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POLICY PAPER

Optimum Territorial Reforms in Local Government: An Empirical Analysis of Scale Economies in Ireland

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Abstract: Economies of scale are often the underlying rationale for local government amalgamations. Yet the international evidence on the relationship between municipal output or size (in population terms) and costs as measured by expenditure per capita is unconvincing, with doubts over whether size matters at all for the efficient provision of local public services. Given the 2014 structural reforms aimed at local government territorial consolidation in Ireland, we use pre- and post-merger data to investigate whether there is any evidence of scale economies in the Irish local government system. The econometric study finds empirical evidence of "U-shaped" cost curves for Irish local councils in 2011 and 2016. In both years the range of turning points are near the median council size, suggesting that many local authorities were operating in the diseconomies region before and after the 2014 territorial reforms and amalgamations. With more territorial changes currently planned, policymakers should look at further amalgamations only on a case-by-case basis but also at other mechanisms to deliver efficiencies, either through strategic alliances and more shared services arrangements or other ways of inter-municipal cooperation as is common in many continental European countries.

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I INTRODUCTION

The economic rationale frequently cited for local government territorial reforms and municipal amalgamations is the economies of scale argument, that is the effects of size on the cost of delivering local public goods and municipal services. As with profit-making private firms, it is argued that in the sub-national public sector sphere, larger councils may exhibit scale economies and provide services at a lower per unit cost than smaller councils. In contrast to the "small is beautiful" argument that is advocated by political scientists using the local democracy, subsidiarity and participation arguments, but also by economists in favour of decentralisation, competition and government restraint (see Tiebout, 1956; Oates, 1972; Brennan and Buchanan, 1980), this is the case of "big is better". Following the 2008 economic crash and the fiscal crisis that followed, local government structural reforms have been motivated, at least from an economic or financial viewpoint, by this "big is best" claim. In Ireland, town and borough councils have been abolished and a number of city and county councils have been amalgamated. Currently, there are additional plans to merge neighbouring councils or, in other cases, extend the existing boundaries of city councils. Yet, despite the numerous reports and subsequent reforms aimed at territorial consolidation, the research evidence examining scale economies in the Irish case is virtually absent, with the notable exception of Callanan *et al.* (2014), which raised concerns about the risks of intuition relating to the perceived benefits that flow from bigger councils, and local authority mergers.

Beyond Ireland, whilst acknowledging the difficulties in establishing evidence of scale economies due to the problems in accurately measuring output and costs, and the not insignificant difficulty of disentangling effects given the potential endogeneity and selection bias problems with often modest-sized datasets, the international research evidence in relation to economies of scale and municipal provision of services is mixed, inconclusive and even contradictory (Copus *et al*., 2005; LUARCC, 2009; Drew *et al*., 2014). In earlier work, Byrnes and Dollery (2002: 405) concluded that the "… lack of rigorous evidence of significant economies of scale in municipal service provision casts considerable doubt on using this as the basis for amalgamations."

Returning to the Irish case, given the amalgamation of six city and county councils into three unified local authorities in 2014 and the possibility in the near future of more mergers and boundary extensions, while at the same time opposing calls for secession and the re-introduction of town governments, we set out to look for evidence of scale economies in the Irish local government system, cognisant of the aforementioned difficulties involved in finding suitable measures or proxies for service output and costs, and availability of such data for Ireland.

Focusing only on the economic case for or against territorial consolidation and local authority amalgamations, the paper has four sections. Following on from an

outline of the theory of scale economies and a review of the international empirical literature on the relationship between local government output and costs, we contextualise our paper by providing the reader with a brief background on local government territorial rescaling in Ireland post the 2008 economic crisis. This is followed by a description of the data, the model specification, results and an analysis of the findings. The paper ends with some conclusions and tentative policy recommendations.

II THEORY AND LITERATURE REVIEW

Economies of scale are a well-known concept in economics and industrial organisation whereby the average cost of providing a good or service is influenced by the output of that good or service. More specifically, it states that costs per unit fall as the scale of output rises. Simply put, as a firm grows in size it experiences cost savings. Arising from the technological nature of the production process, the average cost may decline for a number of reasons, including indivisibilities and higher utilisation rates of fixed assets, the spreading of fixed costs over larger levels of output, benefits from specialisation and discounted bulk-buying, and both financial and distribution economies. Given these potential sources of scale economies, the argument is that for firms to be efficient, they must operate on a large scale. However, beyond a certain point, due largely to co-ordination complexities and industrial disputes between a more bureaucratic management and a workforce experiencing low morale in large hierarchical organisations, costs per unit may actually increase resulting in diseconomies of scale from these communication and control problems. If so, the average cost of production may be "U-shaped", as it initially falls due to economies of scale but then after a certain level of output rises because of diseconomies of scale. It follows that at the lowest point of the "U-shaped" average cost curve unit costs are at a minimum, inferring an optimum size of production (Stigler, 1958; Williamson, 1967; Ferguson, 1969).

Normally related to profit-maximising firms providing private goods and services in a market setting, this research relates size and costs of local government as a provider of public services. More specifically, in terms of output and costs, it refers to a decrease in the cost per person for a given amount of service as population served increases (Dollery and Crase, 2004). Applying the same reasons as above, do local councils serving large numbers of residents incur lower per capita costs for service delivery? Are there forces at work that reduce the unit cost as the local council serves a bigger population? Are there scale economies in the provision of municipal services, so that local government mergers generate cost savings? Subject to the availability of appropriate measures and data, this is largely an empirical question that is testable using suitable statistical techniques. Fortunately,

there is a large literature on the relationship between population size and per capita costs relating to local government services. We present a review of the empirical literature here.

On a note of caution, in examining structural and organisational reforms aimed at seeking out the optimum size of local government – a question debated as far back as in the writings of Plato, but in relatively more recent times and before the widespread availability of large datasets and sophisticated statistical techniques, by, amongst others, Lomax (1943), Hirsch (1959) and King (1984) – the most likely conclusion based on international evidence is that there is no single or standard size that is appropriate for all local governments, i.e. no one-size-fits-all solution and no universal prescriptions for the design of local government systems (Schwab *et al*., 2017).[1] As King (1996: 55) noted in his seminal work on optimal local authority size "…economic analysis cannot hope to ascertain the exact optimum size". This is further reinforced by the knowledge that local government services are not homogeneous and have their own unique production characteristics. Using more colourful language, Newton (1982: 193) maintained that "the search for optimum size…has proved to be as successful as the search for the philosopher's stone, since optimality varies according to service and type of authority". Given the variety of local government functions and activities, Sancton (2000: 74) in a more recent study concluded that "…there is no functionally optimal size for municipal governments because different municipal activities have quite different optimal areas". Fox and Gurley (2006), looking at territorial consolidations worldwide, reach similar conclusions in respect of the importance of individual country and local circumstances and system-specific characteristics.

