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ABSTRACT

Does Labour Market Risk Increase the Size of the Public Sector? Evidence from Swedish Municipalities*

It has been argued that the public sector is an insurance against otherwise uninsurable risks. If that is the case, it is reasonable to expect the public sector to be larger in regions where the private labour-market is risky. Using data from Swedish municipalities, this paper reports that labour-market risk has a substantial impact on public employment. The results for aggregate spending and taxation are, however, much weaker and labor-market risk thus affects the labour intensity of the municipal public sector.

JEL Classification: C23, H11, H40 and J45
Keywords: labour market risk, panel data, public employment and public sector size

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1. Introduction

In a pair of influential papers, Rodrik (1998, 2000) shows that open economies tend to have larger public sectors. He also presents evidence in favor of a plausible explanation for this phenomenon: International trade raises the volatility of income, which can be decreased by the public sector. Optimally, an open trade regime therefore goes hand in hand with a larger government, when other insurance mechanisms are not available. Agell (1999) has subsequently argued that the globalization of economic activity increases labor market instability and hence, political demand for labor market rigidities. Although Alesina and Wacziarg (1998) have questioned the link from trade-induced risk to government size, the theoretical argument still has considerable appeal. Indeed, it would be surprising if the resources spent by the public sector were completely independent of the need for insurance. Here, the hypothesis that private sector risk increases the size of the public sector is addressed using data from Swedish municipalities. Several problems related to cross-country data availability and comparability are therefore circumvented.[1] The fact that there is no need to aggregate public spending across different levels of governance might be most important: local aggregate risk is directly related to the size of the local public sector.

The indicator of private-sector risk in local labor markets is found to have a substantial impact on municipal public employment. It is also found that shocks increasing the size of the public sector across all municipalities tend to generate larger increases in risky locations. While some of the results hold even for aggregate municipal spending and the rate of taxation, on balance the hypothesis can be rejected for these variables. Hence, labor-market risk affects the labor intensity of the municipal public sector, rather than its size.

By using municipal data, several well-known problems with cross-country data can be circumvented. First of all, data might not be comparable across countries. Second, institutional and cultural factors are not easily controlled for in a cross-country setting. Finally, there are plainly not enough comparable countries. Researchers are thus forced to compare countries of very different degrees of development, hence aggravating the problems mentioned above. For these reasons, several researchers have successfully used municipal (or regional) data to test the predictions of different political-economy related models. The appeal of such an approach is obvious. Using municipal data in this study does not come without cost, however. There are three main reasons for expecting the effect of market-induced risk on government size to be smaller in Swedish municipalities than between countries. First of all, the Swedish central government provides insurance against individual-specific labor market risk through the unemployment insurance. No such mechanism exists between countries. Second, despite the international mobility of capital, private capital markets do not (yet) provide much risk sharing between countries (see e.g. Lewis 1995). These markets are therefore poor providers of insurance against aggregate country-specific shocks. Within a country, however, capital markets can certainly provide some insurance against municipal-specific risks. Sorensen and Yosha (2000) verify this by showing that interregional credit markets are highly integrated whereas the same is not true between OECD-countries. Finally, the Swedish central government has the means and power to transfer funds directly to the municipalities. Since we can find an economically significant effect of labor-market risk on local government size, despite these mitigating factors, this should be read as support for Rodrik's (1998, 2000) argument.[2]

A key issue in this paper is the indicator of labor-market risk, which is based on the industry structure of local labor markets; hence taking commuting patterns into explicit consideration. The behavioral consequences of local labor market risk have mainly been analyzed in the field of labor economics. Simon (1988) shows that frictional unemployment is higher in less diversified local labor markets and thus provides evidence that industrial shocks are less costly to people working in well diversified cities. Diamond and Simon (1990) probe deeper into the differences in unemployment risk between local labor markets. By building on a portfolio theoretic

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[1] Swedish municipalities enjoy a constitutional right of self-governance, thereby making them appropriate units of analysis for questions regarding government size. Self-governance has given rise to considerable variation in the dependent variables used in this study.

[2] This said, countries have both monetary and fiscal policy instruments at their disposal to smooth temporary fluctuations. To some extent, Swedish municipalities can also use fiscal policy to this end (Dahlberg and Lindström, 1998). In fact, Pettersson-Lidbom (2001) even finds that municipalities use debt to strategically influence future policy makers.

view of labor markets pioneered by Conroy (1975), they show that cities with a more diversified industrial structure have both a lower probability of unemployment and lower wages. The reason is that a diversified labor market creates a portfolio effect for the individual worker, thereby making the aggregate risk lower compared to a specialized city. Thus, everything else equal, a worker is willing to accept lower mean wages on a diversified than on a specialized local labor market. All models used in local labor market analysis are based on the interplay between costly migration and local labor market conditions. Given the everyday importance of local markets, it should be of no surprise if political attitudes are also influenced by the insurance properties of different locations.

The paper is organized as follows. In Section 2, Rodrik's (1998) argument is presented. In Section 3, the data is described, with special attention given to the indicator of labor-market risk. Section 4 discusses the empirical specification, while the results are presented in Section 5. Section 6 concludes. In the appendix, all variables and data sources are described in detail.

