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No. 26 April 1995

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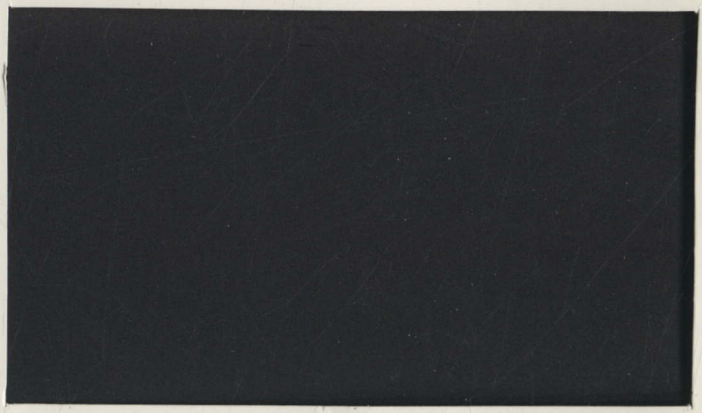

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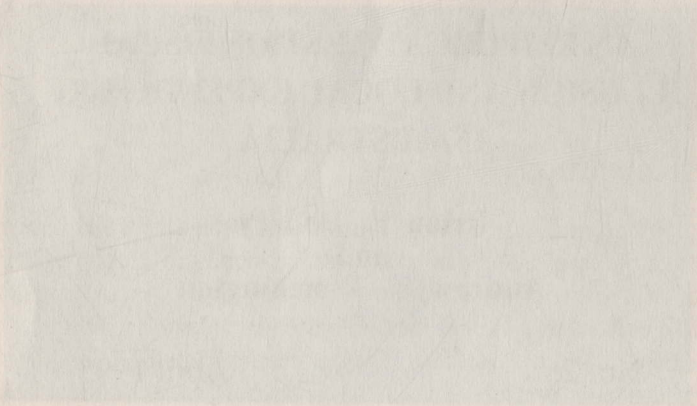

AN EMPIRICAL TEST OF FISCAL ILLUSION AND LOCAL EXPENDITURE IN AUSTRALIA*

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Abstract. This paper seeks to extend the literature on the empirical analysis of fiscal illusion in two ways. Firstly, it provides a simultaneous test of four specific hypothesis subsumed under fiscal illusion, namely the revenue-complexity, renter illusion, debt illusion and flypaper models. And secondly, it adds evidence drawn from the Australian institutional milieu to existing empirical work which has an overwhelming North American focus. Using 1991 data from 46 local government authorities in Tasmania, the results suggest significant support for revenue-complexity, renter illusion, debt illusion, and the degree of indirectness of the revenue system.