In a survey research paper, Byrnes and Dollery (2002) examined over 30 studies that used multivariate models of expenditure variation to investigate scale economies in local government. Some of these studies used total expenditure per capita as the dependent variable, while others used expenditure per capita in various functional areas, e.g. education, housing, social services. They found that (pp. 393-394):

> *… 29 per cent of the research papers find evidence of U-shaped cost curves, 39 per cent find no statistical relationship between per capita expenditure and size, 8 per cent find evidence of economies of scale, and 24 per cent find diseconomies of scale. From this evidence alone we can conclude that there is a great deal of uncertainty about whether economies of scale exist in local government service provision.*

[1] Plato wrote that, 'The number of our citizens should be 5,040 – this will be a convenient number; and these shall be owners of the land and protectors of the allotment' (Plato, *Laws*, Book V, trans. B. Jowett). As Plato was counting heads of households only, based on the average size of households back then this number translates into a city of about 25,000-30,000 residents (see Swianiewicz, 2010 for more details).

To illustrate this uncertainty, Byrnes and Dollery (2002) highlight three studies of fire-fighting services in the UK, all published within the same decade, but which do not agree on the existence of economies of scale. In another survey paper, LUARCC (2009) find that although there are inconsistencies in the literature, some broad conclusions can be drawn: size is associated with economies of scale for capital-intensive services and highly specialised services, resulting in greater efficiency in larger governments; size is associated with diseconomies of scale for labour-intensive services, suggesting greater efficiencies in smaller governments. Katsuyama (2003: 3) states that "…nearly 80 per cent of municipal services and activities don't possess economies of scale beyond a population of approximately 20,000 residents". Beyond a population of 250,000 inhabitants efficiency declines with increasing population (LUARCC, 2009: 7).

The majority of studies reviewed used either total expenditure per capita or expenditure per capita in various functional areas as the measure of unit costs. Some studies examined only administrative overhead expenditure (Ting *et al*., 2014; Bikker and van der Linde, 2016). A few studies used expenditure per household (Drew and Dollery, 2014) or expenditure per user (Blom-Hansen *et al*., 2016). One problem with expenditure per functional area is the issue of allocating overhead and administrative expenses to service areas. Expenditure per capita or employees per 1,000 population are "…extremely crude measures of efficiency, if they can be called efficiency measures at all" (Ammons and Rivenbark, 2008: 310). Expenditure per capita does not capture variations in the quality or scope of services provided. Expenditure comparisons by functional area are an improvement "…but often are plagued by cost accounting variations from city to city" (Ammons and Rivenbark, 2008: 310).

Many studies acknowledge that population is a poor proxy for output. Local governments provide several goods and services, much of which are very difficult to measure, e.g. childcare, social care. Andrews and Boyne (2009: 747) argue that "even if measures of the separate outputs of all services were available, it is far from obvious that they could be weighted and combined in a single index." Using population is only valid if population and output are positively correlated (Byrnes and Dollery, 2002: 395). Drew and Dollery (2014) argue that in countries where local government services are provided mainly to property, rather than to people, then alternative proxies for output should be used. Services to property include water, wastewater, local roads and refuse functions, while services to people include education, social care, etc. One alternative proxy is the number of households. Changes in the number of people living in each household will have a smaller effect on service costs than changes in the number of households. Businesses place demands on local government services, and if they employ staff from outside the local government area this means extra demands on services, not directly correlated with the local population. Drew and Dollery (2014: 238) suggest that "…the number of businesses and households would be combined into a single index, weighted

according to local government expenditure specific to each council function", although they acknowledge that this is difficult in practice. Notwithstanding these criticisms, most studies use population served as a proxy for output.

Here we review 18 studies of local government size and economies of scale, all published after the 2008 economic crash: see Table 1. Four of the studies (22 per cent) find some evidence of scale economies, ten studies (56 per cent) find some limited evidence, and four studies (22 per cent) find no evidence. Reingewertz (2012) studies 244 Israeli municipalities and finds that the benefits from amalgamations decline as municipality size increases. In a study of amalgamations among 479 Japanese municipalities, Nakazawa (2013: 587) finds that although scale economies are present, other "…administrative adjustment costs after amalgamation" arise. Although Hanes (2015) finds evidence of scale economies during amalgamations of Swedish municipalities, this happens as long as the municipalities did not exceed a critical size. Some studies provide estimates of optimum local government size. Bikker and van der Linde (2016), in a study of 467 Dutch municipalities, estimate an optimal size of 48,200 inhabitants using one technique, and around 57,100 inhabitants using other techniques. Drew *et al*. (2016) found economies of scale up to a population of 99,000 inhabitants in Queensland. Matějová *et al*. (2014) find evidence of a "U-shaped" cost curve in their study of education provision across 3,279 Czech municipalities, with a minimum cost per capita at a population size of about 233,600 inhabitants.

Over half of the studies reviewed find evidence of scale economies in some functional areas (Matějová *et al*., 2014; Drew and Dollery, 2014; Drew *et al*., 2016) or just in administrative overhead expenditure (Moisio and Uusitalo, 2013; Blesse and Baskaran, 2016). Some studies suggest the existence of economies of scale, but suffer from data problems (Soukopová *et al*., 2014; Kortt *et al*., 2016). Other studies find that when adjustments are made for population density, "…municipal government expenditures are characterised by constant returns to scale" (Holcombe and Williams, 2009: 416).