2. Rodrik's model

Following Rodrik (1998), an economy with a fixed supply x of a manufactured good, not consumed within the economy, is considered. The manufactured good is traded for an import good at price π. In addition, there is a publicly and a privately produced good and the productivity of private production is enhanced by the import good. Since trade is continuously balanced, the economy can afford $x\pi$ of the import good. The private sector employs (1-λ) of the total labor supply (which is normalized to one). Assuming that the production of the private good is linear, total production is $x\pi(1-\lambda)$. The supply of the publicly produced good is $h(\lambda)$, where $h'>0$ and $h''<0$. The size of the public sector, λ, is determined before the realization of π is known. Assuming that the public and the private good are perfect substitutes, the government's problem is to maximize $V(\lambda) = E[u(h(\lambda) + x\pi(1-\lambda))]$ with respect to λ. $u(\cdot)$ is the utility function of a representative household, displaying standard properties. If the mean of π equals π_m, and the variance equals σ^2, the Taylor expansion of $V(\lambda)$ gives the following expression (after taking expectations)

(2.1) $$V(\lambda) \approx u(h(\lambda) + x\pi(1-\lambda)) + ½\, u''(h(\lambda) + x\pi_m(1-\lambda))(1-\lambda)^2 x^2 \sigma^2.$$

The first-order condition of this expression is then (if $z = x\sigma$),

(2.2) $$\{u'(\cdot) + ½\, u'''(\cdot)(1-\lambda)^2 z^2\}[h'(\lambda) - x\pi_m] – ½\, u''(\cdot)\, z^2 = 0.$$

As long as households display prudence ($u'''>0$), the first term is positive.[3] Then, the larger the aggregate risk z, the larger is the optimal level of λ. To see this, consider an economy, A, with zero aggregate external risk ($z_A = 0$). The first-order condition is then reduced to $h'(\lambda_A) = x\pi_m$. In another economy, B, risk is positive ($z_B > 0$) and hence $h'(\lambda_B) < x\pi_m$. Since $h''<0$, it must be that $\lambda_B > \lambda_A$. In other words, a relocation of resources to the safe public sector is the optimal response to a higher level of aggregate manufacturing risk.

Naturally, the providing a safety net would be the ideal way of insuring against aggregate risk. Swedish municipalities do not, however, have the power to directly redistribute income between households: this task is performed by the central government. Given that the local government wants to provide further insurance for its inhabitants, it must do this in less direct ways.

It should be noted that the issue here is not whether counter-cyclical policies can reduce income volatility, but whether the *size* of the public sector can do so.[4] The answer to this question is not obvious and ultimately, it is empirical. Fatás and Mihov (2001) document a strong negative correlation between government size output volatility across OECD countries, as well as across US states. Their study explicitly deals with several conceptual and econometric problems arising when investigating the proposed effect. In Table 1, the standardized variance of the pre-tax municipal per capita income for the period 1985-1999 is regressed on the 1985 values of municipal employment, spending, and tax rate, respectively (all variables are in logarithms). Per

[3] For a discussion of prudence in a macro context, see e.g. Romer (1996), chapter 7. In a micro context, see e.g. Menezes et al. (1980).

capita income and a dummy for municipalities performing tasks usually performed at county level (see footnote 5) are added as control variables in this regression. Admittedly, this is a very crude way of analyzing the relation between public sector size and income volatility, and the results should therefore be read as indicative rather than conclusive. As Rodrik (1998, p. 1023) notes, the coefficient on government size is downward biased in this regression if the hypothesis presented here is true. Despite this, a substantial negative effect on income volatility can be found for all three indicators of public sector size, however.

[Table 1]

3. Data

The constitutional right of self governance enjoyed by Swedish municipalities makes them appropriate units of analysis when studying the determinants of government size. In total, there are at present 289 Swedish municipalities. Nine of which are removed from the sample because they are either split or created in the time period 1983-1999.[5] The local tax rate, per capita municipal spending, and the share of inhabitants employed by the municipality will be used as dependent variables. There is considerable variation in these variables: The tax rate ranges from 9.7 to 23.6 percent, per capita spending from 20400 to 61500 SEK, and the share of municipal employment from 2.1 to 9.7 percent.[6]

When measuring the degree of labor market risk, commuting and other spillovers make the use of data on the municipal level unreasonable. Rather, data on the "local labor market"-level is used. Local labor markets are analytical, and not administrative, units of analysis whose boundaries are based on actual commuting patterns within and between municipalities. In total, there are 109 local labor markets in Sweden and data

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[4] Sorensen et al. (2001) find that strongly procyclical revenue and weakly procyclical spending lead to procyclical budget surpluses in U.S. state and local governments. Dahlberg and Lindström (1998) find that Swedish local governments act to intertemporally smooth income.

[5] Three municipalities (Malmö, Gotland, and Göteborg) also perform tasks normally undertaken at the county (landsting) level. Whether these municipalities should be included in the sample is an open question. Here, they are included since they constitute a substantial share of the Swedish population. Further, the municipal specific fixed effects should capture the difference in responsibilities across municipalities. Excluding them has a miniscule effect on the results.

