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TREATMENT OF ENTERPRISE RESTRUCTURING IN BUSINESS PANELS

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ABSTRACT

For business panels, there is unfortunately no unique definition of the longitudinal enterprise. One reason for this problem is that enterprises can merge (concentration) or split (deconcentration). This complicates the longitudinal analysis because it supposes generally that the units are indivisible and that they cannot merge (like individuals, for example). It is therefore important to obtain a definition for the longitudinal enterprise that treats the cases of concentrations and deconcentrations of enterprises as well as possible. In this paper, we first present the usual case where the links through time between enterprises are established using the Business Register Identification Number (BRID). Second, we will discuss the other case where the links are not solely based on the BRID, but by using other criteria. This forces then the use of methods to handle concentrations and deconcentrations. Third, we will propose four approaches to solve this problem of concentrations and deconcentrations together with a comparison of their advantages and disadvantages.

KEY WORDS: Business panels; Longitudinal units; Business number; Concentrations; Deconcentrations.

RÉSUMÉ

Dans les panels économiques, il n'existe malheureusement pas de définition unique de l'entreprise longitudinale. Une des raisons de ce problème est que les entreprises peuvent se fusionner (concentration) ou se scinder (déconcentration); ce qui complique l'analyse longitudinale parce que cette dernière suppose généralement que les unités sont indivisibles et ne peuvent se fusionner (comme les individus, par exemple). Il importe donc de chercher à obtenir une définition de l'entreprise longitudinale qui traite le mieux possible les cas de concentrations et de déconcentrations d'entreprises. Au cours de la présentation, on traitera premièrement du cas courant où on établit les liens entre entreprises au cours du temps à partir du Numéro d'entreprise (NE). Dans un deuxième temps, on abordera le cas où les liens ne sont pas uniquement fondés sur le NE, mais en utilisant d'autres critères. Ces derniers obligent alors le choix de méthodes pour traiter les concentrations et déconcentrations. Troisièmement, on proposera quatre approches pour traiter ce problème des concentrations et déconcentrations avec une comparaison des avantages et désavantages de celles-ci.

MOTS-CLÉS: Panels d'entreprises; unités longitudinales; numéro d'entreprise; concentrations; déconcentrations.

1. INTRODUCTION

Enterprises are typical statistical units for business surveys, including business panels. For panels, the followed units are called *longitudinal units*. In the present paper, we will focus on the enterprise. Unfortunately, there is no unique definition of a longitudinal enterprise. An enterprise is a dynamic entity whose composition can change through time. Note that the discussion would be quite similar if any other type of unit was chosen.

With business panels, several questions need to be answered. First, sameness through time should be defined; this determines whether any given enterprise can be observed on two occasions. In general this might depend on factors such as: (1) the continuity of ownership or of the higher-level unit; (2) the continuity of the lower-level units; (3) the continuity of characteristics such as the economic activity and location; (4) the continuity of utilization of production factors such as employees; and (5) market continuity. The time lapse between the two observations (for panels: the time lapse between the waves) also plays

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an important role. If one waits a very long time, it is improbable that sameness is preserved, whatever the specific criteria applied. For a detailed discussion of these factors, see Struijs and Willeboordse (1988 and 1995).

Second, what happens when enterprises concentrate or deconcentrate? According to Eurostat (1997a), a *concentration* is an event involving more than one enterprise before the event, and one enterprise after the event. *Mergers* and *take-overs* are the two possible types of concentrations. Similarly, a *deconcentration* is an event involving one enterprise before the event, and more than one enterprise after the event. *Break-ups* and *split-offs* are the two possible types of deconcentrations. Note that it also happens that an event involves more than one enterprise before, and more than one enterprise after the event. These cases of so-called restructuring are treated in this paper by reducing them to combinations of concentrations and deconcentrations. The issue is then: How to define the longitudinal enterprise? Or, how can we follow an enterprise through time? Note that this is a well-known problem in social surveys where the longitudinal household has to be defined (see Ernst, 1989).

