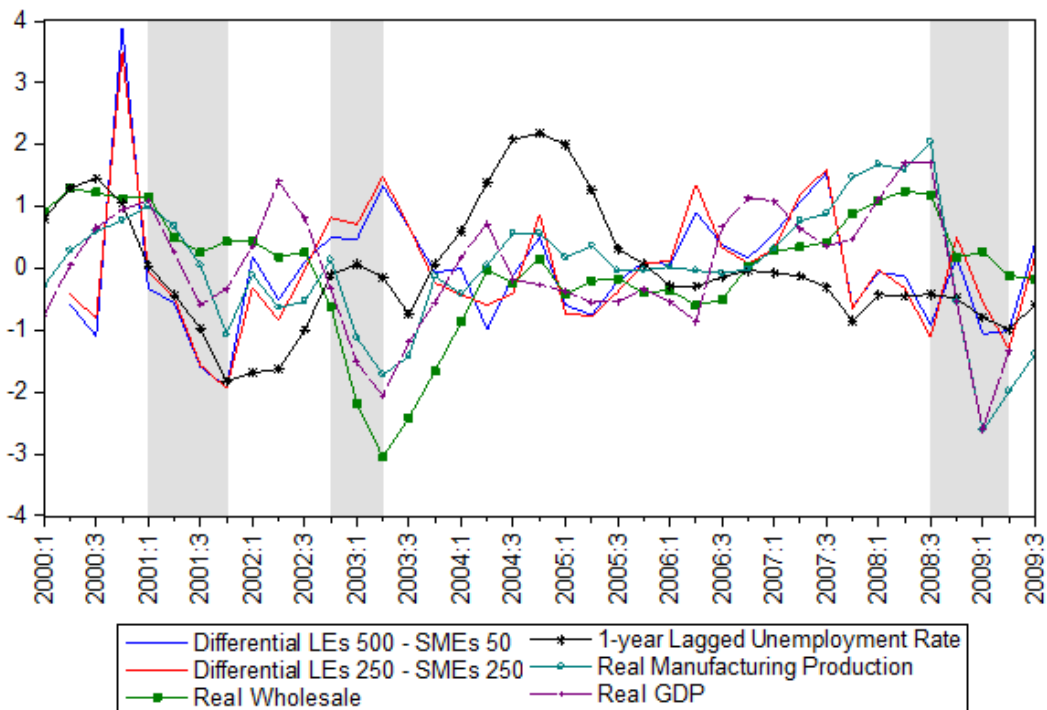
**Table 11. Correlations between Cycles and Differential Firm Growth at Monthly Frequency (Sectors) – HP Filter**

<b>Differential (250-250)</b>	<b>Real Wholesale</b>	<b>Manufacturing Production</b>
Construction (COT)	-0.23	-0.18
Manufacturing (IND)	-0.17	0.07
Services (SER)	-0.07	0.05
Extraction (EXT)	-0.07	0.05
Public Services - SUP	-0.04	0.00
Agriculture - AGR	-0.02	0.01
Commerce - COM	-0.01	0.07
Public Administration - ADP	0.00	-0.08

**Table 12. Correlations between Cycles and Differential Firm Growth at Monthly Frequency (Sectors) – HP Filter**

Differential (50-500)	Real Wholesale	Manufacturing Production
Manufacturing (IND)	-0.20	0.06
Services (SER)	-0.10	0.04
Public Services - SUP	-0.04	-0.03
Extraction (EXT)	-0.03	0.13
Agriculture - AGR	-0.03	0.00
Commerce - COM	-0.02	0.06
Public Administration - ADP	0.02	-0.09
Construction (COT)	0.03	0.06

**C.2 Alternative Results for Quarterly data Using HP filter**



**Figure 7 – Quarterly Differential Employment Growth Rates and Cycles (detrended\_using HP\_Filter)**

**Table 13. Correlations between Cycle Measures and Differential Firm Growth at Quarterly Frequency – HP Filter**

	Differential Growth Rate(500-50)	Differential Growth Rate(250-250)	Real Wholesale	Unemployment (t-12)	Manufacturing Production	Real GDP
Differential Growth Rate(500)	1.00	0.97	-0.20	0.16	0.10	0.06
Differential Growth Rate(250)	0.97	1.00	-0.22	0.20	0.07	-0.03
Real Wholesale	-0.20	-0.22	1.00	0.00	0.60	0.65
Unemployment (t-12)	0.16	0.20	0.00	1.00	0.28	0.01
Manufacturing Production	0.10	0.07	0.60	0.28	1.00	0.76
Real GDP	0.06	-0.03	0.65	0.01	0.76	1.00