[6] These figures do not include municipalities with county-level responsibilities.

is available biannually between 1985-1999.[7] All in all, the data set covers 280 municipalities over eight time periods, giving a total of 2240 observations. The dependent variables from 1983 are included in order to reduce the loss of time periods when estimating dynamic specifications. All variables are entered in logarithms and the monetary variables are expressed in 1995 prices.

To construct the indicator of private aggregate local labor market risk, we follow the portfolio-theoretic approach used by Conroy (1975) and Diamond and Simon (1990) to derive what can best be described as an augmented Herfindahl index. The concept is borrowed from the literature on financial economics: each local market is viewed as a portfolio of industries, each of which is subject to random fluctuations. The total degree of labor market risk in a region is the weighted average of the variances and covariances of these fluctuations. The total variance in city c equals

$$\text{(3.1)} \qquad \mathrm{RISK}_{\mathrm{c}} = \sum_{s}^{n} s_{sc}^{2}\sigma_{ss}^{2} + \sum_{s}^{n}\sum_{u}^{n} s_{sc}s_{uc}\sigma_{su} \quad , s \neq u, \mathrm{c} = 1,...,109$$

where s_{sc} is the employment share of sector s in labor market c, σ_{ss} is the variance of employment in sector s, and σ_{su} is the covariance of employment in industries s and u. Specifically, the variance/covariance matrix is constructed as follows: The variance element, σ_{ss}, is the variance in the rate of national employment growth in sector s at time t, while the covariance elements, σ_{su}, equal the covariance between growth rates. In order to capture the degree of unexpected volatility, the employment growth rate of each industry was de-trended by taking the first differences of employment on the national level. The logarithms of the first differences were then regressed on a time trend. For each regression, the residuals were used to construct the variance/covariance matrix and thus the risk index at each point in time provides an indication of the need for insurance against labor market induced risk. It can be noted that under the very strong assumptions of independently and identically distributed

[7] See *Statistics Sweden* (1998) for a closer description of the LLM subdivisions.

growth rates, the portfolio diversification index is equivalent to the well known Herfindahl index.

In order to calculate the variance/covariance matrix, sectoral employment data at the national level between 1985-1999 is used. This procedure amount to the assumptions that industries are subject to the same fluctuations, regardless of their geographical location, and that the pattern of fluctuations is stable over time. Obviously, these assumptions are not a perfect description of reality, but they are necessary to capture both the within and between industry fluctuations in a systematic manner. Another important question is which industries should be included in the study. To mainly capture the effects of economic fluctuations from outside the local market, the sample consists of all manufacturing and a few business-cycle sensitive service industries, making a total of 21 industries. [8]

4. Specification of the empirical model

The shares of population between 0-6, 7-9, 10-19, 65-79, and 80+, respectively are used as control variables. This division of groups is based on the cost differences between age groups.[9] Population density is also included to account for cost differences between municipalities. Per capita income is included in all specifications, while the average wage in the municipal sector is included when municipal employment is the dependent variable. As further controls, a dummy variable for left-wing majority and a dummy for undefined political majority are sometimes included as checks of robustness. It must be kept in mind that these political variables are likely to be affected by the degree of labor market risk (given that labor market risk is an important determinant of policy). The central government redistributes resources both directly to, as well as between, municipalities. However, the system of redistribution has changed during the relevant time period, making it difficult to compare the impact

[8] The industry classification is based on *Statistics Sweden's* "limited level". A description of the industries is available in the appendix. The 21 industries constitute 35 percent of total employment and 52 percent of total private employment. Minor changes in the sample of industries do not change the results.
[9] Swedish Government Official Reports (1993).

of government grants on the size of the local government over time (see Bergström et al. 1998). This problem is further accentuated because of changes in grants-variable definitions over time. Another problem with central government grants is that for part of the period, they were mainly matching grants.[10] Hence, they are likely to be endogenous to the fiscal decisions taken in the municipalities. For these reasons, per capita grants will only be included to check for robustness. Since grants can be negative, they cannot be entered as a separate regressor in a logarithmic specification. Rather, they are added to per capita income.[11] In addition to these variables, I have also experimented by using the share of non-Swedish citizens, the share of women, the share of welfare recipients, and changes in aggregate employment at the municipal level. None of these variables has significant explanatory power, and their inclusion does not change the other estimates in any substantial way.

The general specification of the empirical model is then

$$(4.1) \qquad y_{it} = \beta z_{it} + \gamma \boldsymbol{X_{it}} + \lambda_t + v_i + \varepsilon_{it} \,,$$

where y_{it} denotes a particular measure of government size in a municipality in a specific year, z_{it} is the indicator of labor market risk, and $\boldsymbol{X_{it}}$ the vector of control variables mentioned above. As concerns the remaining variables, λ_t is a time-specific effect, constant over municipalities, v_i is a municipal-specific effect, constant over time, and ε_{it} is the usual residual.

The advantage of using fixed municipal- and time effects is that they account for a large number of uncontrollable factors affecting the size of government. The time-specific effects, for example, control for business-cycle movements that could affect public spending. Since the fixed effects may be falsely attributed to changes in government size that should really be accounted for by other variables, this advantage comes at a cost, however. An attempt to account for these problems will be made in Sections 5.3 and 5.4.

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[10] Aronsson and Wikström (1996) and Bergström et al. (1998) provide descriptions of the Swedish grants system.
[11] In fact, a different effect on spending from grants than from tax revenue is not supported by any utility function (Dahlberg and Jacob 2000).