Noting that economies of scale mostly occur at the plant-level, rather than at firm-level, Blom-Hansen *et al*. (2016: 815) take the example of education and state:

> *… it is not municipal governments that educate children, it is schools that do so. The most relevant cost effects relate to the size of the school, not that of the school district. The same is true of child care centers, libraries, and residential homes for the elderly – in each case, smaller organizations are the direct providers of services, and it is primarily the scale of these smaller organizations that determines efficiency.*

Mergers of local governments that do not change the size of individual service providers will have little effect on unit costs. Lower plant-level unit costs can be achieved by scaling up the size of service providers within existing municipal

Table 1: Summary of 18 Studies on Economies of Scale in Local Government

Major finding	*Authors*
Evidence of economies of scale	Reingewertz (2012) Nakazawa (2013) Hanes (2015) Bikker and van der Linde (2016)
Mixed evidence of economies of scale	Moisio and Uusitalo (2013) Callanan *et al*. (2014) Drew *et al*. (2014) Soukopová *et al*. (2014) Drew and Dollery (2014) Matějová *et al*. (2014) Ting *et al*. (2014) Kortt *et al*. (2016) Blesse and Baskaran (2016) Drew *et al*. (2016)
No evidence of economies of scale	Holcombe and Williams (2009) Allers and Geertsema (2014) Blom-Hansen *et al*. (2016) Steiner and Kaiser (2017)

boundaries, without the need for mergers. Mergers can lead to reduced firm-level costs, i.e. administration overheads. Some studies suggest that if there are economies of scale in a few capital-intensive service areas, then these savings can be achieved by shared services or regional cooperation (Dollery *et al*., 2008; Drew *et al*., 2014). The cost savings of scale could be achieved without losing the benefits of smaller local governments.

III COUNTRY CONTEXT

Public sector reforms in Ireland, including the reform of local government, have been ongoing since the economic crash of 2008 and the subsequent years of austerity (Turley *et al*., 2018). As with other local government reforms worldwide, territorial restructuring and reorganisation are part of these reforms. Of all the different elements to local government reforms (including changes to expenditure functions and revenue sources, internal governance and management reforms, performance measurement and monitoring improvements, etc.), territorial rescaling and especially municipal mergers have been the most controversial and contested (Sancton, 2000; Lago-Peñas and Martinez-Vazquez, 2013).

Given the need to reduce costs, increase efficiencies and improve service delivery, much of the earlier focus was on the number of councils in Ireland (114 in total pre-2014, comprised of 34 city and county councils, and 80 town/borough councils), and the perceived need to reduce the number of local authority units and councillors. Recommendations from the 2009 *Special Group on Public Service Numbers and Expenditure Programmes* and the 2010 *Local Government Efficiency Review Group Report* were to reduce or reform the local authorities from 114 to 22 (in the case of the 2009 report) or, in the case of the 2010 report, greater integration of administrative structures across county/city areas and between town and county (Special Group on Public Service Numbers and Expenditure Programmes, 2009; Local Government Efficiency Review Group, 2010). Although shared services are not uncommon many of the early policy recommendations focused less on joint administrative areas and shared services and more on amalgamations and/or abolition of local government units. Arising from the 2012 *Putting People First: Action Programme for Effective Local Government* and the subsequent *Local Government Reform Act, 2014* the number of local authorities in Ireland was reduced from 114 to 31, partly as a result of the abolition of all 80 town councils but also the amalgamation of some neighbouring city and county councils into bigger local government units.

Furthermore, two 2015 reports into the local government organisational arrangements in Cork and Galway recommended amalgamation of the respective city and county councils. Interestingly, having considered different options (status quo/shared services/boundary extension/amalgamation), the Galway Local Government Committee unanimously favoured a merger of its two respective local authorities whereas, in contrast, the Cork Local Government Committee, also comprised of five independent members, failed to agree on a consensus position, with a majority of three in favour of an amalgamation into a new and bigger unitary council as against two in favour of a boundary extension for Cork City Council but with a retention of the two separate city and county councils (Cork Local Government Committee, 2015; Galway Local Government Committee, 2015). After other reports and further debate on the pros and cons of amalgamations and boundary extensions, in June 2018 the Government approved the planned merger of Galway City and County Councils, and a significant boundary extension for Cork City Council.[2]

To put into context the size of local councils in Ireland, Figure 1 and Appendix A show the average size, as measured by population, of municipalities in OECD countries and the size of local authorities in Ireland as of the 2011 and 2016 census years. The average population size of local councils varies greatly across OECD countries, and indeed, worldwide. The difference is not only between countries, but

[2] http://www.housing.gov.ie/local-government/reform/boundaries/minister-phelan-announces-government-recommendations-local and http://www.housing.gov.ie/local-government/reform/boundaries/minister-phelan-announces-government-recommendations-local-0 [Accessed 8 June 2018].

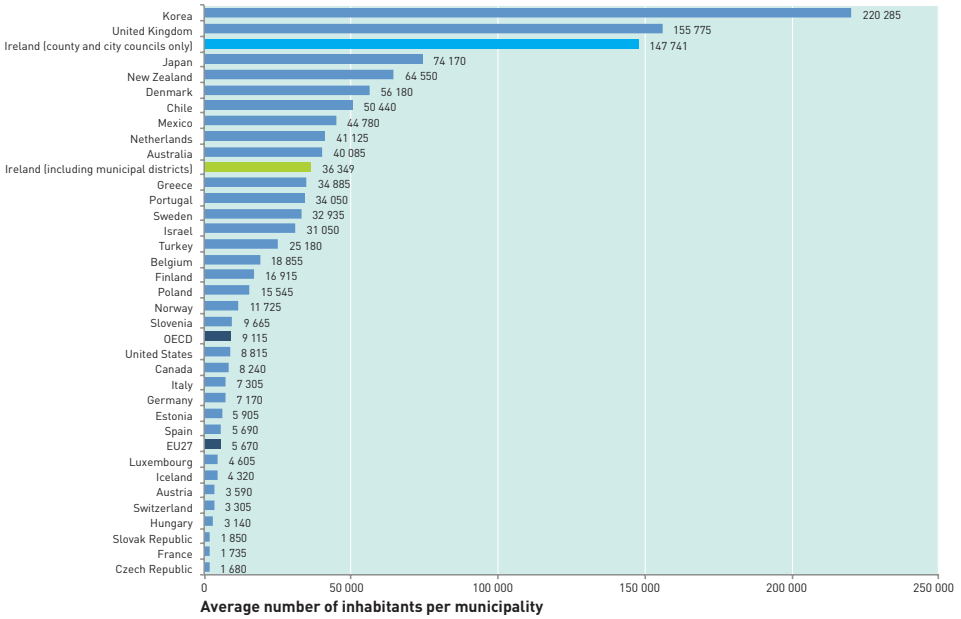
also within countries, with no obvious or clear regional pattern. Some of the smallest councils as measured by average population can be found in France (with over 35,000 municipalities or communes) and some Central and Eastern European countries where the average size of municipalities is less than 4,000 inhabitants. In contrast, South Korea and the UK have some of the largest councils. For example, the average population size of a local authority in England and Wales, Scotland and Northern Ireland (post-2015 councils) is 146,500, 164,000 and 164,500 inhabitants respectively (Callanan *et al*., 2014).