This issue of defining the longitudinal enterprise is mainly of concern because concentrations and deconcentrations complicate longitudinal data analysis. The theory used for such analysis generally assumes that the same enterprises are followed through time, which implies that the longitudinal enterprises should be indivisible through time, and cannot merge. To analyze data from a panel of enterprises, the longitudinal enterprise has to be defined in such a way that this requirement is met. Cases of concentration or deconcentration clearly pose a problem. A "good" solution would be one that reduces such cases to situations where one can follow single entities through time. As we will see later in the paper, there is no perfect solution to handle this problem. All solutions have advantages and disadvantages that need to be taken into account.

2. FOLLOWING ENTERPRISES THROUGH THEIR BRID

One common way to follow enterprises though time is to use the Business Register Identifier (BRID). The BRID is a unique identifier that is assigned and managed through time by following rules associated to the Statistical Business Register (SBR). In the present section, the longitudinal enterprises are defined through their BRID. That is, an enterprise will remain the same through time as long as its keeps the same BRID. In particular, after a take-over or a split-off, the continuing enterprise is the one with the same BRID. In the case of a merger or a break-up, no enterprise is continued: there are only old enterprises that are discontinued and new enterprises created.

This definition of the longitudinal enterprise is often used mainly because it is easy to implement within the NSI, provided a SBR is available. For example, the statistician willing to perform a longitudinal analysis based on annual data can simply merge the survey files for the years of interest by using the BRID as the merging key. As mentioned before, the longitudinal enterprises will be the ones keeping their BRID for the period of interest. On the other hand, enterprises for which the BRID will not match next year will be considered as leaving the population, while the new BRID appearing at a given year is considered to be a new enterprise.

One important concern when following enterprises through time using the BRID is the fact that it is related with the management of the BRID by the NSI. If the rules for the assignment of the BRID change at a given moment, then the panel inflow and outflow as identified by matching the SBRs of different years might not be comparable with the previous years. This phenomenon would not be related to any change in economic reality, but would simply occur because of changes in register management. Another aspect is the management of BRID across countries. Again, if the rules as applied by the NSI are not the same between countries, the definition of the longitudinal enterprise is not same, even though the latter has been said to be based on a common notion: the BRID. Consequently, for example, the number of births and deaths identified within the countries concerned are not comparable. In trying to overcome this problem of comparability of management of BRID across its member states, Eurostat has made up methodological recommendations for the SBRs (see Eurostat (1997a)).

3. FOLLOWING ENTERPRISES THROUGH OTHER FACTORS THAN THEIR BRID

Following enterprises through their BRID is relatively simple, provided a SBR is available. However, it might not be the best for all applications. As mentioned in the introduction, sameness through time

can be based on various criteria that might be different from the ones used to assign the BRID.

Three factors may affect the decision not to use solely the BRID to define the longitudinal enterprise. First, there is the application envisaged. Second, for practical reasons, the rules for assigning the BRID may have little economic meaning. If a country has poor administrative sources for updating the SBR and cannot or does not want to spend resources on sophisticated and elaborate rules, it may make more sense to establish enterprise continuity on another basis than the BRID. The third factor is the requirement of data comparability between countries, which implies the use of a uniform definition of the longitudinal enterprise.

It is important to note that the choice of not using the BRID, at least solely, might require some processing that could be difficult to implement in practice. Checking the applicability of the definition chosen is particularly important in the case of concentrations and deconcentrations. For instance, it may not be easy to establish whether an observed enterprise that has no match with enterprises at a later date has really died or has been taken over by another enterprise. Moreover, in general, concentrations or deconcentrations may be difficult to distinguish from real enterprise births and deaths.