5. Results

5.1. Fixed effects estimates

Table 2 shows the basic results for both the base and the full conditioning set of control variables.[12] The explanatory power is very good for the employment and taxation specifications (adjusted $R^2 = 0.93$), and quite good for spending (0.69). The indicator of labor market risk is highly significant when municipal employment is used as the dependent variable. In the base specification for per capita spending, labor market risk is weakly significant (at the ten percent level), but not in the full specification. The municipal tax rate, on the other hand, seems to be independent of labor market risk. A high per capita income increases the size of the public sector while population density has a negative effect. Municipalities where the public wage rate is high tend to have a lower number of employees and most of the demographic variables display a high level of statistical significance.

[Table 2]

The point estimates are not very large: 0.09 and 0.08 for the employment equation. There is, however, considerable variation in labor market risk. One standard deviation increase from the mean of this variable implies a change in the dependent variable by 4 percent. As a comparison, one standard deviation change in employment equals a 28 percent deviation from the mean of this variable. Some calculations show this effect to be somewhat larger than the effect of having a left-wing rather than a right-wing political majority in the municipality (see Pettersson-Lidbom 2000 for a thorough discussion of this topic).

[12] The full set includes central government grants (added to per capita income), a dummy for left-wing political majority, and a dummy for undefined political majority.

5.2. Dynamic specification. GMM.

Several studies (e.g. Bergström et.al 1998 and Pettersson-Lidbom 2000) of Swedish local governments have found that dynamics are important. Further, in a study of the demand for local public services, Dahlberg and Jacob (2000) have shown that the explanatory variables used in this paper are not strictly exogenous.[13] Since the fixed effects estimator is biased and inconsistent in a dynamic set-up, the Arellano and Bond (1991) GMM-estimator is used when introducing a lagged dependent variable to the specifications. This estimator is based on the use of lagged levels of the dependent and endogenous variables, while strictly exogenous regressors are estimated in differences. In order to check the model specification and the validity of the instruments, the Sargan over identification test is used. Since this test tends to over reject in the presence of heteroskedaticity, two-step estimates are used to judge the model specification. The reported coefficients are, however, based on (robust) first-step estimates, since Arellano and Bond show that the two-step standard errors tend to be downward biased. In order to save space, only the specifications where all regressors are treated as endogenous are presented.[14] The Arellano-Bond method is only valid if second-order autocorrelation is not present. For this reason, the test statistics of an AR(2) test (null hypothesis of no autocorrelation) are also presented.

[Table 3]

As shown in Table 3, the lagged dependent variables are highly significant in all specifications for all three dependent variables. Allowing for dynamics and endogeneity results in an increase of the point estimates of the risk variable by almost 100 percent (0.14-0.18). A 44 percent increase in labor market risk then implies an increase in municipal employment by 6-8 percent, which is indeed substantial. This is just the short-run effect, however. The long-run elasticity is calculated by dividing the coefficient on labor market risk by one minus the coefficient on the lagged dependent variable, which yields an elasticity of 0.52-0.72, i.e. very large indeed. Column 3 shows that the point estimate in the spending equation is now statistically significant

[13] The reason can be Tiebout-migration, causing both income and the demographic structure to be endogenous.
[14] The Sargan test rejects all specifications where the regressors are treated as strictly exogenous.

and large (short-run elasticity 0.2, long-run 0.33). This result is somewhat sensitive to the model specification, and when using the full conditioning set, statistical significance falls just short of the 10-percent level. Interestingly, labor-market risk has a small and marginally significant *negative* effect on the tax rate in these dynamic specifications. The reason could be that there is relatively little variation over time in this variable, and that tax increases were illegal during the first half of the 1990's.

5.3. Response to unobservable shocks. NLS.

One problem with the estimates presented in Sections 5.1 and 5.2 is that there is less variation over time in the degree of labor market risk within labor markets compared to the variation between labor markets. More precisely, the range of the risk variable within labor markets is 0.15-0.42, while the range between labor markets is 0.17-1.61. Since both the fixed effect- and the GMM-estimators mainly exploit the short-run time variation in the data, it is possible that some of the effects that should be attributed to labor market diversity are actually captured by the fixed effects. In particular, it is plausible that municipalities respond differently to similar shocks, depending on how well diversified their labor markets are. In all regressions, the time-effects are highly significant, indicating that some set of common shocks has influenced (i.e. increased) the size of the municipal sector in Sweden. These shocks may, for example, include business cycle effects, changes in preferences, and changes in the municipalities' responsibilities. Since we do not exactly know what shocks are captured by the time-effects, it is not obvious how to estimate their interrelation with labor-market risk. Blanchard and Wolfers (2000), however, suggest a method for dealing with this type of problem. In a study of the effect of labor market institutions on unemployment, they interact measures of country-specific institutions with shocks common to all countries in their study. Persson and Tabellini (2001) employ the same methodology when investigating the effects of political institutions on economic policy.