Figure 1 should be viewed in the context of the wave (one of a number of merger waves in Europe since the middle of the nineteenth century) of local government amalgamations that have taken place in the developed world in the last half century, resulting in fewer and larger local councils.[3] A summary of territorial reforms and local council mergers for developed countries is given in Blom-Hansen *et al*. (2016). This is in contrast to many developing or post-socialist countries, where for much of the same period local government fragmentation was more common. As for Ireland, local authorities are already large in size, and indeed constitute some of the largest local councils in the OECD, as measured by average population size. In 2016 the smallest council had a population of over 30,000 inhabitants whereas the largest council had a population of over half a million (CSO, 2016).

What is different about local government and service provision in Ireland is the limited range of functions that local councils have responsibility for, with, for example, education, health and social services (with the exception of housing) the responsibility of central government. Of the eight service divisions that local governments provide, the most important are in the areas of social housing, local roads and amenities, planning and development management, and environmental services. Before 2014, water services were a competence of local government but are now the responsibility of a national water utility. Overall, this so-called services to property or infrastructure-type services, as opposed to services to people distinguishes local government in Ireland from many local government systems and municipalities across Europe. This raises the question that even if there is evidence of scale economies in the Irish case (see below), the impact and outcome of local government reforms may not be large, given the limited role of local authorities as providers of key public services in Ireland.

[3] Contrary to popular opinion of ever-increasing local authority mergers and larger local councils, Schwab *et al*. (2017: 26) in a recent four-year (2013-2017) study of 30 European countries found that "…there is no general trend towards countries having larger municipalities." More specifically in relation to the 2008/2009 Great Recession and the economic and fiscal crisis that followed, the conclusion was that although "some countries dramatically reduced the number of their municipalities as a response to fiscal pressures (e.g. Greece, Ireland, and Albania) and/or to enhance effectiveness and efficiency of local service provision (e.g. UK, Turkey, Denmark, the Netherlands, Belgium, Finland)…in general, amalgamations have not been a common way to react to the most recent fiscal crisis…." (Schwab *et al*., 2017: 110).

Figure 1: Average Municipal Size (by Population) in OECD Countries



Source: Boyle, 2016

IV DATA, MODEL SPECIFICATION, ANALYSIS AND FINDINGS

As alluded to earlier, applying economies of scale to local government is not a straightforward task as empirically it is very difficult to measure the output and costs of municipalities. Local governments are multifunctional bodies, providing services that are heterogeneous in nature whose output cannot be simply measured or pooled into a single number or index. Furthermore, the costs of delivering these services are difficult to measure, or more precisely get access to, even with the availability of adopted budgets or audited annual financial statements (see Turley *et al*., 2015). For these reasons, proxies are usually used to measure both output and costs. In the literature, the proxy for output is typically population size, or some variant of the average population served (for example, change in population, population density, etc.). Using size in population terms as a proxy for output has its drawbacks. Aside from the question of whether population captures the output of a local government, using the resident population as a proxy can be problematic as many councils serve a bigger population than the official resident population because of, for example, better work opportunities, the likelihood of a bigger student population or greater tourist attractions. Although not perfect, operationally it is the proxy that we use in this paper. In support of it, as population relates directly to the users of local services and is often the measure used in debates on reorganisation and amalgamations it is appropriate to use it as a proxy for output.

As for costs, the proxy that is commonly used, albeit imperfect, is expenditure per capita. Although costs and expenditure are not identical, and with the added problem of the apportionment of overhead and administrative expenses to particular services, it is the measure that is widely used in the literature. In the absence of a better proxy, and given the diversity of functions undertaken by local government, we also use expenditure per capita. In defence of its use, expenditure (per capita) is what matters from the perspective of the local resident and taxpayer.

As scale economies are likely to be specific to particular activities or expenditure type, we disaggregate total expenditure into its various service divisions. In general, capital-intensive services such as roads or water are more likely to exhibit economies of scale as the cost of the fixed assets can be spread across a greater number of households. In contrast, labour-intensive, customer-orientated services such as libraries or environmental and planning inspectors generate few scale economies as larger numbers of staff are usually required as the volume of service increases.

Other generic problems associated with testing for economies of scale that can result in misspecification of the relationship between population size and expenditure include the use of accounting costs (as opposed to the true economic or opportunity cost), the distinction between economies of scale and the returns to scale concept, the absence of suitable indicators of service quality as opposed to service quantity, the difficulty in measuring the costs of the direct service providers (e.g. local schools, libraries, fire stations, etc.) as opposed to the costs of the municipality itself (the plant-level versus firm-level effects), and the need to differentiate between the often conflated concepts of scale economies and scope economies (Dollery and Crase, 2004; Drew *et al.*, 2014). Given these problems, our paper is consistent with the local government and scale economies literature, in defining economies of scale as the effects of population on per capita expenditures, with larger populations associated with lower per capita expenditures evidence of scale economies, and vice versa for diseconomies of scale.

For the statistical exercise that follows, our unit of analysis is the local authority or council, with both city/county councils and borough/town councils in 2011, as against only city/county councils in 2016. As stated earlier, there were 114 local councils in Ireland in 2011. Of that, 26 were so called town commissioners with very limited functions and no rate-setting powers. For these reasons they are omitted from the dataset, leaving us with 88 local councils, comprised of five city councils, 29 county councils, five borough councils and 49 (rate-setting) town councils. They are listed in Appendix A, with population figures taken from the 2011 census. In 2016, after the abolition of town and borough councils and the merger of certain neighbouring city and county councils, there were 31 local councils, comprised of three city councils, 26 county councils, and two city and county councils.