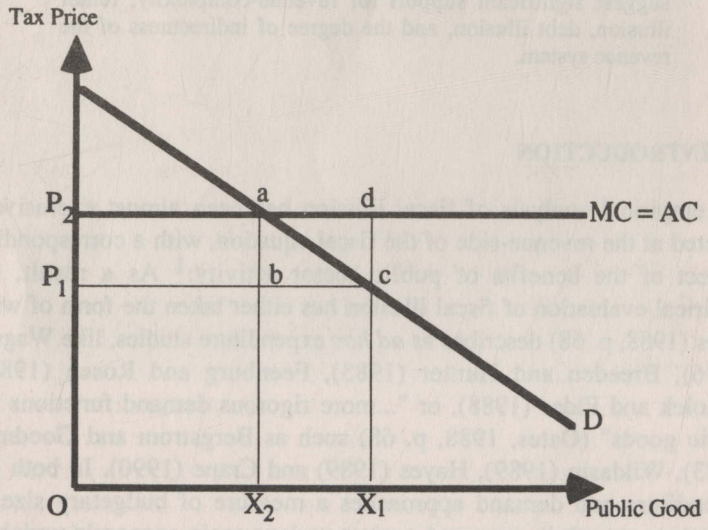
1. INTRODUCTION

The empirical analysis of fiscal illusion has been almost exclusively directed at the revenue-side of the fiscal equation, with a corresponding neglect of the benefits of public sector activity.[1] As a result, the empirical evaluation of fiscal illusion has either taken the form of what Oates (1988, p. 68) describes as *ad hoc* expenditure studies, like Wagner (1976), Breeden and Hunter (1985), Feenburg and Rosen (1987), Misiolek and Elder (1988), or "...more rigorous demand functions for public goods" (Oates, 1988, p. 68) such as Bergstrom and Goodman (1973), Wildasin (1989), Hayes (1989) and Crane (1990). In both the expenditure and demand approaches a measure of budgetary size or budgetary growth is regressed against various socio-economic variables aimed at capturing those determinants present in the absence of fiscal illusion. An indicator or proxy for the relevant illusionary variable is than added, so that a significant directional coefficient indicates the

presence of fiscal illusion. The generic model involved takes the form $E = \alpha X + \beta F + u$ where E is a measure of budgetary size, X is a vector of explanatory variables in the absence of fiscal illusion, F is a vector of variables intended to measure fiscal illusion, and u is the error term.

Apart from this general approach, the empirical study of fiscal illusion has proceeded in five distinctive directions. Each of these has attempted to model the process, shown in Figure 1, where the underestimation of the tax-price of the public good due to fiscal illusion results in an unambiguous expansion in the level of public expenditure and/or revenue and/or output. In Figure 1, P_2 and X_2 represent the tax-price and desired output of the public good in the absence of fiscal illusion, and the area OP_2aX_2 the public budget (expenditure or revenue). Such an outcome is consistent with the socio-economic vector αX. With the introduction of fiscal illusion the perceived tax-price falls to P_1, desired output expands to X_2 and the perceived budget is OP_1cX_1. However, the actual budget is OP_2dX_1 since the actual tax-price is still P_2. Empirical tests of fiscal illusion aim to evaluate the significance of the area X_2adX_1, the excess budget/revenue/expenditure attributable to the illusion vector βF.

FIGURE 1



The first of these approaches is revenue-complexity where the misperception of the tax-price results from fragmentation of the revenue system. Studies by Wagner (1976), Pommerehne and Schneider (1978),

Baker (1983) and Breeden and Hunter (1985) have been directed at this form of illusion. In terms of Figure 1, the increasing complexity of the revenue system would entail a fall in the perceived price of the public good and more public goods. The second genre of work focuses on revenue-elasticity where growth in the level of public activity is associated with income elastic fiscal extraction devices. Oates (1975), Craig and Heins (1980), Hunter and Scott (1987) and Misiolek and Elder (1988) are included in this area. Figure 1 would show the y-axis as being associated with the level of income elasticity of the revenue structure. The higher the level of dependence on income-elastic revenue devices (the lower the proportion of revenue from inelastic sources), the higher the level of illusion, and the higher the level of expenditure. The third type of approach is the flypaper effect, where lump-sum grants and public utility profits are assumed to exert a stimulatory effect on expenditures. Contributions by DiLorenzo (1982b), Winer (1983), Logan (1986) and Grossman (1990) fall into this category. Figure 1 would show the y-axis as being associated with the level of dependence on grants or utility profits. All other things being equal, the higher the level of dependence on grants/utility profits (the lower the proportion of revenue from other sources), the higher the level of illusion, and therefore expenditure. The fourth area centres on renter illusion, where fiscal illusion is related to the level of property owners in a jurisdiction. Bergstrom and Goodman (1973) and Martinez-Vazquez (1983) provide examples of this kind of work. The y-axis in Figure 1 would then illustrate the proportion of owner-occupiers in a jurisdiction. The lower the proportion of owners (and the higher the level of renters), the higher the degree of fiscal illusion, and the higher the level of public good provision. Finally, the situation where debt provides illusionary effects has been examined. Oates (1972), Epple and Schipper (1981) and Dalamagas (1993) have undertaken empirical studies in this area. Figure 1 would show that as a jurisdiction increasingly relied on debt (the proportion of revenue from taxes falls) the level of fiscal illusion would increase, and as a result the level of public good expenditure would also increase.