4. SOME SOLUTIONS TO HANDLE CONCENTRATIONS AND DECONCENTRATIONS

Whether or not sameness through time is determined solely based on the BRID, we need some specifications for the treatment of concentrations and deconcentrations. This is especially true if the way the BRID is managed does not fit the chosen definition for the longitudinal enterprise. The specifications for the treatment of concentrations and deconcentrations depend on: (1) the application envisaged; (2) the requirements of the framework of which it may be part; (3) the question whether the complete population is available, or only a subset (sample); (4) the availability and timeliness of the data used in the criteria; and (5) usual practices. In this section, some solutions are presented to handle concentrations and deconcentrations. As mentioned earlier, a "good" solution would be one that reduces to following single entities through time.

Solution 1: Choose a definition such that at most one longitudinal enterprise is recognized

This solution is based on the idea of predominance. For concentrations, if one of the concentrating enterprises were much "larger" than the other ones, then this one would be considered as the continuing enterprise. We would see this concentration as a take-over. If none of the concentrating enterprises is "larger", then no enterprise would be considered as continuing, and then all the concentrating enterprises would be considered as cessations and the new enterprise a creation. For deconcentration, a similar pattern would apply.

The terminology used is in line with the Eurostat recommendations for SBRs (see Eurostat 1997a). This also suggests that a distinction is required between enterprise creations resulting from concentration and deconcentration, and real enterprise births. A similar distinction between cessations resulting from concentration and deconcentration, and real enterprise death is recommended.

The main difficulty with this first solution is the definition of "large". This can be based on one or several quantitative variables at a time (e.g., annual turnover, number of employees). Note that "large" should normally be defined in relationship with the remaining enterprise after concentration (or the initial enterprise for a deconcentration). That is, the concentrating enterprises should be large or not compared to the remaining enterprise. In addition to quantitative variables, one can also add some other criteria based on qualitative variables. These other criteria can also work in conjunction with the management of the BRID.

Example:

For deconcentrations, the continuing enterprise is the one that keeps at least 70% of its employees. For concentrations, it is the one that contributes at least of 70%.

We first illustrate (see Figure 1) the above stated criteria for a deconcentration. Suppose that enterprise A has 100 employees at wave 1. Between waves 1 and 2, a deconcentration occurs and at wave 2, enterprise C now divides into enterprises A and B having 80 and 20 employees, respectively. Applying the above rule, since A has inherited more than 70% of the employees

from C, A continues to exist via C and B can be considered as created from a split-off. Another illustration of a deconcentration is the one given by Figure 2. Applying the above rule, since neither A nor B has at least 70% of the employees from C, both A and B are considered creations from a break-up, and C as a cessation.

We now consider an illustration of a concentration (see Figure 3). Suppose that enterprises A (80 employees) and B (20 employees) of wave 1 amalgamate to form enterprise C at wave 2. Applying the above rule, enterprise C is found to be the enterprise continuing from A, while enterprise B is considered as a cessation.

The more interesting cases are the complex ones, i.e., both concentrations and deconcentrations occur. See Figure 4. At wave 1, there are two enterprises A and B having 100 and 10 employees, respectively. Between waves 1 and 2, a portion of enterprise A leaves and forms enterprise C. Also, the rest of enterprise A (80 employees) amalgamates with enterprise B to form enterprise D. This does not have to happen simultaneously, but it is assumed that the deconcentration and the concentration both occur between the two waves. Enterprises C and D have 20 and 90 employees, respectively. We now apply the above rule. It is clear that C does not have the required 70% of the employees of A and therefore, C is not considered as continuing from A. Looking at enterprise D, we see that enterprise A provides 89% of the employees, while enterprise B provides only a small percentage. Thus enterprise D is considered as continuing from A, while B is a cessation and C a creation.

Solution 2: Preserve the initial structure of the enterprises.