To avail of cross-council expenditure data we use budgeted expenditures, from the consolidated *Local Authority Budgets* publications. The data are for current

expenditures only as disaggregated capital expenditures are not readily available. For population size, we use the census data, for 2011 and 2016, allowing us to capture both before and after the 2014 local government territorial reforms.

In attempting to answer the question of whether size can explain variation in the cost of providing a range of local government services, we regress per capita expenditure against population, but controlling for other variables that may be correlated with population. In estimating the relationship between population and expenditure, we need to include control variables to separate the effects of population from the effects of other variables. Aside from other population variables as our independent variables (for example, population growth and the population density as found in the urban sprawl literature), our control variables include socio-economic variables such as the rate of unemployment, the percentage of single-parent families, deprivation scores and disposable income per capita. The variables used in our model are listed and explained in Table 2.

4.1 Empirical Strategy

The empirical strategy in the study follows Drew *et al*.'s (2016) analysis of the amalgamation of local authorities in Queensland, Australia. We estimate in (1) separate ordinary least-squared (OLS) regressions for 2011 and 2016 to model the association between population size and per capita expenditure of Irish councils both pre- and post-amalgamation:

$$E = \alpha + \beta \boldsymbol{P} + \gamma \mathbf{X} + \varepsilon \tag{1}$$

In Equation (1), E is the log of per capita expenditure, $\boldsymbol{P}$ is a vector of the log of population variables (population, population-squared, population density) and population growth, $\mathbf{X}$ is a vector of exogenous controls, and ε is an independent and identically distributed random error term with the usual OLS properties. Economies of scale are defined as a negative and statistically significant coefficient on (the log of) population in (1). A squared population term is included to capture possible non-linear relationships between population and spending per capita. Specifically, we follow the literature and test for the presence of a "U-shaped" relationship between expenditure per capita and population size. Any convexity would point to economies of scale up to a certain population size (the "turning point") but with diseconomies setting in thereafter.

The empirical strategy is three-fold. First, we examine the relationship between the log of total expenditure per capita and population size in both 2011 and 2016 respectively (see Figures 2a and 2b). In the baseline specification, we only include population, population squared, population density and population growth to determine the relationship between population and council spending per capita. As robustness checks in stage two we explore if the population coefficients have been biased by (relevant) missing variables by including a range of control variables.

Table 2: Definition and Descriptive Statistics of Variables, 2011 and 2016

			2011			2016		
Variable	*Measured by*	*Source*	*Min*	*Mean*	*Max.*	*Min.*	*Mean*	*Max.*
Costs	Expenditure per capita, €	LA Budgets[1]	179	848	1,649	518	837	1,449
	– on amenities per capita, €	LA Budgets	14	83	340	37	79	203
	– on environment per capita, €	LA Budgets	15	118	407	64	123	325
	– on housing per capita, €	LA Budgets	24	130	404	68	177	583
	– on planning per capita, €	LA Budgets	19	58	258	43	74	113
	– on roads per capita, €	LA Budgets	56	192	516	85	196	343
	– on water per capita, €	LA Budgets	0	122	267	43	85	138
Output	Population, average (persons)	CSO Census	1,441	52,139	527,612	32,044	153,609	554,554
	Population growth (5 year), %	CSO Census	–13.9	13.4	659[3]	–1.2	3.2	8.0
	Population density (persons per km^2)	CSO Census	20	1,036	4,526	21	470	4,757
Control variables	Unemployment rate, %	CSO Census	11.2	22.5	35.1	7.4	13.8	19.6
	Single-parent families, as % of total families	CSO Census	13.4	20.2	29.0	14.7	17.7	23.3
	Disposable income per capita, €[2]	CSO	15,629	17,934	21,677	15,061	18,337	21,963
	Pobal deprivation index	HP[4]	–7.2	–1.7	10.6	–6.4	–0.9	10.0
	Council size (surface area/km^2)	CSO	0.7	778	7,366	39	2,209	7,403

Sources: Department of Housing, Planning and Local Government, CSO, Haase and Pratschke.
Notes: 1. LA = Local Authority. 2. Latest available data at time of undertaking this research in late 2017 were for year 2014. 3. = due to a boundary change. 4. HP = Haase and Pratschke.

Figure 2a: Log of Expenditure per capita and Population, 2011

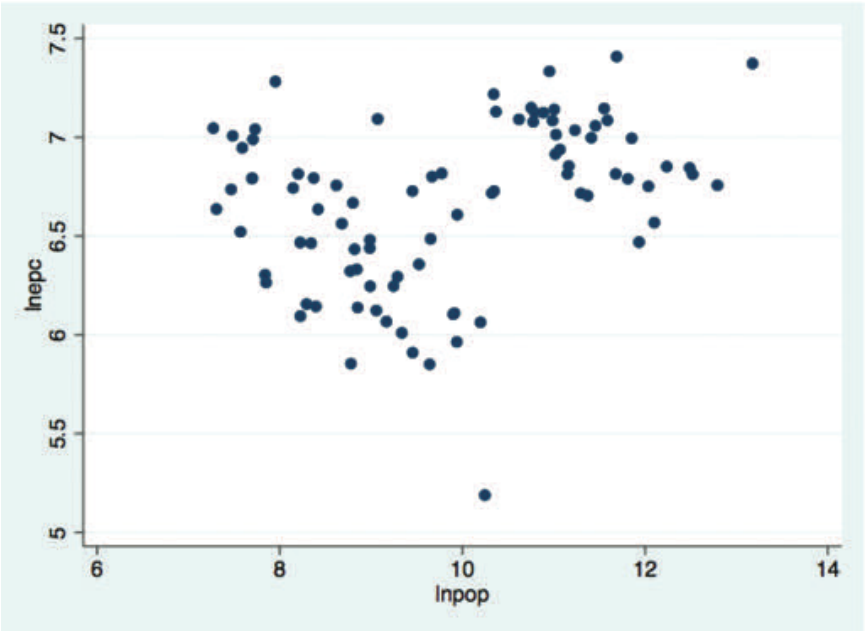
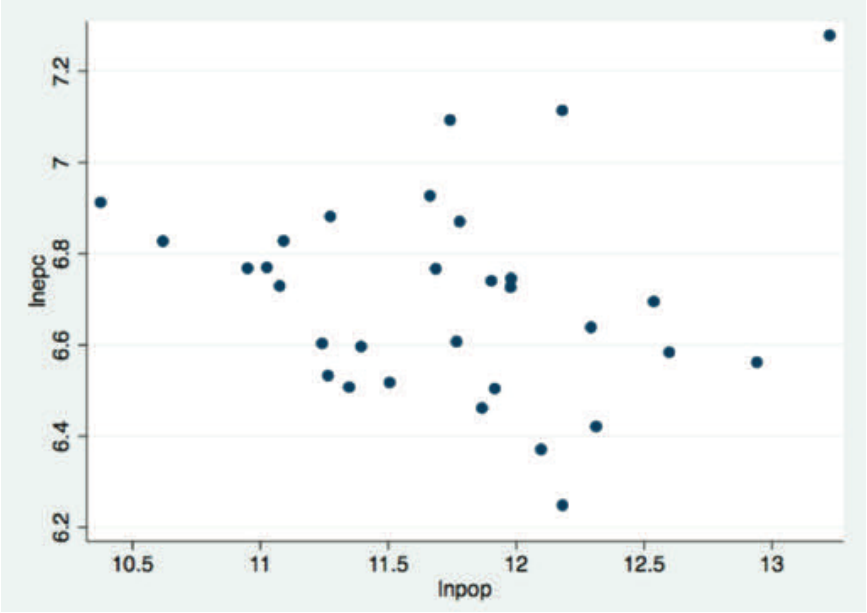


