Plant-level Productivity in A Declining Market: The Case of Union Locals

Thomas Breda*, Alex Bryson** and John Forth***

*Paris School of Economics, Paris, France and CEP, London, UK
**National Institute of Economic and Social Research and CEP, London, UK
*** National Institute of Economic and Social Research, London, UK

Abstract

Unions are businesses like many others. They rely on the sale of representational services to employees, through subscriptions, in order to generate revenue that will cover their labour and non-labour costs. Consequently they have an interest in maximising productivity. Following studies of firms and plants in the market sector of the economy, we investigate both the level and dispersion of productivity across union locals in the United States. These locals operate in a mature market characterised by declining demand and unions have responded via agglomeration, such that the number of locals providing union membership has fallen and their average size has risen. We find that productivity dispersion across union locals is substantial - whether measured in terms of sales or units sold - as it is in plants in the commercial sector. Union locals' Total Factor Productivity (TFP) is also a significant predictor of locals' survival. Aggregate TFP in the sector has fallen in the last decade or so and is increasingly dispersed. The nationals to which most locals belong account for roughly one-fifth of TFP growth, indicating that organisation-level factors do affect locals' efficiency. However, nearly three-quarters of TFP growth occurs within locals, rather than across locals, confirming the importance of local-specific effects.

Keywords: productivity; trade unions; Cobb-Douglas; survival

JEL classification: J5; L1; L2; L3

1. Introduction

It is well-known among economists that productivity levels and productivity growth vary enormously, even among seemingly «like» plants in the same industry, both in the United States (Syverson, 2004a) and elsewhere (Hsieu and Klenow, 2009). This is even the case among plants in the same firm (Griffith et al., 2006). Most recently, Ashenfelter (2012) suggested huge variance in real wages across workers doing the same job for the same firm in 60 countries was accounted for, in large part, by substantial differences in Total Factor Productivity (TFP). To date the literature has focused on what might contribute to these differences among plants in the market sector. In his review of this literature Syverson (2011) makes a plea for research which sheds more light on sectoral variance in productivity growth (op. cit.: 358). We contribute to this literature by examining plant-level labour productivity and TFP over time in a small part of the not-for-profit sector, namely trade union locals in the United States.

The selling of trade union membership is an interesting setting in which to estimate plant-level productivity for a number of reasons. First, although it is perhaps not immediately obvious, labour productivity is critical to the operation and survival of not-for-profit voluntary organisations in much the same way as it is for for-profit organisations, since they often face market competition for their services. Although it is not always clear how much competition there is in the provision of union services to specific groups of employees, in some industries and occupations it can be intense: "Turf wars" frequently break out between unions with some locals' organising coming at the expense of other locals[1]; and many unions face direct competition from employers, some of whom engage 'union busting' consultants to dissuade employees from unionisation.

Second, union locals are reliant on the recruitment and retention of members (their customers) as their primary income source. This in turn relies on successful organising and servicing of their membership by the union's employees in order to balance its accounts. Consequently locals' survival is likely to depend on the efficient management of capital and labour in the face of market competition and, as such, they will be cognisant of the value of organising and servicing members, as well as the marginal returns of doing so.

[INSERT FIGURE 1]

[1] For a recent example see http://www.huffingtonpost.com/2011/08/12/seiu-nuhw_n_925584.html.

Thirdly, the union sector is informative in understanding how important productivity can be in a sector operating in a declining market. This is indicated by the decline in union membership that has occurred over the period we analyse (Figure 1). As Gomez et al. (2010) note, the decline in union density in recent years is akin to the final phase in a product life cycle model in which the demand for the good (in this case union membership) is diminishing and suppliers' efforts focus on capturing market share. This has implications for the size and location of suppliers and their entry and exit rates discussed in the next section.

Finally, as in the case of Ashenfelter's (2012) study of McDonald's burger joints, union locals deliver a single good, namely union representation. Standardising on a single good means we are able to avoid complexities associated with organisations' ability to substitute between goods and services in response to demand. There may be differences between union locals in the services they offer and the prices they charge for those services; however we would argue that there is no more variation than would typically be seen in the market for a single type of service. Analysts are often unable to distinguish between increased productivity arising from the number of units sold, and sales growth, which may simply be a function of pricing decisions. Fortunately, we are able to distinguish between price effects and quantity effects because our data, like Ashenfelter's, identifies the price of the good and net change in the number of units sold.

The remainder of this article is set out as follows. Section Two reviews the existing literature Section Three introduces the hypotheses we test in the data to contribute to the literature. Section Four presents the data and describes the empirical approach we adopt. Section Five presents the results and Section Six concludes.

2. The Existing Literature on Unionization

As is well-known, union membership and union density has been in decline in the United States for much of the post-War period, as is the case in many developed economies (Schnabel et al., 2013). Between 2000 and 2012 - the period analysed in this paper - the number of workers in the U.S. economy rose from 120.8 million to 127.6 million, but membership fell by 1.9 million from from 16.3 million to 14.3 million - a rate of roughly 1 percentage point per annum. Union membership density thus fell from 13.5 per cent to 11.2 per cent. This decline has its roots in fundamental societal changes (Bryson et al., 2010) which, some argue, has resulted in a secular decline in worker demand for unionisation

(Farber and Krueger, 1992). This, in turn, has led some to maintain that unions have little influence over the rate of unionisation, regardless of the price or quality of the union good they are offering. As such, any prospects of "union revival" appear slim or non-existent.

The counter argument is that demand for unionisation among non-union workers has actually been rising, as indicated by polling since the early 1980s (Bryson and Freeman, 2013: 5) such that union decline is, at least in part, a supply side problem: unions have been unable to offer union services in sufficient quantities to those who may wish to pay for them. Yet very little is known about the difficulties unions face in meeting any demand for unionisation in the United States. The literature has focused on the costs of union organizing arising from the National Labor Relations Act system under which unions must win workplace votes to achieve bargaining rights, often in the face of employer hostility, plus the unfavourable political climate unions have faced in recent years. However, even if the system is not conducive to union organising, declining union organizing activity appears to predate Regan-inspired changes to the NLRA in the 1980s, while the decline in union membership rates has been driven by a relative decline in the share of employment in the union compared to the non-union sector (Farber and Western, 2000).

The literature summarised above draws predominantly on household surveys of employees, notably the Current Population Survey (CPS) and administrative data on organizing drives collected by the National Labor Relations Board. It pays little regard to the performance of individual 'suppliers' of membership, apart from what we can discern about the performance of individual national unions from aggregate data. There are two exceptions. The first is the work of Jack Fiorito and colleagues which investigates the effectiveness of national unions (Fiorito et al., 1995). The second is the study by Holmes and Walrath (2007). Using the annual accounts data unions are required to file under federal law, known as the Labor Organization Reporting System (LORS), they examine union membership dynamics among union locals between 2000 and 2007.[2] Taking their cue from the employment dynamics literature, their analysis is primarily concerned with identifying the relative importance of entry, exit and within-unit growth in understanding union membership dynamics. They find that despite net decline in union membership there is significant new membership creation and that new gross membership creation occurs differentially across unions.

