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Some remarks on the sampling
and
the charge-out rates method

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Introduction

The aim of this paper is to detail two aspects which appear to be important when setting up PPI for business services in France: the problems linked to the sampling method on the one hand and the charge-out rates method on the other. During an internal discussion held in 2003 within the PPI team in France, it came to light that the operations linked to the sampling method were a weak point in our operation. Work was started in 2004, essentially to assess the relevance of the current sampling method and weightings used. Part 1 of this paper details the problems found in our sample base, the sampling method used and its limits, while proposing new alternatives. In France, the main method used to build PPI on some business services (computer services, consultancy, engineering, etc) remains the charge-out rates method (price per qualification and per unit of time). In part 2, the basic principles of this method will be examined in detail: what should be measured and what is really being measured?

Problems linked to the sampling method

The sample base consists of the results per product to the services' annual business survey. In this annual survey, businesses are required to break down their turnover per product. The classification chosen for products is based on the CPC classification but appears to be more detailed in some cases. With this sample base, we can therefore have a real product approach, and not just a sector approach. Therefore, some businesses are questioned within several sub-groups: computer services and consultancy for example. The correlation relating to products between this sample base and our price monitoring problem appears to be good in most cases. However in some cases, notably computer services, the results should be read with much more care as the professionals cannot locate themselves in the current product classification.

However, this base is not ideal and many businesses sampled appear to be **outside the scope** following examination. Businesses are essentially classified outside the scope for two reasons: **absence of market price** on the one hand and **incorrect classification** on the other. Some businesses in the sample base effectively do not implement a market price due to the fact that they only work for a single customer or a single group, without being subject to competition and receive subsidies from their single customer. For the time being, our main objective is to monitor market prices only. This case appears fairly frequently in some sub-groups (consultancy, data processing). It means we have to do more preliminary research to identify this type of business very early on in the process, in order to exclude them. Nevertheless, this exclusion can pose a problem: the turnover of the sub-group includes that declared by these businesses while the price index used as a deflator does not. Businesses may also have an incorrect product code for two reasons. It may involve an error linked to the statistics system (i.e. incorrect coding, misunderstanding), but may also relate to a strategic decision by the business. For example, many businesses want to obtain the activity code of "consultancy" which seems prestigious, although their activity in practice is far from this. Businesses

outside the sample scope, which are classic for a statistics survey, are also noted due to the time delay between the reference period for the annual business survey and the field officer's visit for price monitoring study. Some businesses will have closed in the meantime.

From this sample base per product, the sampling principle involves systematically retaining the largest businesses and selecting others by sampling. In practice, this involves setting several thresholds. The turnover threshold above which companies will be selected; other thresholds can also be used, since the sampling rate is not uniform for other levels (e.g. selection of one business in ten for medium-sized businesses and one in 20 for small businesses). These thresholds are largely determined empirically, which involves taking into account the concentration in the sub-group and the relative importance of this. The major problem comes from the inability to calculate "real" coverage rates. In effect, due to the out of scope problems mentioned above, we cannot calculate the global reference turnover per product. Examining the whole base to perform this calculation proves to be too lengthy an operation. Rather than the sampling method, **the weighting calculation method** seems to be important. The weighting of a given business for a given product will be the turnover of the business for this product. In other words, we do not take into account the selection probability by multiplying the turnover by the inverse of the sampling rate.

For some sub-groups at the end of the process, we consult the Internet sites of the professional organisations or we talk directly with them to obtain a list of major players per product, according to the professional organisation. We compare this list with our sample. Businesses may be added to this list which do not initially appear in our sample.

Forming samples to measure price changes in services is essentially therefore a **pragmatic procedure**, which differs from many theoretical concepts. Consequently, it seems practically impossible to calculate variance indicators linked to the sampling.