Following Blanchard and Wolfers, equation 4.1 is re-specified as

$$(5.1) \qquad y_{it} = \alpha + \beta z_{it} + (1 + \eta\, (z_{it} - z_t))\, \varphi_t\, \lambda_t + \gamma \boldsymbol{X_{it}} + v_i + \varepsilon_{it}\ .$$

As above, y_{it} is the measure of government size, z_{it} is the indicator of labor market risk, $\boldsymbol{X_{it}}$ is the same vector of control variables as in the previous sections and v_i is the municipality specific effect. As before, the set of year dummies is used to estimates the effect of common events. Now, the effect of common events λ_t is proportional to $\eta(z_{it} - z_t)$, where z_t is the year average across municipalities. In other words, I measure whether the same unobservable shock has a different effect in municipalities deviating from average labor market risk. Because of the form of the specification, the variable η must be estimated using non-linear least square. An additional problem is that the lagged dependent variable cannot be included in these regressions since that would yield biased and inconsistent estimates.[15]

[Table 4]

In Table 4, results are presented that indeed support this hypothesis. The time effects on the size of the public sector and the interaction term η are highly significant in the employment and taxation equations, although no such effect can be found on spending. This means that any undefined shock increasing the size of the public sector is associated with a larger effect in risky labor markets than in safe ones.

To understand the size of this effect, the cumulative time-effect is calculated by subtracting the coefficient of the 1999 time-period dummy from the 1985 dummy ($\varphi_{99} - \varphi_{85}$). The time effect is then multiplied by the interaction term η, and by 44 percent (a one standard deviation increase from the mean in the risk variable), resulting in a cumulative effect of around 4 percent. As seen in the top row of Table 4, the point estimate of labor market risk (β) is around 0.1 in this specification. Altogether, these results suggest that two municipalities with the same per capita number of employees in 1985, going through the same sequence of shocks with a 44 percent difference in labor market risk, display a 8.5 percent difference in per capita employment in 1999.

[15] When only entering the lagged dependent variable in a fixed effects setting, the point estimates of labor market risk are insignificant for all specifications. As has been seen, however, when using the GMM-estimator to properly address the dynamic econometric problems, labor market risk does indeed

5.4. Response to observable shocks

The above results show that the response to common shocks indeed differs with labor market risk. Naturally, some curiosity arises as to what types of shocks are considered. We can, for example, expect the public sector to expand more during a temporary economic downturn when the private labor market is risky than when it is well diversified. To investigate this hypothesis, the GDP growth rate is interacted with the indicator of labor market risk. The interaction term is expected to be negative since risky labor markets have a greater incentive than safe ones to expand the public sector when the growth rate is low. The same reasoning applies when using the interaction between the total change in employment (at the local labor market level) and labor market risk. In other words: a negative (positive) point estimate indicates that the public sector is expanded to a relatively small (large) extent in risky labor markets when employment growth is high.[16]

[Table 5]

These predictions do find some support in Table 5, although the results are somewhat dependent on the type of shock. Interpreting the point estimates is quite difficult, but they carry the general message that labor market risk is one determinant as to how growth and employment shocks are handled at the municipal level.

5.5 Some additional tests

On average, staff costs constitute about 50 percent of total spending. In the full sample this ratio varies from 26 to 68 percent. So far, the results indicate that municipalities subject to large labor market risk tend to increase the number of employees rather than the size of the public sector per se, which implies that the public sector is relatively labor intensive in risky locations. A direct way of testing this hypothesis is to regress the ratio between total municipal labor costs and total

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come out significant. When including the lagged dependent variable in the NLS-specifications, the results are considerably weakened.

[16] Entering employment change as an independent variable does not change any results, and its point estimate is not statistically significant. The high correlation between changes in GDP and changes in local employment (0.86) makes it likely that the time-period dummies capture any direct effects.

expenditures on the indicator of labor market risk. In the first two columns of Table 6, the results from fixed effect estimates, as well as NLS-estimates using an interaction term between unobservable shocks and the indicator of labor market risk (as in Equation 5.1) are presented. As can be seen, there is indeed support for this hypothesis. The point estimates are similar to those in Table 2 and 4, indicating that the increase in labor intensity is roughly similar to the increase in public employment. One might also worry about the possibility that safe municipalities have a greater propensity to have services provided by private entrepreneurs. If that were the case, municipal spending would be constant, while municipal employment would be lower in these municipalities. The results in Table 6 are, however, a strong indication against this possibility.

[Table 6]

As an additional check of robustness, the ratio of public employees to the working age population (ages 20-64) is used as the dependent variable, rather than the per capita ratio used before. As can be seen in the last two columns of Table 6, the results are similar to the previous ones.

6. Conclusions

Consider two municipalities that only differ in the degree of aggregate private labor market risk. More precisely, one labor market is one standard deviation above the mean (44 percent) riskier than the other. These municipalities go through the same sequence of shocks to the size of the public sector between 1985-1999. The findings in this paper indicate that per capita public employment is between 8 (lower bound) and 30 (upper bound) percent higher in the risky relative to the safe municipality at the end of this period. Surprisingly, given these results, labor market risk does not seem to be an important determinant of aggregate municipal spending or taxation. Rather, the public sector in municipalities with a substantial representation of risky private industries is relatively labor intensive.