Figure 2b: Log of Expenditure per capita and Population, 2016



Sources: CSO; Department of Housing, Planning and Local Government; authors' analysis.

We also need to know whether population has been biased by a correlation with population density. When introducing the control variables in Model 1, population density is simultaneously dropped to ensure we are not conflating economies of scale with economies of density (Drew *et al*., 2016). In the third part of the methodology, total per capita expenditure is disaggregated into six spending divisions: amenities, housing, planning, environment, roads and water. We use the same methodology to estimate the relationship between types of spending and population size. This separation by service division is important as some services might be more likely to exhibit scale economies than others (e.g. activities associated with large fixed costs).

4.2 Results

In Model 1 we regress the natural log of total expenditure per capita against the natural log of the population variables (population (ln), population-squared (ln), population density (ln)) and population growth over the previous five years. Table 3 shows that in both 2011 and 2016 the log of population and the squared terms are highly significant at the 1 per cent level and show "U-shaped" cost curves. The coefficients on both the log of population and population squared are much higher in 2016 than in 2011 in this baseline specification. As a result the turning point in the cost function (the minimum point from when diseconomies set in) rises from a population of around 13,000 inhabitants to 140,000 inhabitants between 2011 and 2016.

However, failure to include relevant control variables can bias the estimated relationship between population and per capita expenditure (Byrnes and Dollery, 2002). The inclusion of control variables raises two considerations: firstly, the availability of data on a geographical council basis and, secondly, the small number of degrees of freedom. The following control variables are used for each council; share of single-parent families, disposable income, unemployment rates and council size, with the latter measured by surface area.[4] Table 3 shows an improvement in the model fit measured by the R-squared when the controls are added to Model 1 (and population density is dropped). The rise in the adjusted R-squared is notable for 2016. For both 2011 and 2016 the coefficient on population and population squared continue to be statistically significant at the 1 per cent level when the controls are added and continue to show "U-shaped" cost curves.

[4] In unreported regressions a deprivation index is included as the sole control variable. This mitigates the problems of multi-collinearity in the control variables and small degrees of freedom. The deprivation index is significant in 2011 but not in 2016. This approach does not change the overall findings of Model 1 for both years. These results are available on request. Regressions were run including dummy variables for Cork and Dublin. The inclusion of the dummy variables does not change the main findings and these results are also available on request.

Table 3: Relationship between Per Capita Council Expenditure and Population: 2011 and 2016

	2011 Model 1	*2011 Model 2*	*2016 Model 1*	*2016 Model 2*
Lnpop	–0.947***	–1.098***	–3.315***	–3.023***
	(0.326)	(0.342)	(1.132)	(1.033)
Lnpopsq	0.0507***	0.0563***	0.138***	0.127***
	(0.0163)	(0.0172)	(0.0482)	(0.0440)
Popgrowth	–0.00215***	–0.00215***	–0.0819***	–0.0747***
	(0.000517)	(0.000529)	(0.0156)	(0.0164)
Lnpopden	–0.0607**		0.129***	
	(0.0255)		(0.0239)	
Constant	11.36***	14.07*	26.26***	15.47*
	(1.637)	(7.395)	(6.649)	(8.329)
Controls?	No	Yes	No	Yes
Observations	88	88	31	31
F	13.05	7.57	5.10	10.15
RMSE	0.336	0.339	0.248	0.127
Adj R-squared	0.356	0.346	0.354	0.681
R-squared	0.386	0.399	0.645	0.755

Source: Authors' analysis.
Notes: Dependent variable is the log of expenditure per capita. Model 2 drops population density and contains the following control variables by council: number of single-parent families, disposable income, unemployment and council size. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

The inclusion of the controls (and dropping of population density) changes the estimated turning points in both years compared to the baseline Model 1.[5] However, the turning points continue to show an increase between 2011 and 2016. The estimated eight-fold increase when controls are added in 2016 (from around 18,000 inhabitants to 150,000 inhabitants respectively) is of a smaller magnitude to the ten-fold increase in Model 1. The median council population sizes pre- and post-amalgamations are around 15,000 and 130,000 respectively, and therefore show that many councils continue to operate in the diseconomies region after the amalgamations. The omission of the log of the population density ratio does not

[5] Detailed regression results including the coefficients and standard errors of the control variables are available on request. Only council area is significant at the 10 per cent level in 2016. In 2011 none of the controls are significant.

have a dramatic effect on the population coefficients in Model 1. The reasons are likely to be two-fold. First, the correlation coefficient between population and population density is far from perfect at just –0.004 in 2011 and 0.57 for 2016. Second, the estimates for population density themselves are quite erratic in Model 1 and even change sign between 2011 and 2016.

4.3 Individual Spending Categories

While the empirical analysis in Table 3 provides evidence of "U-shaped" cost curves in both 2011 and 2016, it is important to examine the cost structures of different types of spending. The log of total per capita expenditure is disaggregated into the following six categories: amenities, environment, housing, planning, roads and water. The same empirical strategy used for aggregate data is used to model the individual spending divisions with the baseline (Model 1) first estimated and then control variables added to Model 1 and population density omitted.