At least four dominant themes may be identified in the empirical literature on fiscal illusion. The first is that, in general, results have been mixed. Whilst many studies have found unqualified support for a particular hypothesis, others have found the evidence for fiscal illusion inconclusive. This is in part attributable to the diversity of data and models employed. In addition, the heterogeneity of results also applies across the different forms of fiscal illusion. For example, significant attention has been directed to the issues of revenue-complexity and

revenue-elasticity, whereas much less effort has been expended on other forms of fiscal illusion. Even more noticeable is the failure of most empirical studies to incorporate more than one illusionary hypothesis, and few studies have analysed more than two (Wagner, 1976; DiLorenzo, 1982a, 1982b; Martinez-Vazquez, 1988; Grossman, 1990). Secondly, the ability to find empirical support for the fiscal illusion hypothesis is persistently qualified by alternative hypotheses and the endogeneity of some variables. Whilst some of these issues may be addressed by careful econometric analysis, it may not be possible to resolve fully the psychological black box in which decisions under partial information are undertaken (Munley & Greene, 1978; Hamilton, 1983; Martinez-Vazquez, 1983; Marshall, 1989, 1991; Dougan & Kenyon, 1988; Oates, 1988). Thirdly, the body of theory concerning fiscal illusion is incomplete. Issues such as the derivation of suitable proxies for illusionary variables and the usefulness of these variables remains contentious. It may well be that some of the assumptions used in past approaches to fiscal illusion lack the theoretical rigour required for empirical analysis (Flowers, 1977; Oates, 1975; 1988; Marshall, 1989; 1991). And finally, empirical work on fiscal illusion has had an overwhelmingly North American institutional focus, with only limited interest in alternative national contexts, most notably Switzerland and the United Kingdom. Given the federal character of its constitutional milieu, it is somewhat surprising that no Australian study of fiscal illusion has been undertaken. The present paper seeks to address at least some of these issues by examining the revenue — complexity, renter illusion, debt illusion and flypaper hypotheses simultaneously in the jurisdictional context of forty-six local government areas in the state of Tasmania, Australia.

The paper itself is sub-divided into three main sections. Section 2 sets out the models and hypotheses in question, and discusses the variables employed. The results of the subsequent econometric procedures are analysed in section 3. The paper ends with some brief concluding remarks in section 4.

2. MODELS AND HYPOTHESES

Tests of fiscal illusion are usually subject to two constraints. Firstly, it is unlikely that a test may be designed that will evaluate all five forms of fiscal illusion simultaneously. For example, whilst renter illusion may be examined at the local rather than the federal level, there is little apparent scope for the analysis of the revenue-elasticity hypothesis, and *vice versa*. Accordingly, any empirical test for fiscal illusion should be

addressed at a particular type of illusion, or sub-group of illusions. Secondly, it is doubtful whether fiscal illusions are significant to the same extent at all levels of governmental expenditure. In particular, testing for illusion at the federal level is likely to obscure some of the effects on state and local expenditures. The models and hypotheses that follow are designed to accommodate these constraints.

The Bergstrom and Goodman (1973) demand function for public goods forms the basis for the analysis of fiscal illusion at the local level (Wildasin, 1988, p.355). This approach, which hypothesises that the level of expenditure conforms to the median voter model, may be placed in a linear-regression formulation which allows for the statistical analysis of fiscal illusion (Marshall, 1991, p. 1337). Modelling fiscal illusion in this manner is consistent with both the literature associated with the demand function for public goods, such as Bergstrom and Goodman (1973), Romer and Rosenthal (1979), Holcombe (1980) and Wildasin (1988), and with the majority of past empirical approaches to fiscal illusion, notably Wagner (1976), Clotfelter (1976), Munley and Greene (1978), Breeden and Hunter (1985), Marshall (1989) and Grossman (1990). Support for the fiscal illusion-augmented, public good demand function is further enhanced *a fortiori* by the predominance of this method in studies of fiscal illusion at the local level (Wagner, 1976; Clotfelter, 1976; Pommerehne & Schneider, 1978; Munley & Greene, 1978; DiLorenzo, 1982b; Grossman, 1990).