The current sampling method is therefore neither a probability proportional to size sampling (**PPS sampling**) type approach, nor an approach based on the **cut-off sampling** method. This intermediate approach risks combining the disadvantages. It does not limit the response load of small businesses, which allows the use of the cut-off sampling approach and does not rely on solid theoretical bases like PPS sampling. We have tried to ascertain in the first instance whether the PPS sampling type approach would not be more relevant. **The PPS approach seems to be more relevant when the size variable (turnover in our case) is proportional to the survey variable of interest**. In studies on price monitoring in services, our variable of interest is the change in prices from one quarter to the next rather than the price level for a given quarter. Schematically, we can even say that it is not of consequence if the price level measurement in incorrect, as long as the price change measurement is correct (e.g. constant biais on the price measurement).

We therefore wanted to find out if there was a link (linear) between the business size and the change in prices. This study was carried out by Solène Armange, who was on a two month placement at INSEE, for three sub-groups: computer services, accounting services and cleaning activities. The choice of these "pilot" sub-groups was made from several criteria: the size of the sub-group, the sample size and the existence of a link in theory following contact with the businesses. The results of this study seem clear: **there is not any linear relation between the size of the businesses and the change in prices** for the three areas mentioned. Likewise, it seems there is no linear log relationship. This does not necessarily mean that the size of the businesses has no influence on the change in prices. The lack of a proportionality relationship implies that using a PPS sampling type method risks generating a variance on the results obtained. In fact, for a given business, multiplying its turnover by the inverse of the sampling rate to obtain its weight assumes that the change in prices for this business is similar to those of a similar size which were not selected. Even if these results are only provisional, they do not favour the choice of a PPS sampling method in France.

Apart from continuing the previous study in more detail, the next step to be considered will be to find out if it would be better to apply **the cut-off sampling method** in the following manner: only choose businesses above a certain turnover threshold. Economically for a given sub-group, this means that the change in prices in a sub-group is similar to that found for the industry leaders. Currently, given the way the weightings are calculated, the concentration of the sample implies that the influence of small and medium-sized businesses is very low. Thus within accounting services, the six largest businesses in the sample generate 75% of its turnover. Although it seems that the influence of small structures is very limited, the cut-off sampling approach would also have the advantage of reducing the response burden of businesses to the surveys.

Our investigations on the sampling method linked to the measurement of PPI on business services are only just starting. It seems important to us to focus on this point, and not just on the delicate issue relating to the choice of method. Even if this sampling method remains essentially **pragmatic**, it is essential to limit the risks of bias and variance of price change estimators caused by an incorrect sampling method. On this subject, the experiences of other countries and **international co-operation** can only be beneficial.

Charge-out rates method

The main problem when monitoring PPI on services comes from the unique nature of the services in many sub-groups. It is therefore very difficult (impossible?) to monitor the actual prices of recurring operations within computer services, consultancy or even engineering. Faced with this problem, we mostly try to monitor **the prices per qualification** in order to obtain a good idea of the evolution of prices over the quarters. Even when the labour component is not the only one taken into account in the price of the service, in facilities management for example, we are trying to extend this concept with

average price monitoring per unit. This choice of method results from a compromise between theoretical and practical aspects, notably linked to the ability businesses have to provide us with the requested information. Nevertheless, after carrying out several experiments on this matter in different sub-groups, many questions arise regarding this method.

In the first instance, it might be good to recall that, in most cases, the customer of a services company is essentially buying the result of a project and not "100 working hours of a Unix consultant engineer". The customer is therefore buying the result of a project, and not the human resources to complete it directly. Schematically, to calculate the price of the service, the service company naturally works out the working time required per qualification and calculates this using the average daily rates per qualification. Once added to the other costs, we obtain a price proposal for the customer which will then be negotiated. **The price is therefore set after negotiation and is calculated on the estimated time**.