For illustrative purposes, Table 4 summarises the econometric evidence on economies of scale by spending division and indicates if the cost functions are linear or non-linear. In general, the results are largely unaffected by the inclusion of control variables and the dropping of population density in Model 1. The detailed econometric results for individual categories under Model 1 are set out in Appendix B.[6]

Table 4: Evidence of Scale Economies - Yes or No? Linear (L) or Non-Linear (NL)

Categories	*2011 Model 1*	*2011 Model 2*	*2016 Model 1*	*2016 Model 2*
Amenities	No	No	No	No
Environment	Yes (NL)	Yes (NL)	No	No
Housing	No	No	No	No
Planning	Yes (NL)	Yes (NL)	No	No
Roads	Yes (L)	Yes (NL)	Yes (NL)	Yes (NL)
Water	No	No	Yes (NL)	Yes (NL)

Source: Authors' analysis.
Notes: Economies of scale defined as a negative and statistically significant coefficient on (log of) population. Linear (L) or non-linear (NL) is determined by the significance of the (log of the) squared population term. Model 1 and 2 specifications are defined as above.

[6] The results using the Model 2 baseline are available on request for the individual spending categories in both 2011 and 2016.

There is no evidence of economies of scale in amenities or housing in either pre- or post-amalgamation periods. The evidence for the other spending categories is mixed in both periods. In 2011 economies of scale are found for environment, planning and roads with negative and statistically significant coefficients on the log of population in all three cases. In the case of environment and planning there is evidence (at least at the 5 per cent level) of non-linear "U-shaped" cost curves. The turning points are modest at populations around 6,000 inhabitants for environment and 20,000 inhabitants for planning. Economies of scale are found for roads and water in 2016 with large and significant negative coefficients on the population coefficient. For both of these categories there is evidence of a non-linear "U-shaped" cost function with a positive coefficient on the log of population squared. For roads these economies of scale are found to exist for populations of around 230,000 inhabitants (covering all but a handful of councils) and around 140,000 inhabitants for water before diseconomies set in. There is no strong evidence of economies of scale for planning or the environment in 2016 as there is for 2011.

V CONCLUSIONS

In addressing the question of whether municipalities enjoy the cost advantages of scale economies, the international research evidence on the relationship between local government output and costs is inconclusive, with conflicting results. Empirically it is not a straightforward hypothesis to test as both local government output and costs are difficult to accurately measure. Using population served and per capita expenditure as the most widely accepted proxies, much of the research evidence is weak and limited with some evidence of scale economies, other economies of scale evident but only for certain services, in some cases evidence of diseconomies of scale, and in other studies no evidence of either economies or diseconomies of scale as no significant statistical relationship between size and per capita expenditure was found (Byrnes and Dollery, 2002; Callanan *et al*., 2014). Given this partial and incomplete evidence of a systematic relationship that holds across time and space, we set out to test the hypothesis in the Irish local government system, pre and post the 2014 territorial reforms and mergers.

This study finds econometric evidence of "U-shaped" cost curves for Irish councils in both 2011 and 2016. While the estimated population turning points are erratic in both years, reflecting the small sample sizes and the change in local government cost structures due largely to the reassignment of water services to Irish Water, in all cases they increase post-amalgamation by a significant order of magnitude. In both years the range of turning points are near the median council size, suggesting that many councils were operating in the diseconomies region both

pre- and post-mergers. Economies of scale are found in roads spending in both 2011 and 2016, and in water expenditure post-amalgamation. Notwithstanding the small post-merger sample the results are robust to the inclusion of control variables.

The evidence of economies of scale in roads and water services raises further questions. Amalgamations may result in efficiency savings in these two functional areas, but may lead to higher costs in the other service areas. Changes in total costs will depend on the share of expenditure accounted for by roads and water services, and on the relative size of savings or higher costs in each functional area. After accounting for any changes in revenue due to harmonising local commercial rates among merging councils, it is not clear that amalgamations will always lead to net financial savings. The decision to transfer responsibility for water and wastewater services to a single national utility in 2014 is supported by the evidence of economies of scale. In the capital-intensive roads function, the evidence supports larger-scale operations, which could be delivered by mergers, or by some form of collaboration between local authorities.

Finally, we turn to future policy implications and, given the results above, possible alternatives to local authority mergers as a way of securing scale economies and net cost savings without the adverse political and democratic effects of consolidation. Given the historical evolution of Irish local authorities and their relatively large population size, inter-municipal cooperation (IMC) does not have the same presence or role in Ireland that it has in many continental European countries. However, given the technological, cultural, demographic and economic changes confronting society and the Irish public sector, serious consideration should be given to the different IMC arrangements and institutions as a policy alternative to local authority up-scaling and amalgamations, while at the same time cognisant of Ireland's institutional context and limited local public domain.[7] Shared services collaboration allows local governments to exploit economies of scale where they exist, while avoiding introducing diseconomies of scale in other functional areas. Whereas some progress has been achieved in joint provision and shared services projects in such areas as local government procurement, payroll and superannuation, ICT back office, library management and building control management systems (see NOAC, 2016), continental European-style IMC structures and practices can offer solutions that may help local authorities in Ireland continue to build capacity, enhance efficiency and deliver better quality services while, at the same time, ensuring local democracy is preserved and government remains close to its citizens, whatever might be the optimum size of local government.

[7] The diverse nature of IMC arrangements include the following structures: formal/informal; legal entity/non-legal entity; top down/bottom up; mandatory/voluntary; single-purpose/multi-purpose; and public/private/public-private partnership.