[2] Theirs was not the first study to use these data. See Troy's (1965) earlier work on estimating union membership over time and across states.

Like Holmes and Walrath (2007) we analyse the LORS data but we take the productivity literature as our starting point, examining heterogeneity in the performance of individual union locals over time. We draw on the existing literature on firm and plant productivity and apply it to union locals: in this framework union locals are akin to plants, and the nationals are the multi-plant firms. The union locals are a set of suppliers all acting in a single industry, in the sense that they are all producing the same type of good (union representation) purchased by customers (union members) through subscription. But like car manufacturers or banks (say) they are supplying heterogeneous consumers and hence not all are competing in exactly the same market. Their competitors come from within the industry (other unions) and, perhaps, from those supplying competing goods.[3] We observe little of the market structure in our data. However, we have detailed information on the location, size and operation of all union locals in the U.S., allowing us to establish whether some of the stylised facts from the literature on plant-level productivity in the commercial sector apply in part of the not-for-profit sector where productivity remains a potentially very important factor in unions being able to survive and prosper. We examine how much productivity dispersion there is within this industry, how this changes over time, what role union locals play in the productivity dispersion and what explains it in cross-section and over time.

3. Hypotheses

We test six hypotheses regarding union locals' productivity, its correlates and its consequences.

Hypothesis 1: The declining market for union membership will affect locals' size and their entry and exit rates

In declining markets it is often optimal for service providers to merge plants to increase returns to scale and strip out costs where they are duplicated across plants (Caves, 1998). This suggests the average size of locals should rise over time with the monotonic decline in membership. However, it is possible that union locals need to be situated near their customer base to offer satisfactory union services to their members - a situation that might be analogous to a food store offering convenience to its customers. If this is the case there will be limits to

[3] It is arguable that unions are monopoly suppliers of the union good. Certainly, when they achieve recognition status following an NLRB-sanctioned vote, a union obtains sole rights to act as the bargaining agent of covered workers. However, union membership has been conceived of more widely as a multi-attribute good offering services, such as worker voice, which might conceivably be provided by others, whether it be a solicitor or, even, employer-generated voice mechanisms such as town hall meetings (Bryson and Gomez, 2003).

the distance between a local and its membership base which may constrain union mergers and acquisitions.

Union service providers may also be unwilling to invest in setting up new locals if the market is declining, preferring instead to hold fixed costs constant by relying on existing locals to provide the service to new members. This may result in a decline in the rate of new entry of locals to the market.

Hypothesis 2: The production function for union membership should be similar to that for commercial goods and services

There is no reason to believe that the production function for union membership should differ from the standard Cobb-Douglas function commonly used in the literature (Syverson, 2011). In the basic Cobb-Douglas specification ln(output) is regressed on ln(capital inputs), ln(labour inputs) and ln(intermediate inputs). Intermediate inputs include materials, electricity and so on. So we have:

$$\ln Y_i = a_0 + a_1 \ln K_i + a_2 \ln L_i + a_3 \ln M_i + e_i$$

The plant-specific component of logged TFP is then e_i (since a_0 is common across all plants).

This basic equation is sometimes augmented by specifying different types of capital or labour inputs, or by identifying factors which contribute to the variation in e_i across plants. These may be internal to plants (e.g. aspects of its compensation structure) or external (e.g. aspects of the market in which it operates). We do not do that here. Furthermore we ignore intermediate inputs as most locals in our data do not report it. As locals provide services rather than transforming an intermediate good into a final one, ignoring intermediate inputs should not be a problem; indeed, those who do report it typically cite very small amounts.

In this literature it is common to find capital accounts for around one-third of output, while labour accounts for two-thirds. We anticipate the production function for union membership to reflect this empirical regularity.

Hypothesis 3: There is substantial dispersion in productivity levels across locals

In studies of commercial organisations, it is typical to find that the most efficient plants in an industry are three, four or even five times as productive as the least efficient plants (Syverson,

2011: 326-7). If the market for union goods is comparable to the for-profit sector, as we think, then we anticipate finding similar levels of dispersion across local unions. If, on the other hand, we find little variance in productivity, this might suggest the market for union membership differs from markets for commercial goods and services.

Hypothesis 4: The national union to which the union belongs will account for part of the local's productivity but most of it will be accounted for by persistent effects across locals over time

Most of the locals in the data belong to national unions. For example, in 2012 two-thirds (64%) of the 14,543 union locals belonged to one of the top 20 largest national unions (authors' calculations based on LORS). These locals are akin to establishments in multi-plant firms, while the stand-alone locals are akin to single-plant firms. The literature on plant productivity indicates that the firm to which the plant belongs can account for a sizeable part of its productivity. For example, Baily et al. (1992: 232) show firm-level productivity growth accounts for a substantial part of plant-level productivity growth in U.S. manufacturing. They speculate: "There may be common productivity shocks that hit the plants in the same firm because of similarities in technology or product mix. And these "shocks" may not be simply random events. They could easily be the result of research and development or product development at the firm level." In the case of union locals, it's conceivable that they will also be hit by shocks at national union level, but it is also possible that locals' productivity is tied to that of the national where they pursue policies and practices that emanate from the centre, or if they learn from others in the same organisation.

Although some part of a local's productivity may therefore be accounted for by the national to which it belongs, most of the dispersion in productivity in manufacturing plants in the U.S. over the period 1972-2010 occurs within firms, rather than across firms (Kehrig and Vincent, 2012). Thus, if this finding translates to the service sector and service providers such as union locals we can expect the bulk of productivity dispersion to be accounted for by locals (plants) rather than nationals (firms).

Evidence from a single wholesale building and plumbing firm in the UK shows remarkable persistence in plant-level productivity over time, such that the rank-order of the plants varies little over a four to five year period (Griffith et al., 2006: 518-520). If the provision of union services is in the declining phase of its life cycle, such that one would not expect substantial

innovation among locals, then we would expect to find a considerable degree of persistence in our data also.

Hypothesis 5: The age of locals will affect their productivity

Plant age will affect locals' productivity in a number of ways, but the net effect of age is unclear a priori. In capital intensive industries, firms' productivity will decline with capital vintage. It is not clear how important capital investment is for union locals. However, if locals learn by doing, as is the case in Pakes and Ericson's (1995) active learning model, they may become better at organising workplaces and servicing their membership base, leading to greater productivity. Older locals are also more likely to be more productive than younger ones due to a process of natural selection whereby less productive locals are shut down.

Following on from Hypothesis 1, any reduction in the rate of new entry of locals to the market may result in a secular rise in existing locals' productivity. Alternatively, it may result in entry for only the most productive new entrants, resulting in a rise in productivity among new entrants.