This solution consists of the following rules. For deconcentrations, we sum for each variable the values of all new enterprises coming from the same initial enterprise, and we give the total to the initial enterprise. For concentrations, we divide for each variable the value of the new enterprise between its initial enterprises by prorating according to one or more auxiliary variables. When applied, this solution creates at wave 2, *synthetic enterprises* for which the structure corresponds to the one that existed at wave 1, i.e., before the concentration or the deconcentration. All original enterprises are considered longitudinal enterprises. The idea behind this solution is to keep the initial structure of the enterprises of the population at the start of the panel, because this population is in fact the one for which the panel is representative (see Lavallée, 1997).

To illustrate the proposed solution, we can consider cases of concentration and deconcentration of enterprises similar to those used for solution 1. First, consider the deconcentration situation where enterprise C divides itself into two enterprises A and B. See Figure 5. Applying the above rules, for each characteristic we sum the values of enterprises A and B to form a "new" enterprise. This synthetic enterprise might be called A+B. With respect to the panel, enterprise A+B will then be considered as the continuation of enterprise C through time.

Now consider the case of a concentration. See Figure 6. First, we need to choose one or more variables to prorate. Let us choose again the number of employees. At wave 1, enterprise A has 80 employees while enterprise B has 20. At wave 2, enterprises A and B have amalgamated to form enterprise C. With the present solution, each of the characteristics (e.g., revenue, profits) of enterprise C is divided by prorating according to the number of employees of enterprises A and B. Once this is done, we have created two synthetic enterprises that might be called C_A and C_B, where C_A is the new enterprise created for the portion of 80%. At the end, C_A is the synthetic enterprise considered to be the continuation from A, and C_B the synthetic enterprise continuing from B.

Complex cases are treated by directly applying the above rules. Consider, as an illustration, Figure 7. Enterprise C, which has 30 employees, is simply coming from enterprise A, and therefore no division is required for this one. On the other hand, enterprise D, which has, we assume, 120 employees, needs to be divided into two synthetic enterprises D_A and D_B, according to the number of employees that come from enterprises A and B. For A this is 70 (100 minus 30), and for B this is 50. The revenue of enterprise D is divided into two according to the ratio 70 to 50 employees, and so on. Once synthetic enterprises D_A and D_B are created, we need to sum the values of the enterprises C and D_A for each of their characteristics, because enterprise A is also subject to deconcentration. This results in the synthetic enterprise $C+D_A$. Finally, we obtain the synthetic enterprise $C+D_A$ continuing from A, and the synthetic enterprise D_B continuing from B.

Solution 3: Apply the final structure of the enterprises.

This solution is inspired by retrospective surveys. In such surveys, we identify a population at a given point in time and select a sample from it. The selected enterprises are then asked questions that refer to events or characteristics concerning the past. For example, one can ask the revenue of enterprises for the last past five years. With retrospective surveys, the structure of the enterprises that is considered is the one of the population at the selection time of the sample, i.e., the final structure of the enterprises in the survey.

Solution 3 is the exact opposite of solution 2. For deconcentrations, for each variable we divide the value of the initial enterprise between the final enterprises by prorating according to one or more auxiliary variables. For concentrations, for each variable we sum the values of all initial enterprises that form the same final enterprise, and assign the total to the resulting final enterprise. The result is that at wave 2 synthetic enterprises are created for which the structure corresponds to the one that resulted from the concentration, or the deconcentration.

To illustrate this solution, we first consider the deconcentration case where enterprise C divides itself into two enterprises A and B. See Figure 8. We need to choose one or more variables to prorate. We choose once more the number of employees. Each of the characteristics (e.g., revenue) of enterprise C is then divided by prorating according to the number of employees of enterprises A and B. Once this is done, we have created two new synthetic enterprises that might be called C_A and C_B, where C_A is the "enterprise" of which A is considered the continuation, and C_B the "enterprise" of which B is the continuation. Now consider the case of concentration. Between waves 1 and 2, enterprises A and B have amalgamated to form enterprise C. Applying the above rules, for each of the characteristics of enterprises A and B, we sum their values to form a new synthetic enterprise that might be called A+B. With respect to the panel, enterprise A+B will then be considered as continuing to enterprise C through time. See Figure 8. Complex cases are treated by directly applying the above rules, as in Solution 2.