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APPENDIX A

Table A1: Local Authority Population Size in Ireland, 2011

City Councils	*Population Size*	*Borough Councils* [2]	*Population Size*	*Town Councils* [2]	*Population Size*
Cork	119,230	Clonmel	15,793	Listowel	4,205
Dublin	527,612	Drogheda	30,393	Longford	8,002
Galway	75,529	Kilkenny	8,711	Macroom	3,738
Limerick	57,106	Sligo	17,568	Mallow	8,578
Waterford	46,732	Wexford	19,913	Midleton	3,733
County Councils[1]		*Town Councils*[2]		Monaghan	6,637
Carlow	54,612	Arklow	12,770	Naas	20,713
Cavan	73,183	Athlone	15,558	Navan	28,158
Clare	117,196	Athy	9,587	Nenagh	8,026
Cork	399,802	Ballina	10,361	New Ross	4,533
Donegal	161,137	Ballinasloe	6,449	Skibbereen	2,568
DLR	206,261	Birr	4,428	Templemore	1,941
Fingal	273,991	Bray	26,852	Thurles	6,929
Galway	175,124	Buncrana	3,452	Tipperary	4,332
Kerry	145,502	Bundoran	1,781	Tralee	20,814
Kildare	210,312	Carlow	13,698	Trim	1,441
Kilkenny	95,419	Carrick on Suir	5,886	Tullamore	11,346
Laois	80,559	Carrickmacross	1,978	Westport	5,543
Leitrim	31,798	Cashel	2,275	Wicklow	6,761
Limerick	134,703	Castlebar	10,826	Youghal	6,990
Longford	39,000	Castleblayney	1,752		
Louth	122,897	Cavan	3,649		
Mayo	130,638	Clonakility	4,000		
Meath	184,135	Clones	1,491		
Monaghan	60,483	Cobh	6,500		
North Tipperary	70,322	Dundalk	31,149		
Offaly	76,687	Dungarvan	7,991		
Roscommon	64,065	Ennis	20,180		
Sligo	65,393	Enniscorthy	2,842		
South Dublin	265,205	Fermoy	2,223		
South Tipperary	88,432	Kells	2,208		
Waterford	67,063	Killarney	12,740		
Westmeath	86,164	Kilrush	2,539		
Wexford	145,320	Kinsale	2,198		
Wicklow	136,640	Letterkenny	15,387		

Source: CSO.

Notes: 1. The population of the county councils is the total county population, including populations of borough and town councils located in the respective counties.

2. This list of town councils does not include the 26 town commissioners, for reasons outlined in the text. The population of the borough and town councils is taken from the urban areas with legal defined boundaries classification, and does not include the environs.

Table A2: Local Authority Population Size in Ireland, 2016

Local Councils	*Population Size*
Dublin City Council	554,554
Cork County Council	417,211
Fingal County Council	296,020
South Dublin County Council	278,767
Kildare County Council	222,504
Dun Laoghaire-Rathdown County Council	218,018
Meath County Council	195,044
Limerick City and County Council	194,899
Limerick City Council (pre-merger)	*57,106*
Limerick County Council (pre-merger)	*134,703*
Galway County Council	179,390
Tipperary County Council	159,553
North Tipperary County Council (pre-merger)	*70,322*
South Tipperary County Council (pre-merger)	*88,432*
Donegal County Council	159,192
Wexford County Council	149,722
Kerry County Council	147,707
Wicklow County Council	142,425
Mayo County Council	130,507
Louth County Council	128,884
Cork City Council	125,657
Clare County Council	118,817
Waterford City and County Council	116,176
Waterford City Council (pre-merger)	*46,732*
Waterford County Council (pre-merger)	*67,063*
Kilkenny County Council	99,232
Westmeath County Council	88,770
Laois County Council	84,697
Galway City Council	78,668
Offaly County Council	77,961
Cavan County Council	76,176
Sligo County Council	65,535
Roscommon County Council	64,544
Monaghan County Council	61,386
Carlow County Council	56,932
Longford County Council	40,873
Leitrim County Council	32,044

Source: CSO.

Notes: The pre-merger population estimates are for 2011, from the census data. For comparative purposes, the figures reported above for 2011 include the population of the town and borough councils located in the respective county councils.

APPENDIX B

Table B1: Relationship between Type of Local Government Expenditure and Population Size 2011

	Amenities	*Environment*	*Housing*	*Planning*	*Roads*	*Water*
Lnpop	–0.466	–1.572***	–0.396	–0.965**	–0.768**	–1.258
	(0.570)	(0.503)	(0.437)	(0.415)	(0.379)	(0.958)
Lnpopsq	0.0262	0.0881***	0.0262	0.0489**	0.0356*	0.0738
	(0.0285)	(0.0251)	(0.0218)	(0.0208)	(0.0190)	(0.0478)
Popgrowth	–0.00258***	–0.00275***	–0.00250***	–0.000512	–0.00140**	–0.00267*
	(0.000903)	(0.000798)	(0.000692)	(0.000658)	(0.000601)	(0.00150)
Lnpopden	0.133***	–0.0187	0.0595*	–0.108***	–0.166***	–0.191**
	(0.0445)	(0.0393)	(0.0341)	(0.0324)	(0.0296)	(0.0743)
Constant	5.437*	11.47***	5.712**	9.246***	10.21***	10.70**
	(2.860)	(2.527)	(2.192)	(2.085)	(1.905)	(4.817)
Controls?	No	No	No	No	No	No
Observations	88	88	88	88	88	86
R-squared	0.183	0.389	0.230	0.216	0.352	0.299

Source: Authors' analysis.
Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Model 1 as defined in the text.

Table B2: Relationship between Type of Local Government Expenditure and Population Size 2016

	Amenities	*Environment*	*Housing*	*Planning*	*Roads*	*Water*
Lnpop	–2.435	–3.655*	–1.371	–2.645	–3.112**	–5.443***
	(1.857)	(1.914)	(2.836)	(1.643)	(1.259)	(1.950)
Lnpopsq	0.0952	0.155*	0.0574	0.106	0.126**	0.230**
	(0.0791)	(0.0816)	(0.121)	(0.0700)	(0.0536)	(0.0831)
Popgrowth	–0.0697**	–0.0523*	–0.0721*	–0.0296	–0.0979***	–0.0776***
	(0.0256)	(0.0264)	(0.0390)	(0.0226)	(0.0173)	(0.0269)
Lnpopden	0.315***	0.187***	0.257***	0.0360	–0.0178	–0.00465
	(0.0392)	(0.0404)	(0.0599)	(0.0347)	(0.0266)	(0.0412)
Constant	18.47	25.57**	12.28	20.61**	24.80***	36.75***
	(10.91)	(11.25)	(16.66)	(9.654)	(7.396)	(11.45)
Controls?	No	No	No	No	No	No
Observations	31	31	31	31	31	31
R-squared	0.749	0.565	0.478	0.277	0.787	0.440

Source: Authors' analysis.

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Model 1 as defined in the text.