Hypothesis 6: Locals' productivity matters for their survival

If union locals vary in their productivity, as studies of commercial organisations suggest they might, we would anticipate substantial variance in the rate of membership decline across locals. We may also think that locals' productivity has a direct effect on their likelihood to survive and grow. Indeed, in a market setting competition should lead to the survival of the most productive firms as less efficient firms die. Baily et al. (1992: 227-230) find empirical support for this proposition in their analyses of manufacturing plants in the U.S.: those plants with higher TFP survive longer. Whether market selection of this type occurs in a non-profit sector such as union locals is uncertain. However, there is a second reason why highly productive locals may survive for longer: national unions seeking to increase efficiency will build their capacity to organise and service members around those locals that are most productive, choosing to close down the less efficient locals.

4. Data and Estimation

Our data are the Labor Organization Reporting System (LORS) for the period 2000-2013. The LORS data are a product of the Labor-Management Reporting and Disclosure Act of 1959 (also called the Landrum-Griffin Act). The legislation requires labour organizations to report annually to the Department of Labor (DOL) detailed financial information about their

organizations.[4] Each organization is assigned a permanent unique identifying number. The data are publicly available. We accessed them on December 6th 2013 at the following address: http://kcerds.dol-esa.gov/query/getYearlyData.do

Our final dataset contains 223,112 local*year observations, corresponding to an average of 17,162 locals per year . It includes in total 21893 different locals, implying that a ocal is present for an average of 10.2 years in the data. 57% of locals are present all 13 years between 2000 and 2013.

Full details of the dataset and the way we set it up for this paper are provided in the Data Appendix.

In addition to the descriptive analyses showing the number of locals over time and their membership we present standard Cobb-Douglas production function estimates of locals' productivity. We use two measures of productivity: log union membership each year, which is akin to the stock of units sold, and log sales. From these we derive TFP, as discussed under Hypothesis 3 above, then regress TFP against fixed effects for nationals, states, states*nationals, cities, cities*states and, finally, locals, to establish the variance in locals' TFP explained by these observable characteristics of locals. We then run regressions of TFP to establish the links between TFP and age of local, as well as TFP and size of local. Finally, we present models estimating the determinants of local exit in the period 2000-2010, focusing the discussion on the role played by TFP and labour productivity.

Before turning to the testing of hypotheses it is worth returning to Figure 1 to see that our data show union membership declining between 2000 and 2012. The trend is similar to that for the CPS. However the LORS series shows higher membership than the CPS private sector line, but lower membership than the CPS "all employee" line, just as we would expect given the LORS coverage noted in the Data Appendix.[5]

[4] As Holmes and Walwrath (2007) note: "The intent of the legislation was to provide the members of a given organization–and the general public–with a means of monitoring organizations." One of the motivations behind the original legislation was the desire to limit unions' opportunities to commit fraud, particularly with respect to the use of political funds.

[5] As Holmes and Walwrath (2007: 7-9) note, the LORS may diverge from the CPS because not all state and local government unions file LORS returns), and because LORS data may include retired members.

5. Results

Hypothesis 1: The declining market for union membership will affect locals' size and their entry and exit rates

Table 1a shows union membership rates recorded by the largest twenty union nationals for each year between 2000 and 2012. Most suffered membership declines, but in seven nationals' membership actually rose. The most notable example is the Service Employees union, the SEIU, noted for its particular approach to union organizing under President Andy Stern. It has grown by a factor of 1.55 since 2000.

[INSERT TABLES 1A AND 1B]

Table 1b shows the number of locals in the data set has fallen by 4,537 since 2000 - a fall of almost one-quarter (24%). In 2012, almost two-thirds (64%) of union locals belonged to the 20 largest union nationals. This is the same proportion as in 2000, so the big nationals have accounted for the same proportion of union suppliers over the last decade or so.

In accordance with the proposition in Hypothesis 1, the average size of union locals has grown over time. The average number of members in all locals rose from 578 in 2000 to 759 in 2012 (748 in 2000 to 901 in 2012) - a 30% increase. This is consistent with unions consolidating their resources, thus stripping out some of the fixed costs attached to running smaller locals.

[INSERT TABLE 2]

Table 2 shows the entry and exit rates for union locals for each year. The entry rate has fallen slightly over the period, consistent with union service providers being unwilling to invest in setting up new locals in a declining market. The exit rate, on the other hand, has remained above the entry rate, thus explaining the net decline in the number of locals.

Hypothesis 2: The production function for union membership should be similar to that for commercial goods and services

[INSERT TABLE 3]

Table 3 presents estimates of locals' productivity using the Cobb-Douglas production function outlined earlier. The top panel presents estimates of productivity measured in terms of log sales, while the bottom panel presents estimates using log membership. The only difference in model specification between the top and bottom panels is that we condition on log price in the log membership equations to get a cleaner estimate of the quantity of units sold having adjusted for "quality" (assuming that price proxies for quality). In both cases column 1 presents results for all locals, while columns 2 to 5 present estimates for subsamples based on the size of locals.

As hypothesised, the estimated coefficients in column 1 indicate that capital accounts for around one-third of output, while labour accounts for two-thirds. The relative importance of labour compared to capital seems to increase with the size of locals. These findings are apparent for both productivity measures.

Hypothesis 3: There is substantial dispersion in productivity levels across locals

The right hand panel in Table 2 shows that the mean growth rate for locals surviving throughout the period has been negative. However, there is substantial variance in locals' growth rates every year: those in the lower half of the growth distribution experience net contraction, but those in the upper quartile experience growth. If one compares locals at the 10th and 90th percentiles of the growth distribution the spread is extraordinary: those at the 10th percentile experience a decline of 17% in their membership, whereas those at the 90th percentile experience growth of 12%.

[INSERT TABLE 4]

Table 4 presents dispersion in productivity across union locals using five different measures of productivity: sales over labour costs, sales per employee, and TFP measured in three different ways taken as the residual from different models as described in the table. The story is similar regardless of the measure used: there is very substantial variance in productivity across locals. The ratio between the 75th- and 25th- percentile local union in the locals' total factor productivity distribution is higher than 2-to-1. Similarly, the average 90-10 and 95-5 percentile productivity ratios are over 4 to 1 and 7 to 1, respectively.[6] These values are

[6] It is common in the literature to consider value-added per worker or per hours worked as the measure of labor productivity. In our case, sales is close to value-added, as intermediate consumption in the union sector is close to zero. We then use labour costs rather than employment as a measure of quality-adjust labour. We do so because many locals' employees work part time but we do not have this information, so that the number of

slightly higher than those reported by Syverson (2004b) as the average industry-level productivity dispersion in the US manufacturing sector. They are also comparable to, or higher, than those reported by Criscuolo et al. (2003) for UK manufacturing plants and by Oulton (1998) for the whole economy in the UK. These typical values are considered indicative of a high degree of productivity dispersion in the commercial sector (Griffith et al., 2006). We can thus say that productivity dispersion is also very high among union locals, maybe even higher than among commercial plants.