A reasonable interpretation of these results is that municipalities attempt to provide an insurance against unemployment risk, rather than income insurance per se. Since income insurance is largely provided for by the central government, this may very well be an optimal policy. Support for this interpretation is given by the reduction in point estimates on risk in the spending equations that occur when central government grants are controlled for. In other words, these transfers seem to mitigate the adverse effects of a risky private labor market.

In this paper, only the risk due to the local composition of private industries has been considered. Although Clark (1998) has shown that industry shocks constitute a substantial share of the total variation of regional output, it would be interesting to include other sources of variation in the analysis. One possible extension of this work would therefore be to decompose local labor market risk into its national, regional, and industry-specific components. Since the optimal local policy response depends on the sources of volatility, the different components can then be related to policy choices both at the local and central levels. The greatest challenge of such an undertaking would be to construct indicators that capture risk, rather than fluctuations *per se*. So far, most of the research on regional output and income volatility has only dealt with the latter issue (see e.g. Clark and Shin, 2000).

Appendix. Data description and variables

Split (Borås (1490), Nyköping (480), Södertälje (181), Örebro (1880)) and new (Bollebygd (1443), Gnesta (461), Lekeberg (1814), Nykvarn (140), Trosa (488)) municipalities are removed from the sample.

The industry classification is based on *Statistics Sweden's* "limited level" which, in turn, is constructed using the MIS standard of Swedish industry classification. The following industries are included in the sample: fishery, transport equipment, agriculture, metals, rubber and plastics, textiles and clothing, wood, other manufacturing, mining and minerals, forestry, dirt and rocks, electric and optical appliances, steel and metal products, construction, machinery, telephone and postal services, publishing and graphical printing, paper and pulp, foodstuff, insurance, chemicals. The following industries are not included: Energy- water- and garbage disposals, motor vehicle sales and gas stations, wholesale trade, retail trade, transports and storage, real estate services, recruitment and staffing services, computer consultants and services, other corporate services, education, research and development, health care, child care, elderly care, other care, hotels and restaurants, interest groups, recreation and sports, other services, public administration, unspecified activities. The included industries are listed according to their variance (variance measure described in text), the most volatile come first.

The ten least risky (definition in text) labor markets in 1991 were: Sundsvall, Timrå, Karlstad, Stockholm, Hylte, Ånge, Gävle, Sandviken, Avesta, Borlänge. The ten most risky labor markets in 1991 were: Olofström, Trollhättan, Arboga, Tidaholm, Dorotea, Gnosjö, Gislaved, Oskarshamn, Skövde, Gullspång.

The data is biannual, and all monetary variables are expressed in 1995 prices after being deflated by the GDP-deflator.

RISK: Labor market risk measure calculated according to the portfolio measure described in the text. Source: *Statistics Sweden* "Registerbaserad arbetsmarknadsstatistik". Mean: 0.289. Std: 0.129.

INCOME: Total taxable personal income, lagged one period (due to delay in payments), divided by total population (at the end of the year). Sources: *Statistics Sweden* "Årsbok för Sveriges kommuner" and "Vad kostar verksamheten i din kommun?". Mean: 76870. Std: 15445.

INCOME (grants adjusted): Total taxable personal income, lagged one period (due to delay in payments), plus net grants and redistribution to the central government divided by total population (at the end of the year). Sources: *Statistics Sweden* "Årsbok för Sveriges kommuner" and "Vad kostar verksamheten i din kommun?". Mean: 80637. Std: 16062.

POPULATION DENSITY: Total population (at the end of the year) divided by area. Source: *Statistics Sweden* "Vad kostar verksamheten i din kommun?". Mean: 111.04. Std: 376.58.

SHARE –6: Share of population between 0-6 years of age (×100). Source: *Statistics Sweden* "Sveriges officiella statistik". Mean: 8.67. Std: 1.11

SHARE 7-9: Share of population between 7-9 years of age (×100). Source: *Statistics Sweden* "Sveriges officiella statistik". Mean: 3.89. Std: 0.55.

SHARE 10-19: Share of population between 10-19 years of age (×100). Source: *Statistics Sweden* "Sveriges officiella statistik". Mean: 13.91. Std: 1.68

SHARE 65-79: Share of population between 65-79 years of age (×100). Source: *Statistics Sweden* "Sveriges officiella statistik". Mean: 13.91. Std: 2.95.

SHARE 80+: Share of population above 80 years of age (×100). Source: *Statistics Sweden* "Sveriges officiella statistik". Mean: 4.59. Std: 1.35.

LEFT-WING MAJORITY: 1 if SAP + VP obtains more than 50% of the valid votes, 0 otherwise. Source: *Statistics Sweden* "Sveriges officiella statistik". Mean: 0.396. Std: 0.489.

RIGHT-WING MAJORITY: 1 if MOD + KD + FP + CP obtains than 50 % of the valid votes, 0 otherwise. Source: *Statistics Sweden* “Sveriges officiella statistik”. Mean: 0.360. Std: 0.480.

UNDEFINED MAJORITY: 1 if LEFT-WING and RIGHT-WING MAJORITY both equal 0, 0 otherwise. Source: *Statistics Sweden* “Sveriges officiella statistik”. Mean: 0.245. Std: 0.430.