The illusionary approaches examined in this paper relate to the revenue-complexity, renter illusion, debt illusion and flypaper hypotheses. Table 1 outlines the models and variables examined. In broad terms, cross-sectional variables of forty-six local government areas (LGA) in Tasmania are examined in order to ascertain the directional impacts and significance of the illusionary manifestations.[3]

The selection of local public goods to evaluate fiscal illusion is appropriate for several reasons. Firstly, "... an adequate amount of statistical information is an obvious *sine qua non* for demand estimation" (Wildasin, 1989, p. 355). Australia offers little in the way of governmental diversity at the state level, whilst analysis nationally requires detailed and standardised time-series data over substantial time-periods. Secondly, expenditures at the local level are most likely to adhere to the classical unidimensional assumptions of the median voter model: that is, whilst at state and national level various requirements such as welfare and defence must be "juggled", the provision of public goods at the local level is usually confined to more narrowly defined projects such as roads, parks and sanitation (Romer & Rosenthal, 1979,

p. 146).[4] Thirdly, objective measures of public good performance and alternatives are less difficult to quantify (Romer & Rosenthal, 1979). The cost or benefit of better local roads is surely more recognisable, to both the median voter and the administration, than decisions at a higher level of federal structure. Finally, and most importantly in terms of the median voter model, the local community is more likely to adhere to the implicit assumptions of homogeneity (Bergstrom & Goodman, 1973; Romer & Rosenthal, 1979; Holcombe, 1980; Wildasin, 1989). Thus, if a demand function is to be estimated on the basis of socio-economic variables alone, without the benefit of individual utility functions, some restrictions must be made. For instance, the assumption that voters of a particular income class have particular elasticities of demand would appear to hold better at the local level than at that of the relatively heterogenous state level (Wildasin, 1979).

The dependent variable in Table 1 is local government expenditure (EXP). Whilst this is the only broad measure of public good provision used in past empirical studies (Wagner, 1976; Clotfelter, 1976; Baker, 1983; Grossman, 1990), it is by no means the most appropriate. In other words, the use of expenditure implies that output is measured by the value of public inputs. Criticism of this fact is largely derived from two associated corollaries. The first is that in using expenditure as a proxy for public good provision, cross-sectional studies would imply that the production function is uniform across jurisdictions. Studies by Hamilton (1983) have indicated that community "inputs" may substantially modify the output of public goods, so that misspecification of output may well be a problem. The second corollary is constant returns to scale; that is, increases in expenditure will increase the output of public goods proportionately. Despite these qualifications, and considering the absence of more suitable dependent variables (Marshall, 1989), the level of expenditure is the most appropriate measure of public good provision.[5]

Also shown in Table 1 are the set of socio-economic variables required by the Bergstrom and Goodman (1973) demand function approach. These are intended to capture the characteristics of the local community that may well impact upon the demand for public goods. The rateable area (AREA) and rateable area roads (ROAD) (Wagner, 1976; Munley & Greene, 1978) are expected to exhibit a positive coefficient in regard to expenditure, especially as Australian local governments usually direct significant resources to these purposes.[6] The proportion of the population over sixty-five years (065) is also included. A positive coefficient would be expected, indicating a higher consumption of public goods as this proportion increases (Bergstrom & Goodman, 1973, p. 290).[7]

TABLE 1
MODELS AND VARIABLES FOR LOCAL EXPENDITURE AND FISCAL ILLUSION

Method

Cross-sectional analysis of 46 Tasmanian municipalities 1991.

Models

(1) $EXP_j = \alpha_0 + \alpha_1 AREA_j + \alpha_2 ROAD_j + \alpha_3 TAX_j + \alpha_4 OWN_j + \alpha_5 INC_j + \alpha_6 POP_j + \alpha_7 O65_j + \alpha_8 HERF_j + \alpha_9 GRANT_j + \alpha_{10} UTILITY_j + \alpha_{11} DEBT_j + \alpha_{12} INDIRECT_j + u_j$

(2) $\ln EXP_j = \delta_0 + \delta_1 \ln AREA_j + \delta_2 \ln ROAD_j + \delta_3 \ln TAX_j + \delta_4 \ln OWN_j + \delta_5 \ln INC_j + \delta_6 \ln POP_j + \delta_7 \ln O65_j + \delta_8 \ln HERF_j + \delta_9 GRANT_j + \delta_{10} UTILITY_j + \delta_{11} DEBT_j + \delta_{12} INDIRECT_j + z_j$