Solution 4: Reduce the concentrating or deconcentrating enterprises to a single enterprise.

This solution uses the simplest rules of solutions 2 and 3. For deconcentrations, for each variable, we sum the values of all new enterprises coming from the same initial enterprise, and we assign the resulting total to the initial enterprise. For concentrations, for each variable we sum the values of all initial enterprises that form the same final enterprise, and assign the total to the final enterprise. Whenever concentration or deconcentration situations occur, we always sum the value to obtain an *aggregated synthetic enterprise*. This solution is motivated by simplicity. While solutions 2 and 3 used some prorating to divide enterprises into synthetic enterprises, the present solution does not require proration because no division is performed.

To illustrate the proposed solution, we first consider the deconcentration situation where between waves 1 and 2 enterprise C divides itself into two enterprises A and B, as shown in Figure 10. Applying the above rules, for each characteristic of enterprises A and B, we sum their values to form a "new" enterprise called A+B. With respect to the panel, enterprise A+B will then be considered as the continuation of enterprise C through time. For a concentration, say that between waves 1 and 2, enterprises A and B have amalgamated to form enterprise C. See Figure 11. Applying the above rules, for each characteristic of enterprises A and B, we sum their values to form the new synthetic enterprise called A+B, which is considered as continuing to enterprise C. Complex cases are treated exactly as concentrations and deconcentrations (see Figure 12).

5. ADVANTAGES AND DISADVANTAGES

Each of the four proposed methods to handle the problem of concentrations and deconcentrations has advantages and disadvantages. We now summarize the main ones in the next two tables.

Table 1. Main advantages

	Solution			
	1	2	3	4
1) Keeps the original enterprises (no aggregation).	X			
2) Estimation weight easily obtained for each enterprise.	X			
3) Relatively easy to apply, even after several waves.	X			X
4) Panel can be linked with the SBR using BRID.	X			
5) Distinguish between mergers and take-overs, and also break-ups and split-offs.	X			
6) Proper treatment of out-of-scope enterprises.	X			
7) Simple for deconcentrations.		X		X
8) Simple for concentrations.			X	X
9) Fewer enterprise creations and cessations than solution 1.		X	X	X
10) No prorating required because no enterprise division.	X			X

Table 2. Main disadvantages:

	Solution			
	1	2	3	4
1) Always results in creations and/or cessations (no real births or deaths).	X			
2) Need to identify variable(s) for defining which enterprise is continuing.	X			
3) Easy to apply for quantitative variables only.		X	X	X
4) One needs to identify variable(s) to be used for prorating.		X	X	
5) Application of rules can become cumbersome after some time.		X	X	
6) Synthetic enterprises may not represent the real economic reality as if the change has occurred.		X	X	X
7) Does not distinguish between mergers and take-overs, nor break-ups and split-offs.		X	X	X
8) Out-of-scope enterprises are incorrectly counted in the in-scope population (weighting problems).		X	X	X
9) Data only available after the panel has terminated.			X	X

6. CONCLUSION

After defining sameness through time, which may or may not be based solely on the BRID, the important question is how to handle concentrations and deconcentrations? We have presented four possible solutions to solve this problem. These solutions are relatively simple and can be implemented in practice if some conditions are met. No solution is perfect, and each of the proposed solutions has advantages and disadvantages.

Choosing between the solutions is not easy. On the

one hand, there are the applications envisaged, and on the other, there are a large number of practical considerations. The use of the data for analysis is most hampered in solution 4, but solutions 2 and 3 also result in a distorted presentation of economic reality. This is not the case for solution 1, if enterprise creations and cessations are treated adequately by not confusing them with real enterprise births and deaths.