Hypothesis 4: The national union to which the union belongs will account for part of the local's productivity but most of it will be accounted for by persistent effects across locals over time

[INSERT TABLE 5]

Table 5 presents estimates of locals' TFP which is the residual taken from Table 3 Panel A specification 1 (that is, the log sales specification for all locals). The estimates take TFP as the dependent variable in an OLS framework where they are regressed on different sets of fixed effects. The first row of the table shows that around one-fifth of TFP variance across locals is accounted for by the union national to which they belong, confirming that the "firm" effect is quite important. The state*nationals dummies account for one-third of the variance. Geography is also important, as indicated by the variance accounted for by cities (row 4) and the states*cities dummies (row 5). However, by far the most important factor is the locals' fixed effect: this accounts for almost three-quarters (73%) of the variance in TFP, a finding which is consistent with Baily et al's (1992) research mentioned earlier which emphasises the importance of the role played by persistent plant-level factors in explaining productivity variance among U.S. manufacturing plants.

Hypothesis 5: The age of locals will affect their productivity

[INSERT TABLE 6]

employees of locals systematically over-estimates the actual quantity of labour used by locals. We nevertheless constructed a labour productivity and a TFP variable using employment instead of labour costs and find an even higher degree of productivity dispersion (see bottom of Table 4).

Table 6 focuses on two factors that may affect locals' TFP, namely their age and their size. It is apparent that TFP increases among younger cohorts of locals (column 1). This may be because, in a declining market, unions only set up new locals when they are highly productive. Certainly the result is not consistent with net effects being driven by selection (leading to survival only of the most efficient) nor with active learning. One possibility might be that older locals are "locked" into less efficient methods of recruiting and retaining members, perhaps due to the costs of switching to better methods, costs which new locals do not incur. These cohort effects survive the introduction of controls for locals' size, an important control given the likely correlation between age and growth. TFP is higher among larger locals, the pattern of results being similar whether one conditions on entry cohort or not. The final column incorporates locals fixed effects and so captures the relationship between growth in membership and TFP: the relationship is positive and highly significant, suggesting that unions can make efficiency gains by moving towards a smaller set of larger locals.

[INSERT FIGURES 2-3]

However, Figure 2 reveals that, in aggregate, TFP has become more dispersed over time and has shifted to the left - that is, aggregate TFP has fallen a little. There appear to be no large differences in mean TFP between locals that enter, those that exit and those that are ever-present, though the exiters appear a little less productive than entrants (Figure 3). Thus this pattern of dispersion appears to be driven by trends in ever-present locals.

Hypothesis 6: Locals' productivity matters for their survival

[INSERT TABLE 7]

Finally we turn to the implications of productivity for union locals. Using linear models, we estimate for the period 2000-2010 locals' probability of exit, conditioning on productivity and controls. [7] We find that higher TFP reduces the likelihood of exit. This result is consistent and robust across all eight model specifications of Table 7, including the final model which introduces locals' fixed effects. In contrast labour productivity is less robustly estimated and

[7] Exiters are defined as the locals which are present in the data in a given year and are absent in the two following years, or which report being terminated in one of the 2 following years. Doing so, we avoid incorrectly defining as exiters those locals that are missing from the data in only one particular year for idiosyncratic reasons.

switches sign according to model specification. The fact that the price of union membership is positively correlated with exit suggests that any quality component to price is insufficient to overcome competitive market pressures that lead more expensive providers to leave the market. Unsurprisingly, exit rates fall as local size grows.

6. Conclusions

Using accounting data for union locals over the period 2000-2013 we confirm that unions do appear to behave like commercial businesses, as one might expect since they rely on the sale of union membership to generate revenue to cover their labour and non-labour costs. Locals operate in a mature market characterised by declining demand. They have responded via agglomeration, such that the number of locals providing union membership has fallen and their average size has risen. Productivity dispersion across union locals is substantial - whether measured in terms of sales or units sold - as it is in plants in the commercial sector. Locals' production function is very similar to the standard Cobb-Douglas function commonly identified in the literature for commercial businesses. Union locals' Total Factor Productivity (TFP) is a significant predictor of locals' survival. Aggregate TFP in the sector has fallen in the last decade or so and is increasingly dispersed. The nationals to which most locals belong account for roughly one-fifth of TFP growth, indicating that organisation-level factors do affect locals' efficiency. Other factors that are largely beyond the control of locals, such as their location, also play a role. However, nearly three-quarters of variance in TFP growth occurs is accounted for by locals' fixed effects - that is, it occurs across locals - thus confirming the importance of local-specific effects. Future research may be able to identify some of the sources of this variance across locals by investigating the importance of some of the prominent issues in personnel economics, such as managerial quality (Griffith et al., 2006) and executive compensation (Hallock and Klein, 2011).

References

Ashenfelter, O. (2012) “Comparing Real Wage Rates”, *American Economic Review*, 102 (2): 617-642

Baily, M. N., Hulten, C. and Campbell, D. (1992) Productivity Dynamics in Manufacturing Plants, Brookings Institute 187-267

Bryson, A. and Freeman, R. B. (2013) 'Employee Perceptions of Working Conditions and the Desire for Worker Representation in Britain and the US', *Journal of Labor Research*, 34, 1: 1-29

Bryson, A. and Gomez, R. (2003) ‘Buying Into Union Membership’, in Gospel, H. and Wood, S. (eds.), *Representing Workers: Union Recognition and membership in Britain*, Routledge, London

Bryson, A., Gomez, R. and Willman, P. (2010) ‘Online social networking and trade union membership: what the Facebook phenomenon truly means for labor organizers’, *Labor History*, 51, 1, 41-53

Caves, R. E. (1998) "Industrial organization and new findings on the turnover and mobility of firms", *Journal of Economic Literature*, vol. XXXVI, 1947–82

Criscuolo, C., Haskel, J., and Martin, R. (2003), ‘Building the Evidence Base for Productivity Policy Using Business Data Linking’, *Economic Trends*, 600(Nov.), 39–49.

Farber, H. S. and Krueger, A. B. (1992) "Union Membership in the United States: The Decline Continues", Princeton University Industrial Relations Section Working Paper #306

Farber, H. S. and Western, B. (2000) "Round Up the Usual Suspects: The Decline of Unions in the Private Sector, 1973-1998", Princeton University Industrial Relations Section Working Paper #437

Fiorito, J., Jarley, P. and Delaney, J. T. (1995) "National Union Effectiveness in Organizing: Measures and Influences", *Industrial and Labor Relations Review*, 48, 4: 613-635

Gomez, R., Bryson, A. and Willman, P. (2010) ‘Voice in the wilderness: the shift from union to non-union voice’, Chapter 16 in A. Wilkinson, P. J. Gollan, M. Marchington, and D. Lewin (eds.) *The Oxford Handbook of Participation in Organizations*, pp.383-406 , Oxford University Press

Griffith, R., Haskel, J. and Neely, A. (2006) "Why Is Productivity So Dispersed?", *Oxford Review of Economic Policy*, 22, 4: 513-525

Hallock, K. F. and Klein, F. B.(2011) "Executive Compensation in American Unions", Cornell University mimeo

Holmes, T. J. and Walrath, M. (2007) *Dynamics of Union Organizations: A Look at Gross Flows in the LORS Files*, NBER Working Paper #13212

Hsieh, C. and Klenow, P. J. (2009) "Misallocation and Manufacturing TFP in China and India", The Quarterly Journal of Economics, Vol. CXXIV, 4: 1403-1448

Kehrig, M. and Vincent, N. (2012) "Investment and Productivity Dynamics at the Plant and the Firm Level", mimeo

Oulton, N. (1998), 'Competition and the Dispersion of Labour Productivity amongst UK Companies', *Oxford Economic Papers*, **50**(1), 23–38.