(3) $EXP/POP_j = \beta_0 + \beta_1 AREA/POP_j + \beta_2 ROAD/POP_j + \beta_3 TAX_j + \beta_4 OWN_j + \beta_5 INC_j + \beta_7 O65_j + \beta_8 HERF_j + \beta_9 GRANT_j + \beta_{10} UTILITY_j + \beta_{11} DEBT_j + \beta_{12} INDIRECT_j + v_j$

Variables	Details	Data Sources(s)	Expected Sign
EXP	Total local expenditure in the j-th municipality ($)	*Government Finance Statistics: Tasmania 1990/1991* (ABS) Cat. 5501.6	
AREA	Rateable area of the j-th municipalilty (km^2)	*Tasmanian Inquiry into the Modernisation of Local Government* (LGAB), 1991.	+
ROAD	Road length of the j-th municipality (km)	*Tasmanian Inquiry into the Modernisation of Local Government* (LGAB), 1991.	+
TAX	Median voter tax-price of the j-th municipality ($). It is the amount of local rates payable on a home of median value.	*Tasmanian Inquiry into the Modernisation of Local Government* (LGAB) *Tasmanian Government Gazette* Vol. 275, 1991. *Government Finance Statistics: Tasmania 1990/1991* (ABS), Cat. 5501.6	-
OWN	Proportion of homes owned in the j-th municipality	*Local Government Areas: Tasmania 1991 Census* (ABS) Cat. 2790.6	-
INC	Median voter income in the j-th municipality ($)	*Local Government Areas: Tasmania 1991 Census* (ABS), Cat. 2790.6	+
POP	Population in the j-th municipality	*Local Government Areas: Tasmania 1991 Census* (ABS), Cat. 2790.6	+
O65	Proportion of population over 65 in the j-th municipality	*Local Government Areas: Tasmania 1991 Census* (ABS), Cat. 2790.6	+
HERF	Herfindahl index of simplicity for the j-th municipality.	*Government Finance Statistics: Tasmania 1990/1991* (ABS), Cat. 5501.6	-
GRANT	Dummy for reliance on grants in the j-th municipality	*Government Finance Statistics: Tasmania 1990/1991* (ABS), Cat. 5501.6	+
UTILITY	Dummy for reliance on utility revenue in the j-th municipality	*Government Finance Statistics: Tasmania 1990/1991* (ABS), Cat. 5501.6	+
DEBT	Dummy for reliance on debt revenue in the j-th municipality	*Government Finance Statistics: Tasmania 1990/1991* (ABS), Cat. 5501.6	+
INDIRECT	Dummy of measure of indirectness of the revenue system in the j-th municipality	*Government Finance Statistics: Tasmania 1990/1991* (ABS), Cat. 5501.6	+

The next socio-economic variable selected is median income (INC). The basis for inclusion of this variable derives from Wagner's Law where "... growth in income facilitates the relative expansion in expenditures (on public goods)" (Henrekson, 1988, p. 111). However, income represents "... the willingness to pay for public goods" (Marshall, 1989, p. 120; 1991, p. 1339) on the assumption that public goods may be defined as being normal goods. Moreover, income is often used as a proxy for unmeasurable socio-economic variables, or those unintentionally excluded (so-called income-correlated characteristics). Oft quoted measures include "... educational level, employment and family stability" and "... general success in society" (Hamilton, 1983, p. 347). Broadly speaking, the expected coefficient on income should be positive (as with a normal good). Nonetheless, despite the widespread use of income measures as a variable in public good estimation, there is still some controversy. Firstly, the use of median measures of income may obscure the true income elasticity of demand for the public good, since there is no reason to believe that elasticities are constant across a particular income class of any jurisdiction (Romer & Rosenthal, 1979; Wildasin, 1988).[8] Secondly, an assumption of the median voter model is that the median tax-payer also receives the median income. Romer and Rosenthal (1979) argue that this amounts to assuming income is monotonic; the median voter may not be the recipient of median income, and hence the equation may be misspecified.[9] However, studies such as Wildasin (1988, p. 375) accept that at the "macro-level" i.e. full local expenditure, the impact of the median voter constraints and assumed monotonicity will have a minimal impact given "... the error in the income elasticity ... is not likely to be very large".