**Table 14. Correlations between Cycles and Differential Firm Growth at Quarterly Frequency (Sectors)**

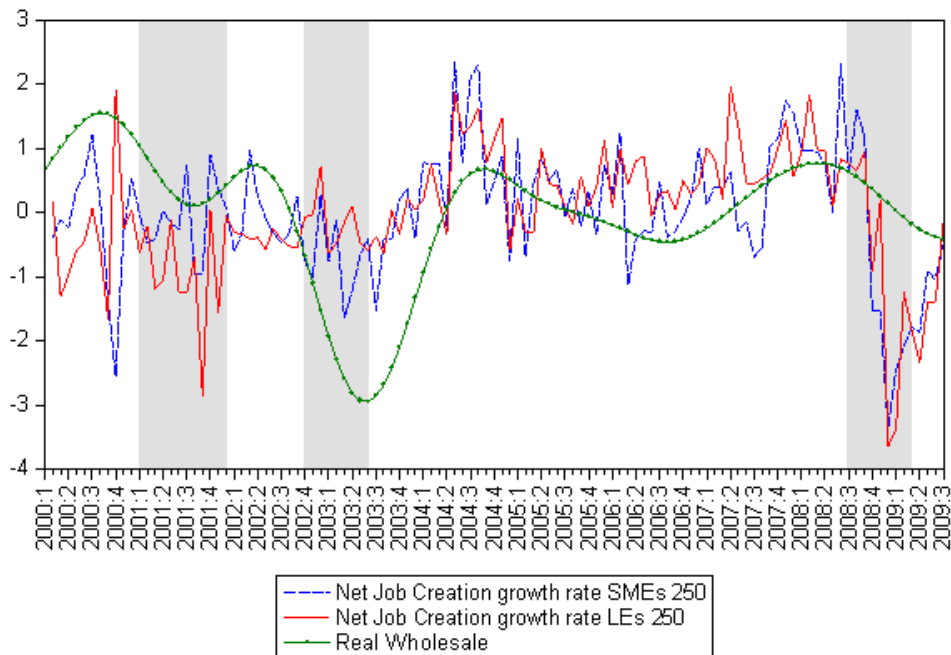
Differential (250-250)	Real Wholesale	Manufacturing Production	Real GDP
Manufacturing (IND)	-0.44	-0.11	-0.20
Construction (COT)	-0.39	-0.34	-0.34
Extraction (EXT)	-0.11	-0.06	-0.13
Services (SER)	-0.10	0.07	0.10
Agriculture - AGR	-0.10	0.01	-0.09
Public Services - SUP	-0.08	-0.03	-0.01
Public Administration - ADP	-0.08	-0.16	-0.05
Commerce - COM	0.08	0.17	0.06

**Table 15. Correlations between Cycles and Differential Firm Growth at Quarterly Frequency (Sectors)**

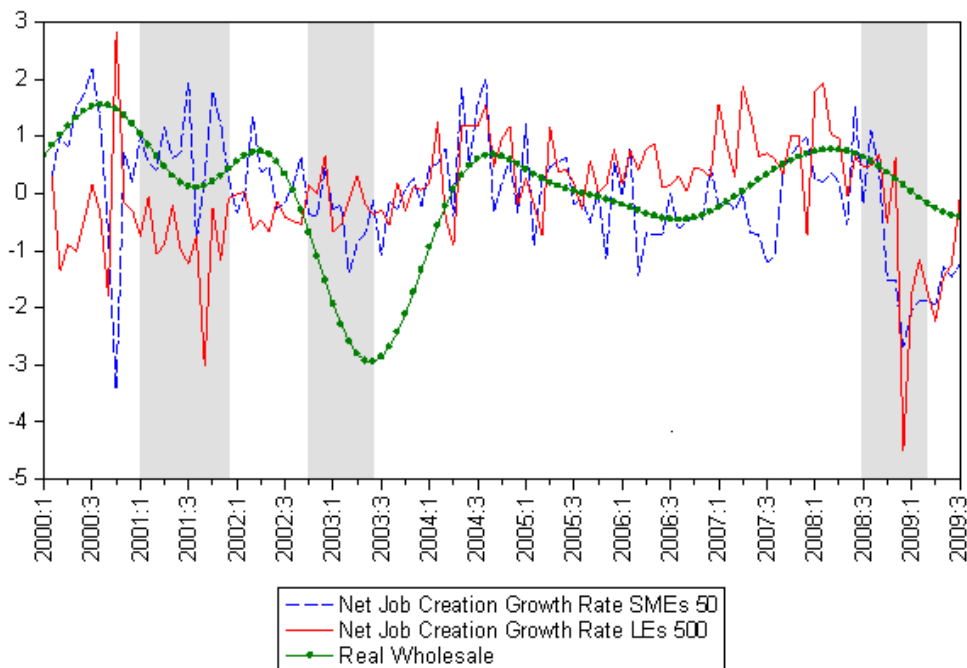
Differential (500-50)	Real Wholesale	Manufacturing Production	Real GDP
Manufacturing (IND)	-0.48	-0.13	-0.10
Services (SER)	-0.15	0.07	0.09
Construction (COT)	-0.11	-0.03	0.04
Public Services - SUP	-0.07	-0.04	0.04
Extraction (EXT)	-0.06	0.12	0.06
Agriculture - AGR	-0.05	0.04	-0.02
Public Administration - ADP	-0.02	-0.14	0.14
Commerce - COM	0.07	0.16	0.12



## Appendix D – Raw Employment Growth Rates (Monthly Frequency)



**Figure 8 – Employment Growth Raw Rates**



**Figure 9 – Employment Growth Raw Rates**

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