Pakes, A. and Ericson, R. (1995) "Markov-perfect industry dynamics: a framework for empirical work", *Review of Economic Studies*, Vol. 62: 53–82

Schnabel, C. "Union membership and density: some (not so) stylized facts and challenges," *European Journal of Industrial Relations* 19:3 (2013): 255-272

Syverson, C. (2004a) "Market Structure and Productivity: A Concrete Example" *Journal of Political Economy*, 112(6): 1181–1222

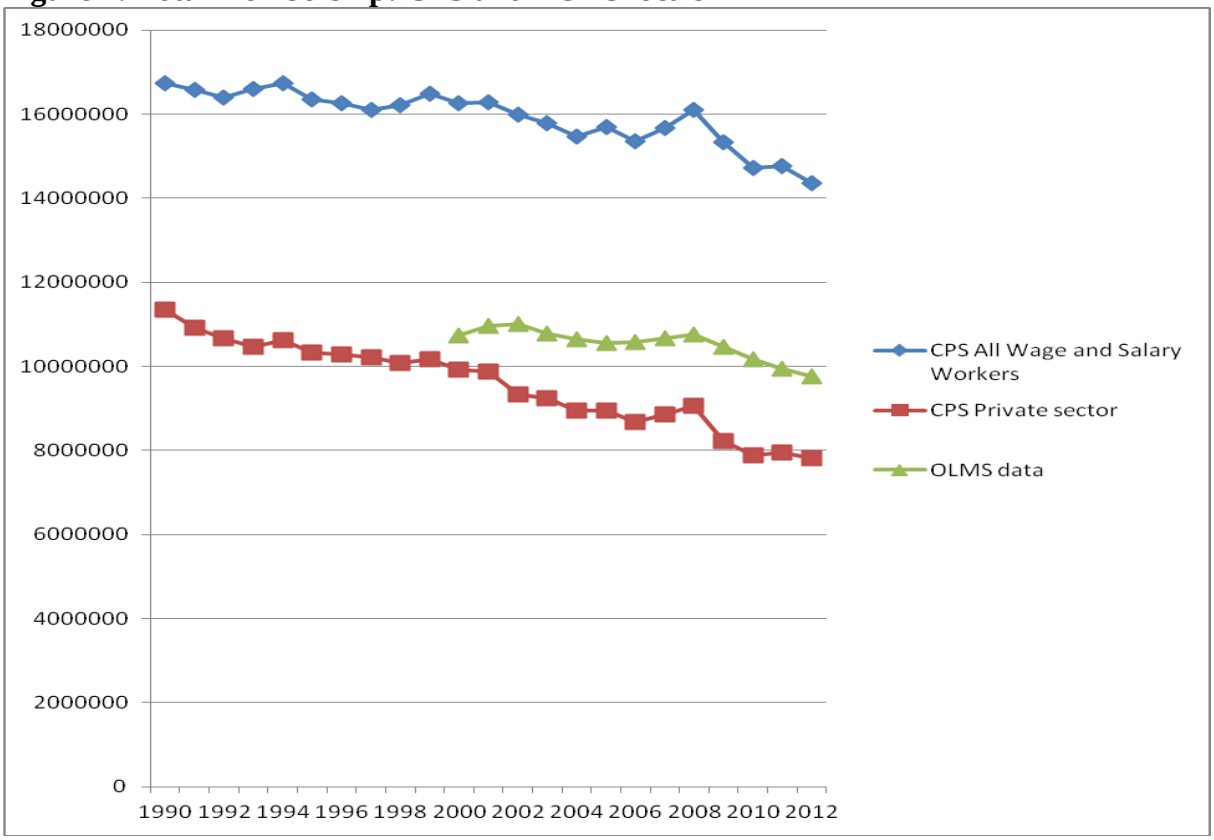
Syverson, C. (2004b) "Product Substitutability and Productivity Dispersion", *The Review of Economics and Statistics*, 86, 2: 534-550

Syverson, C. (2011) "What Determines Productivity?", *Journal of Economic Literature*, 49, 2: 326-365

Troy, L. (1965) "Trade Union Membership, 1987-1962", *Review of Economics and Statistics*, 47: 93-113

FIGURES AND TABLES

Figure 1: Total membership: CPS and LORS locals



Source: LORS: Our own computations (see data appendix). CPS: Barry T. Hirsch and David A. Macpherson, www.unionstats.com.

Figure 2:

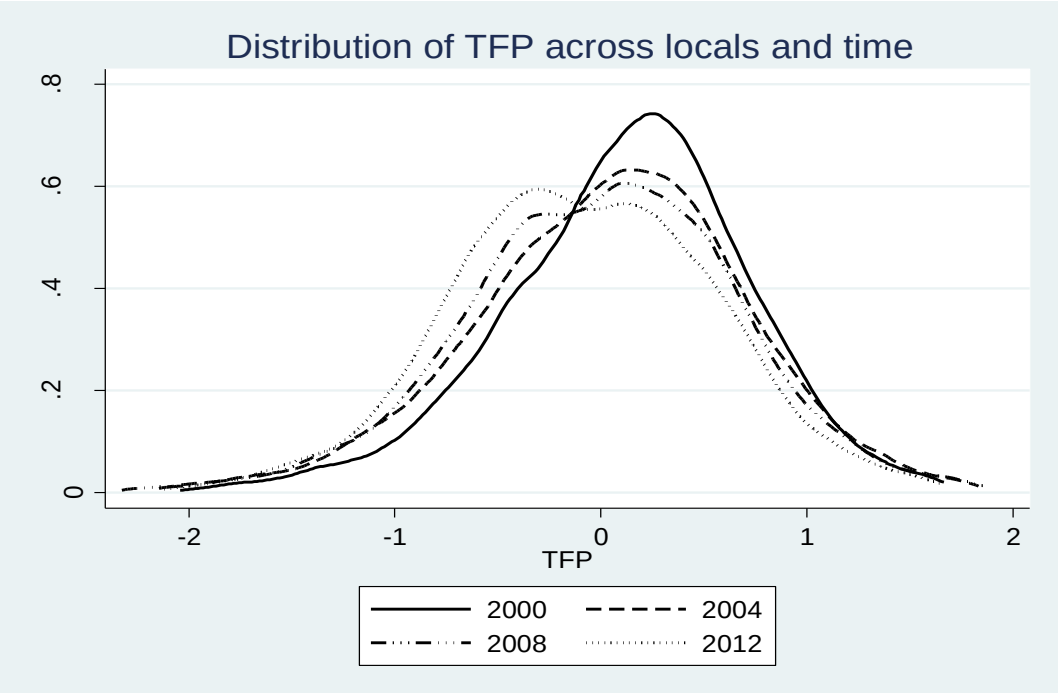


Figure 3: Distribution of TFP for surviving locals, new locals and exiting locals