The variable population (POP) should fulfil two requirements, depending on the model specification. Firstly, unless the local public good is defined in a pure Samuelson sense, goods will be subject to some private divisibility. Numerous studies have indicated that the failure to take into account measures of "crowding" or "economies of consumption" (Romer & Rosenthal, 1979, p. 152) will involve substantial misspecification bias (Bergstrom & Goodman, 1973; Munley & Greene, 1978; Oates, 1988; Marshall, 1989; 1991). And secondly, population may provide an indication of economies of production incurred in the provision of public goods (Romer & Rosenthal, 1973, Marshall, 1989).[10] In general, and if public goods are non-rival in consumption, the expected coefficient on population should be negative in per capita terms, reflecting a decreasing average cost of public good provision as population increases. However, it may well be that the positive

influences on population dominate, not only in gross terms as expected, but also in per capita terms (Borcherding, 1985; Oates, 1988; Marshall, 1989).

The final, and apparently the most important, socio-economic variable is the tax-price (TAX). In common with virtually all public good demand function studies since Bergstrom and Goodman (1973), the tax-price of the median voter should *ex ante* inversely determine the level of provision of the public good, given the substitution from the public to the private good. However, two problems usually surround the selection of a suitable tax-price. The first is the conflict between mean and median tax-prices. Most work has employed the median voter approach, since the mean tax-price has been shown to involve substantial multicollinearity (Munley & Greene, 1978; Pommerehne, 1978) and to violate the assumptions of the primary model of collective choice, the "... results cannot be interpreted as support for the median voter model" (Romer & Rosenthal, 1979, p. 151). The second conflict revolves around the question of whether the relevant median tax-price is the median voter's tax times the marginal cost of public good provision (Yinger, 1982), the median voter's tax rate times the marginal cost of public good provision (Yinger, 1982), the median voter's tax-share (Bergstrom & Goodman, 1973) or an equal share of the additional provision of the public good (Borcherding, 1985). Work by Hayes (1989) has argued that the median voter's tax share is the most appropriate, both theoretically and empirically. After examining all three approaches, Hayes (1989, p. 273) found that the median voter's tax share displayed "small biases" for most socio-economic variables and provided better estimates given "... a possible misspecified production function", as against the alternative approaches which exhibited "inconsistent parameters". Hayes (1989, p. 273) posited that the results indicated "... statistical support for the median voter's tax-share approach". As a result it is the method employed below.[11]

To these socio-economic variables, past approaches to fiscal illusion have added a vector of illusionary factors. The variables selected in this regard depend critically on the processes and powers of a particular governmental level. In an analysis performed at the local level of governmental expenditure, the revenue-complexity, renter illusion, debt illusion and "flypaper" effects are applicable.[12]

The revenue-complexity hypothesis states that:

> ... the more complicated the revenue system, the more difficult it is for the taxpayer to determine the tax-price of public outputs — and the more likely it is that he will underestimate the tax-burden associated with public programs (Oates, 1988, p. 69).

In general, the more complex the revenue system *ceteris paribus*, the larger the level of public expenditure. The variable used for accounting for the revenue-complexity hypothesis is the Herfindahl index of revenue simplicity (HERF) (Wagner, 1976; Clotfelter, 1976; Munley & Greene, 1978; DiLorenzo, 1982b; Breeden & Hunter, 1985; Misiolek & Elder, 1988).[13] This unweighted measure has drawn some criticism given that the visibility of the revenue classes is likely to vary significantly (Clotfelter, 1976; Pommerehne & Schneider, 1978; Breeden & Hunter, 1985; Henrekson, 1988; Misiolek & Elder, 1988). However, there appears to be "... a systematic relationship between ... the Herfindahl index and the degree of revenue visibility", indicating that the use of a weighted measure may well involve substantial multicollinearity" (Oates, 1988, p. 79). The fiscal illusion hypothesis predicts a negative coefficient, "... which would indicate that an increased simplicity or concentration of the revenue structure is associated with a reduced level of local public expenditures" (DiLorenzo, 1982b, p. 247).