The most important practical consideration is probably data availability. The data requirements differ between the four solutions. Data availability does not solely depend on their collection in panel surveys, but also on what is available from other sources, and in particular the SBR. The question of whether or not a system of prorating is to be developed has a number of practical implications (solutions 2 and 3), but not applying prorating as in solution 4 has its price as well. The practical problems of defining sameness through time are biggest for solution 1, because this is essential for the treatment of concentrations and deconcentrations. In all four proposed solutions sameness through time has to be defined for units that are not involved in concentration or deconcentration, in order to determine whether a single unit is continued or discontinued, resulting in a death followed by a birth. It seems that solution 1 can be sustained many waves, whereas the other solutions become cumbersome after a few waves.

Note that one could also consider different solutions for different parts of the panel population. For example, a different solution could be applied to large enterprises than to smaller enterprises. This would make complicate matters with respect to organization, interpretation of the panel data, explaining the panel to the users, and maintaining consistency. However, it could still be considered if one thereby succeeds in combining the best elements of the different solutions and achieving an overall reduction of the disadvantages.

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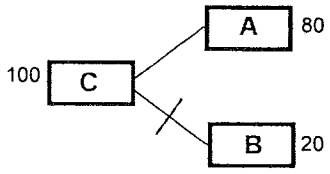
Figures 1 and 2: Solution 1, Deconcentration situations



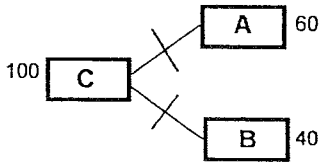
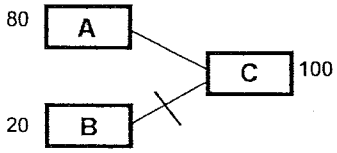


Figure 3: Solution 1, Concentration



Figures 4: Solution 1, Complex Case

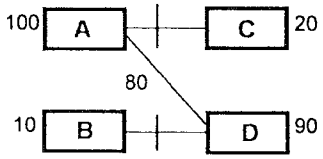


Figure5: Solution 2, Deconcentration

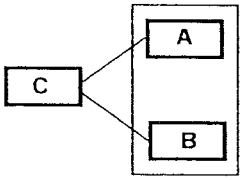


Figure 6: Solution 2, Concentration

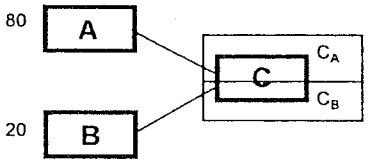


Figure 7: Solution 2, Complex Case

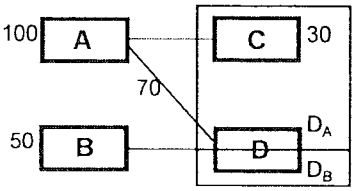


Figure 8: Solution 3, Deconcentration

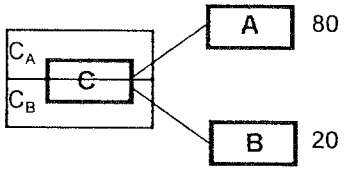


Figure 9: Solution 3, Concentration

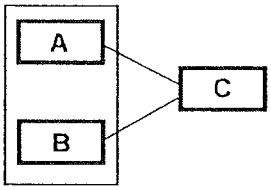


Figure 10: Solution 4, Deconcentration

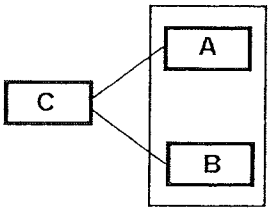


Figure 11: Solution 4, Concentration

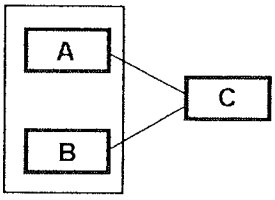


Figure 12: Solution 4, Complex Case