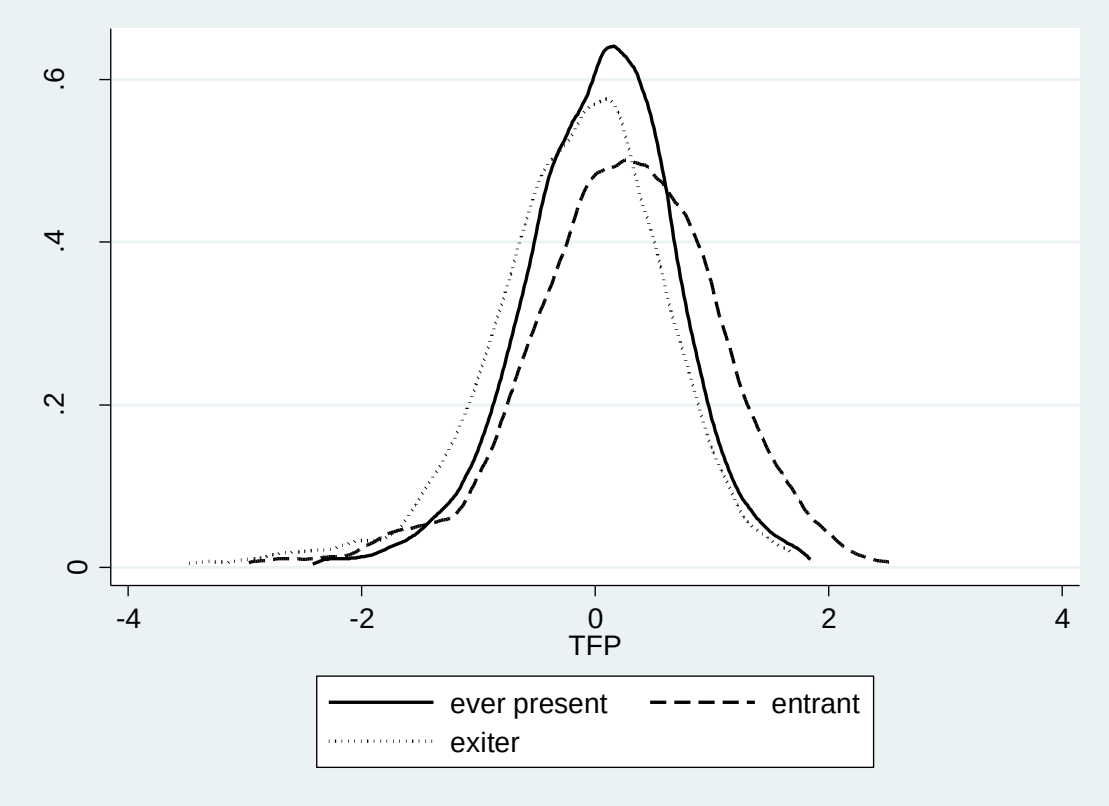


Table 1a: Membership for 20 largest nationals over 2000-2012

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	Membership (in 1000s)												
All unions	10741	10962	11001	10786	10633	10548	10572	10671	10756	10458	10163	9938	9756
For 20 largest nationals:													
TEAMSTERS	1234	1202	1199	1185	1146	1176	1182	1173	1165	1102	1073	1065	1048
FOOD & COMMERCIAL WKRS	1046	1096	1084	1059	1024	1042	1004	1009	1030	1066	998	992	992
SERVICE EMPLOYEES	944	1067	1208	1299	1329	1323	1421	1527	1593	1606	1575	1476	1469
AUTO WORKERS AFL-CIO	770	700	645	623	595	595	539	487	438	363	363	372	369
STEELWORKERS AFL-CIO	735	687	650	612	589	574	552	534	510	471	458	452	446
ELECTRICAL WORKERS IBEW AFL-CIO	653	672	663	640	627	620	622	625	629	615	593	583	571
COMMUNICATIONS WORKERS AFL-CIO	594	577	538	504	482	464	450	435	429	402	375	360	342
CARPENTERS IND	457	488	487	475	473	476	474	481	490	464	424	431	406
STATE COUNTY & MUNI EMPLS AFL-CIO	387	435	456	395	401	390	394	399	407	464	434	420	375
LABORERS	346	369	409	407	399	392	397	403	435	416	408	400	395
ENGINEERS, OPERATING, AFL-CIO	332	346	349	349	350	351	358	361	361	353	340	335	328
PLUMBERS AFL-CIO	261	277	280	283	280	285	287	292	301	293	290	283	281
POSTAL WORKERS, AMERICAN, AFL-CIO	249	257	239	235	222	220	217	212	204	182	173	169	163
TEACHERS AFL-CIO	219	260	269	282	287	286	293	307	317	323	326	323	339
UNITE HERE	206	207	207	208	212	231	237	243	238	227	230	230	231
GOVERNMENT EMPLOYEES AFGE AFL-CIO	186	193	198	200	207	208	209	215	224	234	247	265	276
SHEET METAL WORKERS AFL-CIO	141	138	130	134	132	134	134	135	136	126	122	119	118
WORKERS UNITED, SEIU	122	114	105	99	92	94	90	85	81	73	67	72	73
POSTAL MAIL HANDLERS, LIUNA	112	106	111	106	104	124	129	136	172	166	162	149	134
PAINTERS AFL-CIO	107	113	113	111	110	109	111	113	113	107	99	91	84

Table 1b: Number of locals for 20 largest nationals over 2000-2012

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	Number of locals												
All unions	19,080	19,030	18,751	18,324	17,800	17,428	16,868	16,537	16,249	15,870	15,477	15,090	14,543
For 20 largest nationals													
TEAMSTERS	481	474	466	458	446	428	413	409	399	388	378	373	368
FOOD & COMMERCIAL WKRS	482	483	434	413	402	385	366	345	342	332	314	302	293
SERVICE EMPLOYEES	257	244	236	232	228	231	216	201	146	109	104	100	96
AUTO WORKERS AFL-CIO	933	929	905	884	860	833	799	769	741	716	686	647	616
STEELWORKERS AFL-CIO	2,637	2,614	2,595	2,526	2,461	2,428	2,362	2,302	2,217	2,145	2,037	1,933	1,853
ELECTRICAL WORKERS IBEW AFL-CIO	841	862	854	843	827	819	808	798	791	787	776	771	761
COMMUNICATIONS WORKERS AFL-CIO	1,197	1,195	1,168	1,137	1,097	1,075	1,022	990	965	918	880	850	806
CARPENTERS IND	751	783	772	750	728	705	697	687	665	652	631	640	512
STATE COUNTY & MUNI EMPLS AFL-CIO	248	251	249	265	270	284	293	286	296	301	303	315	304
LABORERS	481	481	473	460	438	407	390	385	375	363	361	360	360
ENGINEERS, OPERATING, AFL-CIO	125	128	129	126	126	122	121	118	118	118	114	107	105
PLUMBERS AFL-CIO	282	284	284	282	275	276	273	272	269	269	266	265	264
POSTAL WORKERS, AMERICAN, AFL-CIO	1,386	1,285	1,320	1,287	1,233	1,187	1,141	1,127	1,107	1,055	1,033	961	911
TEACHERS AFL-CIO	86	90	98	98	101	104	105	108	132	134	136	137	138
UNITE HERE	61	62	63	63	64	65	65	71	67	63	60	60	58
GOVERNMENT EMPLOYEES AFGE AFL-CIO	963	991	1,000	1,002	995	1,017	1,001	1,010	1,004	990	997	1,013	995
SHEET METAL WORKERS AFL-CIO	163	167	157	152	144	144	140	133	132	127	127	125	125
WORKERS UNITED, SEIU	396	420	432	431	440	443	446	459	465	468	453	448	458
POSTAL MAIL HANDLERS, LIUNA	35	36	36	36	36	36	36	36	36	36	36	36	35
PAINTERS AFL-CIO	363	374	364	365	365	357	350	349	343	337	332	325	312