The renter illusion hypothesis argues that:

> ... other things being equal, jurisdictions with a relatively large fraction of renters tend to spend more per capita on local public services ... Such an observation is based on the apparent failure of renters to understand the link between the level of local services demanded and the level of rent paid (Oates, 1988, p. 72).

The variable used to elucidate the renter illusion hypothesis (OWN) is the proportion of homes owned or being purchased in the municipality (Bergstrom & Goodman, 1973; Goetz, 1977; Martinez-Vazquez, 1983). The renter illusion hypothesis would *a priori* indicate a negative coefficient, as the proportion of homes owned or being purchased increases, the level of expenditure would fall.

In terms of the flypaper effect, "... a lump-sum intergovernmental grant is perceived by individuals as a reduction at the margin of the tax-price" such that there is "... a willingness on the part of the electorate to support higher levels of spending" (Oates, 1988, p. 77). Here dummy variables are used to identify those municipalities proportionately more dependent on grants (GRANT) and/or public utility profits (UTILITY) (DiLorenzo, 1982b; Breeden & Hunter, 1985; Marshall, 1989). In general, proportionately higher levels of dependence should be associated with municipalities that are increasingly subjected to illusion of the flypaper nature.[14] The *a priori* regression coefficient on these qualitative variables would be positive, as reliance on grants and/or utility profits increases *ceteris paribus*, so expenditure should also increase.

An identical use of qualitative variables to identify debt-dependent jurisdictions holds for debt illusion (DEBT) (Dalamagas, 1993). In this approach "... individuals are more likely to perceive the cost of public programs if they pay for them through current taxation than if tax liabilities are deferred through public sector borrowing" (Oates, 1988, p. 76). The expected coefficient on this variable should be positive, indicating that "... reliance on debt, rather than tax finance should result in a larger public budget" (Oates, 1988, p. 76).

Finally, a weighting measure for the revenue-complexity hypothesis is employed by the construction of a measure of indirectness of the revenue system (INDIRECT) (Pommerehne & Schneider, 1978; Misiolek & Elder, 1988; Henrekson, 1988).[15] Use of a separate variable tends to avoid the problems associated with "weighting" of the revenue-complexity measure. In line with the hypothesis of "visibility" of revenue sources (Oates, 1988), a proportionately more obscure revenue system would imply an increase in the level of expenditure on the local public good, implying an *a priori* positive coefficient.

In order to correctly evaluate the demand function for local public goods, three alternative regression specifications are also examined. This has been undertaken in order to identify the most econometrically appropriate functional form for the study give that "... the significance of fiscal structure ... is sensitive to the specification of equations" (Munley and Greene, 1978, p. 97). Table 1 illustrates (1) a linear function in gross terms (Wagner, 1976; Munley & Greene, 1978), and (2) a log-linear function in gross terms (Grossman, 1990). These functional forms are evaluated, along with (3) a per capita linear form (Clotfelter, 1976; Pommerehne & Schneider, 1978; Munley & Greene, 1978; Breeden & Hunter, 1985) and log-linear approaches (Baker, 1983; Logan, 1986; Feenburg & Rosen, 1987; Misiolek & Elder, 1988). Moreover, and in line with the questions of endogeneity of tax-price and revenue-complexity posed by Oates (1988) and Marshall (1989), an assessment of possible misspecification flowing from the use of endogenous variables is also made.

3. RESULTS

The *ex ante* models proposed in Table 1 were (1) an aggregate variable linear regression (Wagner, 1976; Munley & Greene, 1978), (2) a log-linear aggregate variable regression (Grossman, 1990) and (3) log-linear (Baker, 1983; Logan, 1986; Feenburg & Rosen, 1987; Misiolek & Elder, 1988) and linear (Clotfelter, 1976; Pommerehne & Schneider, 1978;

Munley & Greene, 1978; Breeden & Hunter, 1985) per capita variable regressions. The corresponding *ex post* results are (1) Model 1, (2) Models 2 and 3, (3) Models 4, 5 and 6, presented in Table 2.