Consequently, **what should be measured so as to be as close as possible to the price of the service purchased by the customer**? First, the **agreed "daily prices per qualification"** should be measured, meaning those drawn up and agreed to at the start of the process when the price is accepted. Second, we must know, for a given quarter, whether we are going to consider just some projects or take an average. We cannot find projects over a period of time which relate to exactly the same content. The business can select, each quarter, projects which it deems representative of its activity and "sufficiently" comparable from one period to the next. From this selection of projects, we will try to see, in another section, how the business can calculate average daily prices per qualification. We can therefore calculate an average across all projects concluded within a given quarter. Even if the average approach is not favoured by index theory, it can limit the effects specific to a given contract. With experience, it does not seem easy to ascertain whether one approach is more relevant than the other. This assessment may change from one business to another. Taking an average may be similar to assessing a representative project of the business's activity for a given quarter. We will see, however, that in practice the management system does not allow average assessments to be performed very easily.

Regardless of the approach chosen to measure these "agreed" prices per qualification, **a weighting** must be allocated to each service, and therefore each qualification. This weighting should naturally remain fixed to measure the price index between two periods. The general idea is that the weight assigned to each qualification should reflect the relative importance of this within the productive staff of the business. However, it is not easy to calculate this weight from the project price determined for a given quarter. On the one hand, projects are changing all the time and on the other hand, a qualification may be used to varying degrees depending on the project. In France, we have chosen to calculate the product of sales price * number of employee in this qualification (Pi*Ei) for the reference period. The weight allocated to a given qualification will therefore be Pi*Ei divided by the sum of all PiEi values for all qualifications. If we combine the prices per qualification, taking into account these

weightings, to calculate an average price per business, this would result in schematically calculating the price of a representative project. **Therefore, the price per qualification is very similar to the model pricing approach**, which uses a "fictitious representative" project. However, in theory, there is a significant difference. From one quarter to the next, the weightings remain fixed in the sales price per qualification approach. In the model pricing approach, the estimated times per category can change (e.g. to reflect the evolution of productivity). In practice, however, these values remain fixed as it is very difficult for a business to work them out for a project which has become fictitious.

One of the main problems when measuring prices in services relates to the **timing**. Ideally, as Eurostat mentionned, prices should be measured **when the service is provided** and not **when the contract is signed**. This problem is not insignificant: the time period between the two may be quite long, especially for computer services, consultancy or engineering. An engineering project may take several years, likewise a computer project which includes consultancy services may, on average, last a year. With this in mind, the only solution would be to select a "representative" project which is being performed (at least in part) during the reference quarter. It will be very difficult to calculate averages. Using which breakdown key should the data from the various projects be combined? **The times estimated** at the beginning of the project are not broken down per quarter, for a given qualification. One option would be to use **the realised times spent** on the project, taken from the time records used within businesses. However in this case, we are moving further away from the price actually agreed to and accepted by the customer. The times spent may vary from the estimated times, just like the actual margin on a project is different to the agreed margin.

In theory, the only alternative to ensure the price actually paid by the customer is monitored and the essential aspects linked to timing are complied with would therefore be to consider a single project each quarter, where this changes over time. However, it will be difficult and "risky" to base a price measuring system, especially in a large business, on comparing prices per qualification in this way. Specific effects may arise, which do not reflect price effects. We risk having a price change situation whereby prices remain fixed for the duration of the chosen project, then jump when a different reference project is used. It is difficult to ascertain whether this price variation really reflects the "actual price situation" within the business surveyed. **In this case, how can the timing problem be reconciled with the previous recommendation of monitoring the price accepted by the customer**? If the management system of the businesses allows, a choice must be made, favouring one or other approach.