WAGE: Implicit unit labor cost, derived by dividing the total municipal labor costs (wages, employer taxes and fees) with total municipal employment. Sources: *Kommunförbundet* “Kommunal Personal” and *Statistics Sweden* “Vad kostar verksamheten i din kommun?”. A few missing observations for 1995 have been replaced by the average of 1994 and 1996. Mean: 307894. Std: 45330.

EMPLOYMENT: Municipal full-time equivalent employees as a share of the population (×100). Source: *Kommunförbundet* “Kommunal Personal”. A few missing observations for 1995 have been replaced by the average of 1994 and 1996. Mean: 5.46. Std: 1.54.

EMPLOYMENT PER WORKING AGE POPULATION: Municipal full-time equivalent employees as a share of the population aged 20-64. Calculated as EMPLOYMENT/(1-[SHARE-6]-[SHARE7-9]-SHARE[10-19]-[SHARE65-79]-[SHARE80+]). Mean: 9.88. Std: 2.94.

SPENDING: Total municipal expenditure divided by total population. Source: *Statistics Sweden* “Vad kostar verksamheten i din kommun” och “Årsbok för Sveriges kommuner”. Nine missing values for 1995 have been replaced by the average of 1994 and 1996. Mean: 32820. Std: 5984.

STAFF COST SHARE OF TOTAL EXPENDITURE: Total municipal labor costs (wages, employer taxes and fees) divided by total expenditures. Sources: *Kommunförbundet* “Kommunal Personal” and *Statistics Sweden* “Vad kostar verksamheten i din kommun?”. A few missing observations for 1995 have been replaced by the average of 1994 and 1996. Mean: 0.50. Std: 0.05.

TAX RATE: The municipal income tax rate (in percent). Source: *Statistics Sweden* “Sveriges officiella statistik”. Mean: 18.04. Std: 2.30.

EMPLOYMENT SHOCK: The percentage change in total employment at the local labor market level between t-1 and t. Source: *Statistics Sweden* “Registerbaserad arbetsmarknadsstatistik”. Mean: –1.54. Std: 5.87.

GROWTH SHOCK: Growth rate of real Swedish GDP between t-1 and t. Source: *Statistics Sweden* “Nationalräkenskaperna”. Mean: 4.07. Std: 3.63.

DEFLATOR: The ratio between nominal GDP and GDP in 1995 year prices. Source: *Statistics Sweden* “Nationalräkenskaperna”.

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Table 1. The effect of public sector size on income volatility.

Dependent variable:	*Income volatility[a] 1985-99*	*Income volatility[a] 1985-99*	*Income volatility[a] 1985-99*
Employment (1985)	-0.486**		
	(0.204)		
Spending (1985)		-0.539***	
		(0.158)	
Tax rate (1985)			-0.731*
			(0.395)
Income (1985)	-0.047	-0.144	-0.520*
	(0.382)	(0.314)	(0.279)
Adj. R^2	0.12	0.15	0.12
# obs.	280	280	280

*** Indicate statistical significance on the 1%-level, ** on the 5%-level and * on the 10%-level. Robust standard errors in parentheses. Regressions also include a dummy for municipalities with county-level responsibilities (coefficient not reported).

a) Income volatility is the variance of per capita income divided by the mean of per capita income.

Table 2. Basic specification. Fixed effects estimates

Dependent variable:	*Employment*		*Spending*		*Tax rate*	
Specification:	Base	Full	Base	Full	Base	Full
Risk	0.091***	0.075***	0.061*	0.049	-0.012	-0.017
	(0.032)	(0.031)	(0.035)	(0.035)	(0.145)	(0.014)
Income	0.609***		0.571***		0.089***	
	(0.062)		(0.067)		(0.028)	
Income (grants adj.)		0.729***		0.552***		0.089***
		(0.058)		(0.064)		(0.026)
Wage	-0.790***	-0.779***				
	(0.030)	(0.030)				
Population density	-0.860***	-0.818***	-0.377***	-0.353***	-0.043*	-0.049**
	(0.051)	(0.050)	(0.055)	(0.056)	(0.023)	(0.023)
Share –6	0.034	0.048	0.226***	0.207***	-0.014	-0.015
	(0.046)	(0.044)	(0.050)	(0.049)	(0.021)	(0.020)
Share 7-9	0.117***	0.101***	0.104***	0.084***	0.004	0.000
	(0.029)	(0.028)	(0.031)	(0.031)	(0.013)	(0.013)
Share 10-19	0.297***	0.251***	0.266***	0.198***	0.006	0.004
	(0.056)	(0.053)	(0.061)	(0.059)	(0.025)	(0.024)
Share 65-79	-0.140***	-0.146***	-0.013	0.015	0.023	0.021
	(0.041)	(0.040)	(0.044)	(0.044)	(0.018)	(0.018)
Share 80+	-0.241***	-0.217***	-0.090***	-0.078**	-0.011	-0.004
	(0.030)	(0.030)	(0.033)	(0.033)	(0.013)	(0.013)
Left-wing majority		0.034***		0.026***		0.019***
		(0.009)		(0.010)		(0.004)
Undefined majority		0.018***		0.018***		0.015***
		(0.006)		(0.007)		(0.003)
Within R^2	0.93	0.93	0.69	0.69	0.93	0.93
# obs.	2240	2240	2240	2240	2240	2240

*** Indicate statistical significance on the 1%-level, ** on the 5%-level and * on the 10%-level. Standard errors in parentheses. Time-period and municipal-specific fixed effects are included.