Table 2: entry, exit and growth of locals 2000-2012

year	Entrant	Exiter	Growth of survivors- excluding potential mergers (i.e. abnormally large growths)					
			mean	p10	p25	p50	p75	p90
2000		3.15%						
2001		3.45%	-3.02%	-19.33%	-8.22%	-0.64%	3.08%	11.11%
2002	1.17%	3.93%	-2.66%	-18.18%	-8.00%	-0.52%	2.94%	11.60%
2003	1.04%	3.64%	-3.11%	-18.18%	-8.27%	-1.30%	1.97%	10.00%
2004	1.22%	3.84%	-2.12%	-16.60%	-7.31%	-0.70%	2.70%	11.63%
2005	1.20%	3.41%	-1.95%	-16.67%	-7.14%	-0.29%	3.33%	12.20%
2006	0.74%	3.22%	-1.31%	-15.61%	-6.42%	0.00%	3.81%	12.28%
2007	1.12%	2.96%	-1.30%	-16.62%	-6.55%	0.00%	3.64%	11.74%
2008	1.19%	3.54%	-1.71%	-17.25%	-6.78%	0.00%	3.73%	12.24%
2009	0.95%	3.40%	-4.68%	-22.22%	-10.34%	-2.44%	1.20%	9.41%
2010	0.77%	3.81%	-1.71%	-16.67%	-7.58%	-1.30%	2.35%	12.24%
2011	1.14%		-0.97%	-14.61%	-6.59%	-0.46%	3.08%	12.50%
2012	0.95%		-1.57%	-15.06%	-6.67%	-0.57%	2.89%	11.76%

Notes:Entrants are defined as locals who are present in the panel whereas they were absent the 2 previous years. Exiters are the locals who are present in the panel but are absent in the two following years or report being terminated in one of the 2 following years.

Table 3: Locals' production function

Sample	*all*	*<100 members*	*100 -999 members*	*1000-4999 members*	*5000+ members*
	Panel A: Dependant variable: log(sales)				
	(1)	(2)	(3)	(4)	(5)
log(assets)	0.250***	0.120***	0.198***	0.160***	0.140***
	(0.002)	(0.004)	(0.002)	(0.004)	(0.009)
log(labor costs)	0.585***	0.341***	0.474***	0.502***	0.874***
	(0.002)	(0.004)	(0.002)	(0.005)	(0.009)
Observations	128,380	30,554	72,853	20,039	4,934
R-squared	0.791	0.271	0.597	0.514	0.910
Controls	No	No	No	No	No
	Panel B: Dependant variable: log(membership)				
	(1)	(2)	(3)	(4)	(5)
log(assets)	0.241***	0.065***	0.147***	0.046***	0.074***
	(0.002)	(0.003)	(0.001)	(0.002)	(0.006)
log(labor costs)	0.508***	0.164***	0.255***	0.257***	0.663***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.009)
log(price)	-0.523***	-0.270***	-0.270***	-0.213***	-0.657***
	(0.002)	(0.004)	(0.002)	(0.004)	(0.011)
Observations	127,200	30,554	72,853	20,039	3,754
R-squared	0.776	0.199	0.461	0.286	0.717
Controls	No	No	No	No	No

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Productivity dispersion across locals

Productivity measure	Mean	Median	75-25 productivity ratio	90-10 productivity ratio	95-5 productivity ratio
Labor productivity *(= sales over labor costs)*	5.24	3.19	2.44	6.18	16.26
TFP1 *(=exp of residual of log(sales)=log(assets)+log(labor cost))*	1.32	1.04	2.39	5.37	9.66
TFP2 *(=exp of residual of log(sales)=log(assets)+log(N employees)+log(price))*	1.26	1	2.18	4.63	7.89
Alternative measures of productivity using employment instead of labor cost:					
Labor productivity2 *(=sales over N employees)*	36200	14461	8.03	37.4	79.9
TFP3 *(=exp of residual of log(sales)=log(assets)+log(N employees))*	1.59	1.01	3.46	10.44	20.99

Table 5: What explains the variance in locals' TFP?

TFP explained by fixed effects for:	Share of the variance explained (R2)	Observations
119 nationals	21.2%	128,380
52 states	2.8%	128,378
2444 states*nationals	33.0%	128,380
10257 cities	24.5%	128,379
25327 states*cities	33.0%	128,380
21532 locals	72.8%	128,380

Note: Results from OLS regression of TFP for each local on various sets of fixed effects. All models include year dummies

Table 6: the effect of size and age on TFP

	Dependant variable: TFP			
	(1)	(2)	(3)	(4)
Created before 1970	REF	REF		
Created in the 1970s	-0.036***	0.082***		
	(0.008)	(0.007)		
Created in the 1980s	0.025***	0.115***		
	(0.008)	(0.008)		
Created in the 1990s	0.178***	0.199***		
	(0.008)	(0.008)		
Created in the 2000s	0.283***	0.320***		
	(0.011)	(0.010)		
1st quintile of membership		REF	REF	REF
2sd quintile of membership		0.440***	0.441***	0.570***
		(0.006)	(0.006)	(0.006)
3rd quintile of membership		0.644***	0.638***	1.050***
		(0.006)	(0.006)	(0.007)
4th quintile of membership		0.713***	0.701***	1.526***
		(0.006)	(0.006)	(0.008)
5th quintile of membership		0.999***	0.987***	2.069***
		(0.006)	(0.006)	(0.011)
Observations	128,380	128,380	128,380	128,380
R-squared	0.015	0.190	0.179	0.799
Fixed effects	None	None	None	21532 locals
Year dummies	Yes	Yes	Yes	Yes
Other controls	No	No	No	No

*Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 7: the determinants of exit 2000-2010