If the services company is large enough and works on long projects, the approach which complies with the recommendations linked to timing must be favoured. In this case, we are going to monitor **average prices per qualification, calculated from the time spent** on the projects per quarter. Apart from the aspects linked to the progress of the project with time, we must see whether **the time spent (time realised) differs from the time estimated** when the customer agreed to the project. We are not really in phase with the price actually accepted by the customer. For example, with this method based on the

time spent, we can try to reconstruct the price of a project. The price calculated in this way will be different to the agreed price, if the time spent is not exactly the same as the estimated time. Likewise, if we assume (for illustrative purposes only) that projects are exactly the same from one period to the next, we can then select a few customer contracts and monitor their prices over time, like we do for cleaning and security. If, in parallel, we apply the charge-out rates method, we will not obtain the same change in price if the time spent differs from the estimated time. In the same way, monitoring prices per qualification is actually moving away from the model pricing approach in this case. In actual fact, no problems arise if the time spent always varies in the same proportion as the estimated time. However, problems occur if the relative difference tends to vary with time. In consultancy, some businesses told us that the time spent was differing from estimated times to a much larger extent (the time spent was much greater) due to increasingly pressurised negotiations with customers. With this error, we tend to underestimate price variations using our measuring method.

To calculate the average prices per qualification, the services company will divide a turnover by the time spent on the project. Using a time monitoring system within the company, it is relatively easy to calculate, per quarter, the time spent on a project per qualification. But how can the company calculate the turnover per qualification for projects in progress? Globally for a project, for all qualifications combined, it is possible that we are monitoring a turnover linked to a monetary payment from the customer rather than the actual completion of the project. For example, a price is drawn up and agreed upon for a project which lasts one year. The customer decides to pay for this project in four identical quarterly instalments. It is the amount of this instalment which we are monitoring per quarter. **This monitored turnover is not necessarily in phase with the actual progress of the project**. The services company can, for internal organisation reasons, spend more time working on this project in quarter 1 than in quarter 4. This risk is however limited by combining all projects. Holiday periods are more difficult to deal with. In the summer, especially during August, the payments received are completely out of phase with the hours worked. This may lead to an artificially high turnover / time spent ratio, therefore giving a seasonal price increase. **The problem is in fact the introduction of an "artificial" seasonal variation**. In computer services, notably following meetings with companies, we notice seasonal variations in prices which do not reflect the actual price movement. Work is currently underway to gain a better understanding of these seasonal variations and to decide how to deal with them (application of moving averages?). Future contacts with businesses will also allow us to gain a better understanding of how turnover is broken down and combined per qualification.

For relatively short projects and work, we can use the **monitoring of prices when the contract is signed** approach. From one or several projects, we can therefore monitor average agreed prices per qualification. We are naturally in this case no longer in phase with the recommendations regarding timing. This problem is often raised by businesses and can be a source of misunderstanding. In actual fact, when considering their perception of price variations, **businesses focus more on the prices when the contract is signed**. We must be sure to explain to companies that we are presenting results based on the time spent, and therefore on the completion of projects in progress, or else they

do not feel they are in phase with the changes noted. We are working extensively on this issue with computer services companies. The professional association has informed us of the trends noted on the prices at the time of contract signature, highlighting the probable trends on prices by taking into account the average project duration. We can deal with this using the calculated indices. If the services company provides us with information relating to prices when the contract is signed, it is very difficult for it to do it "correctly" over several projects. This is because, in its management system, the estimated times are often not saved and agregated for a qualification. In some cases, businesses can do this by using a simple arithmetic average which does not take the respective size of the projects into account. Using a single project to apply this method is not very effective. It would probably be better in this case to take a project in progress rather than a project at the time the contract is signed.

The previous sections have highlighted the possible alternatives to monitor average prices per qualification, by laying out the advantages and disadvantages of each. We have several criteria to choose between the various possible options: **size of the business, average duration of the projects and management system of the businesses** in particular. In France, after having applied this type of method in several sub-groups, our aim is now to gain a better understanding of what businesses do to provide us with the average prices per qualification. Proper understanding will allow us, for example, to anticipate any problems linked to seasonal variations and to try and solve them by ensuring information is disseminated quickly.