Table 3. Dynamic specification. GMM-estimates

Dependent variable:	*Employment*		*Spending*		*Tax rate*	
Specification:	Base	Full	Base	Full	Base	Full
Risk	0.180***	0.147**	0.204**	0.153	-0.069*	-0.070*
	(0.069)	(0.068)	(0.102)	(0.101)	(0.037)	(0.039)
Lagged dep.	0.751***	0.726***	0.405***	0.410***	0.625***	0.631***
Variable	(0.070)	(0.069)	(0.041)	(0.041)	(0.123)	(0.124)
Sargan test[a]	474.00	477.44	337.63	398.98	560.65	558.99
(one-step)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sargan test[a]	256.74	255.50	222.37	224.71	246.13	248.88
(two-step)	(0.563)	(0.550)	(0.713)	(0.638)	(0.265)	(0.223)
AR(2) test[b]	0.16	0.74	1.38	-1.18	-0.83	-0.61
(one-step)	(0.876)	(0.459)	(0.168)	(0.238)	(0.401)	(0.541)
# obs.	1680	1680	1680	1680	1680	1680

*** Indicate statistical significance on the 1%-level, ** on the 5%-level and * on the 10%-level. Standard errors in parentheses. All point estimates are (robust) two-step. The same sets of control variables as in Table 2 are used.

a) Sargan gives the test statistic and p-value of the Sargan test for over-identifying restrictions. Both the test statistics from the first and second step estimations are presented since the test statistic from the first-step has been shown to over-reject in the presence of heteroscedasticity. The null hypothesis is that the instruments are valid/the model is correctly specified.

b) AR2 is the test statistic and p-value for no second-order correlation. The null hypothesis is that there is no second-order serial correlation.

Table 4. Unobservable shocks. NLS-estimates.

Dependent variable:	*Employment*		*Spending*		*Tax rate*	
Specification:	Base	Full	Base	Full	Base	Full
Risk [β]	0.106***	0.093***	0.061	0.043	-0.012	-0.015
	(0.032)	(0.032)	(0.035)	(0.036)	(0.014)	(0.014)
Risk deviation from mean × time dummies [η]	0.341***	0.365***	0.000	-0.156	0.069***	0.064***
	(0.054)	(0.064)	(0.130)	(0.186)	(0.025)	(0.025)
Cumulative time effect 85-99 [φ_{99} - φ_{85}]	0.283	0.23	0.10	0.07	0.22	0.22
Cumulative time effect in municipality with labor market risk 44% above mean. $\eta[\varphi_{99} - \varphi_{85}] \times 44\%$[b]	4.2%	3.7%	0%[a]	-0.5%[a]	0.7%	0.6%
Adj. R^2	0.94	0.94	0.82	0.82	0.95	0.95
# obs.	2240	2240	2240	2240	2240	2240

*** Indicate statistical significance on the 1%-level, ** on the 5%-level and * on the 10%-level. Standard errors in parenthesis. The same sets of control variables as in Table 2 are used.

a) Not significant.

b) One standard deviation is 44 percent above the mean of the risk variable.

Table 5. Observable shocks. Fixed effects estimates.

Dependent variable:	*Employment*		*Spending*		*Tax rate*	
Type of shock:	Growth	Employ.	Growth	Employ.	Growth	Employ.
Risk	0.105***	0.079**	0.070**	0.059	-0.003	0.002
	(0.033)	(0.035)	(0.036)	(0.038)	(0.015)	(0.016)
Interaction between shock and deviation from mean risk.	-0.003**	-0.001**	-0.002	-0.002***	-0.002***	-0.0004
	(0.001)	(0.0006)	(0.001)	(0.0006)	(0.0006)	(0.0002)
Within R^2	0.93	0.92	0.69	0.66	0.93	0.93
# obs.	2240	1960	2240	1960	2240	1960

*** Indicate statistical significance on the 1%-level, ** on the 5%-level and * on the 10%-level. Standard errors in parenthesis. The base set of control variables as in Table 2 is also included.

Table 6. Additional robustness tests

Dependent variable:	*Staff cost share of total costs*		*Public employment per working age population*	
Estimation method:	FE	NLS	FE	NLS
Risk	0.093*** (0.036)	0.090*** (0.036)	0.097*** (0.033)	0.112*** (0.032)
Risk deviation from mean × time dummies		0.384*** (0.084)		0.356*** (0.055)
Cumulative time effect 85-99		0.18		0.29
Cumulative time effect in municipality with labor market risk 44% above mean.[a]		3.0%		4.4%
R^2	0.29 (within)	0.49 (adjusted)	0.93 (within)	0.94 (adjusted)
# obs.	2240	2240	2240	2240

*** Indicate statistical significance on the 1%-level, ** on the 5%-level and * on the 10%-level. Standard errors in parentheses. The municipal wage rate, the population shares of age groups 0-6, 7-9, 10-19, 65-79, 80+, time-period and municipal-specific fixed effects are included in columns 1 and 2. In columns 3 and 4, the same controls as in Table 2 are included. [a)] 44 percent is one standard deviation above the mean.