	Dependant variable: exit in t+1 or t+2							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TFP	-0.006***		-0.008***	-0.008***		-0.002**	-0.005***	-0.020***
	(0.000)		(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Labor productivity		-0.002***	0.003***	0.004***		-0.001*	0.001	0.007***
		(0.000)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
log(price)				0.003***		0.009***	0.014***	0.039***
				(0.001)		(0.001)	(0.001)	(0.001)
Created before 1970					REF	REF	REF	
Created in the 1970s					-0.010***	-0.007***	0.001	
					(0.002)	(0.002)	(0.002)	
Created in the 1980s					-0.003*	-0.001	0.001	
					(0.002)	(0.002)	(0.002)	
Created in the 1990s					0.002	0.004**	0.003*	
					(0.002)	(0.002)	(0.002)	
Created in the 2000s					0.006**	0.009***	0.004	
					(0.002)	(0.003)	(0.003)	
1st quintile of membership					REF	REF	REF	REF
2sd quintile of membership					-0.024***	-0.022***	-0.022***	-0.041***
					(0.001)	(0.002)	(0.002)	(0.002)
3rd quintile of membership					-0.031***	-0.030***	-0.032***	-0.065***
					(0.001)	(0.002)	(0.002)	(0.003)
4th quintile of membership					-0.034***	-0.035***	-0.039***	-0.080***
					(0.001)	(0.002)	(0.002)	(0.004)
5th quintile of membership					-0.041***	-0.044***	-0.053***	-0.098***
					(0.001)	(0.002)	(0.002)	(0.005)
Constant	0.019***	0.018***	0.019***	-0.002	0.048***	-0.005	-0.040***	-0.185***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.002)	(0.004)	(0.005)	(0.009)
Observations	109,880	110,916	109,880	109,051	118,204	109,051	109,051	109,051
R-squared	0.038	0.036	0.039	0.040	0.048	0.046	0.075	0.360
Fixed effects	No	No	No	No	No	No	National	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	No	No	No	No	No	No	No	No

Notes: Exit in t+1 or t+2 equals 1 for locals that declares they are terminated in years t+1 or t+2 but not in year t, and for locals that are absent from the data sample in both years t+1 and t+2. TFP and Labor productivity are standardized to have a mean of 0 and a standard deviation of 1.

Data appendix

1) Setting up the data

The files contain the reports labor organizations have to submit as part of the Labor Organization Reporting System (LORS). The reports cover a specific year and are identify by an identification number (*rpt_id*). The reports are sorted according to the year they cover and are available from 2000 to 2013 in text format. For each year covered, the Office of Labor Management Standards (OLMS) splits the reports and provide a folder including several files that can then be re-merged using the reports' ids *rpt_id*. We use five of these files for each year: (1) "lm_data_data" contains information on organizations' main characteristics (name, number of members, date of creation, main accounting information, etc.), and (2) "ar_disbursements_total_data", (3) " ar_assets_total_data", (4) "ar_liabilities_total_data", (5) " ar_receipts_total_data" contain more specific and more detail information on disbursements, assets, liabilities and receipts for each organization.

Preparing the LORS files for Stata software

We did our analysis using Stata software. In order to insheet the files in Stata, we had to correct some problems by hand in the original files. Typically, some observations included wrongly placed line breaks (usually in the variable "union_name"), inducing swaps between the different variables for those observations. We removed these line breaks by hand. Some special characters also stopped the insheeting process, so that all observations located after the special character in the initial text files were not insheeted in Stata. We detected those characters, removed them from the original files and then checked by hand that the last observation of each text files had indeed been insheeted in Stata.

Creating a panel of locals 2000-2012

For each covered year between 2000 and 2012, we started by merging together the 5 insheeted Stata files described above using the report id *rpt_id*. Some variables are present both in the core summary dataset "lm_data_data" and in one of the four other datasets. When information contained in those overlapping variables was non missing and in conflict between different datasets, we used the information from the core file "lm_data_data". However of the information was missing in the core dataset, we tried to use the other datasets to get it.
As a second step, we appended together all years from 2000 to 2012 (we dropped 2013 as the data was still incomplete for this year).

The report id *rpt_id* is year-specific. However, organisations are also assigned a permanent file number *f_num* that makes it possible to follow them from a year to the next one. We noticed that in some rare cases (less than 1% of all observations), an organisation had more than one report included in the data for a given covered year. This might be because its first report was incomplete or erroneous, or because it needed to add a specific detail. The additional reports can be on the behalf of the organisation or of OLMS without consultation of the organisation. In those cases, we kept only one duplicate in terms of organisation and year covered. We kept the most recent report registered in LORS (identified using the variable *register_date*) when it included non-missing information on membership, or when all reports contained missing information on memberships. Otherwise, we applied the same logic to the second most recent reports, and so on.

We dropped an additional 15 observations that had conflicting information in 2 variables indicating the year covered by the report.

2) Time series of number of locals and aggregate membership

After a thorough cleaning of the intial LORS files, Holmes and Walrath (2007) provide aggregate number of locals and membership for years 2000 and 2007. We extend their analysis up to 2012. We also adopt an alternative approach to construct our series and deal with the mistakes and typographical errors in the data. Namely, we try to exploit the fact that most locals are present in the data during several years to check for discrepancies across years in the membership rates reported by each organization.

Exclusions:

Note first that we miss small filers, i.e. units that are too small to fill an LM report.
Then, we only focus on locals, meaning that we may also miss the few organizations that do not fill reports at the local level but at a higher level of aggregation. 361 organizations have filled an LM report as a local for some years in the period and as another type of organization for other years. As their status is ambiguous and they usually have too large membership as compared to typical locals, we also exclude them, removing 2064 *local*year* observations from the data sample. We finally exclude 6130 *local*year* observations corresponding to locals that declare they have terminated.

Dealing with discrepancies in locals' membership time series and filling gaps

We then design an algorithm to detect typos and obvious mistakes in the membership variable and smooth the membership series for each local. To do so, we look for large year-to-year variations in membership growth that are followed by a similar variation in the opposite direction. If, for example, a local declares 100 members in year t-1, 500 in year t and 100 again in year t+1, we consider that membership in year t is likely to be erroneous. When such irregularities are found, we simply replace membership in year t by the average of membership in years t-1 and t+1. We also impute a local membership from the average of previous and future years' memberships when this local is missing whereas it was observed with positive membership in years t-1 and t+1. In total, our imputation process yields 6912 imputations for years 2001 to 2011. For each of these years, we checked that the additional membership that can be attributed to these imputations is lower than 1%, leaving the trend in membership mostly unaffected.

We finally focus on large changes in membership growth that are not matched by opposite changes the next year. These changes are not necessarily oddities: they can result for example from a merger between two locals. We thus checked by hand large changes in membership, leading us to remove local number 540282 that clearly reported an erroneous membership in 2012.

3) Productivity analysis

We express all accounting variables in 2010 prices using current price index deflator. We apply the similar exclusions as for the aggregate membership analysis, except that, for obvious reasons, we keep in our analysis of survival the locals that have terminated. However we do not smooth the membership series for the productivity analysis. We "windsorize" our main variable of labor productivity (sales over labor cost) so that, for all observations that are above the 99th percentile of the labor productivity distributions, we impute a labor productivity exactly equal to this 99th percentile.