Model 1 below details the results of an Ordinary Least Squares (OLS) linear regression run on the aggregate amounts of the socio-economic and illusionary variables detailed in Model 1 of Table 1. Socio-economic variable coefficients that conform to the *a priori* expected coefficient are ROAD, TAX, INC, POP and 065, though only POP is significant. In terms of the illusionary variable coefficients, OWN, GRANT, UTILITY, INDIRECT and DEBT conform to *a priori* expectations. However, all except DEBT are insignificant and do not conform to the *a priori* expected coefficient, a result similar to that obtained by Misiolek and Elder (1988, p. 241), who observed that "... HERF [is] never significant and often yield[s] the wrong sign". The results generally conform to Munley and Greene's (1978, p. 98) assertion that "... the results are ambiguous when variables are expressed in gross [aggregate] terms".

In terms of relations between the variables, there is a high degree of inverse correlation between ROAD and AREA, and a high positive correlation between OWN and AREA, and O65 and OWN indicating that multicollinearity may well be a problem. This is supported by the relatively high R^2 and the low t-values found.[16]

To test for specification a Ramsey RESET specification test was run along with various tests for heteroskedasticity. The specification F-test rejected the null hypothesis of no misspecification and it was concluded that the model in aggregate terms is functionally misspecified. The tests for heteroskedasticity (Chi distribution) rejected the null hypothesis of homoskedasticity in favour of the alternative hypothesis of heteroskedasticity.[17]

As a result, the Australian analysis of fiscal illusion using aggregate (gross) figures supports the empirical findings of Munley and Greene (1978, p. 97) of equation misspecification "... and heteroskedasticity, indeed, was found to be present". It also lends weight to those theoretical studies that support the use of per capita measures in the median voter model, such as Clotfelter (1976), Pommerehne and Schneider (1978), Breeden and Hunter (1985) and Marshall (1989).

Accordingly, and in common with Munley and Greene (1978), a Generalised Least Squares regression (GLS) is undertaken (Model 2). The coefficients of the socio-economic variables of AREA, TAX, INC, POP and O65 are significant, and the signs correspond to *ex ante* expectations. The coefficients on the illusion variables OWN and

DEBT are significant and positive, GRANT and UTILITY are positive, though insignificant, whilst HERF and INDIRECT are neither significant, nor correspond to the expected sign of the coefficients. As with Munley and Greene (1978, p. 97) "... the t-statistics are generally lower". However, unlike their study, the GLS procedure has improved the level of significance of one illusion variable coefficient, namely UTILITY.[18]

Model 3 details the results of a log-linear OLS regression run on the transformed variables of Model 1 in Table 1 (Grossman, 1990). Socio-economic variables that conform to their *a priori* expected coefficients are ROAD, TAX, INC, POP and O65 of which ROAD, POP and O65 are significant.[19] For illusionary variables, HERF conforms to the hypothesised sign, although it is insignificant: OWN, GRANT, UTILITY, DEBT and INDIRECT also correspond to the *a priori* expectations, of which OWN, DEBT and INDIRECT are significant.

Tests for homoskedasticity fail to reject the null hypothesis, and we may conclude heteroskedasticity is not present. The Ramsay RESET specification test does not conclusively reject the null hypothesis of no functional misspecification, whilst a test for model selection favours the log-linear form over the linear model discussed earlier.[20] These results supporting the latter specification sustain the findings of Baker (1983), Logan (1986), Feenburg and Rosen (1987), Misiolek and Elder (1988) and Grossman (1990) in the econometric suitability of the log-linear over a linear form for demand estimation.

Model 4 is a log-linear modified form of Model 2. In order to correct for presumed multicollinearity present in Models 1, 2 and 3, insignificant variables (those with t-statistics less than 2) are excluded. Whether the alternative specification is preferred over the full *a priori* model is determined with a MSE criterion. Ramsay RESET specification tests support the exclusion of the insignificant variables and the null hypothesis of homoskedasticity is not rejected.

In the modified form, all variables are significant, except HERF which is negative, but insignificant. DEBT and INDIRECT are significant supporting the debt and indirect illusion hypotheses. The renter illusion hypothesis is supported by the significantly negative sign of OWN indicating that a lower proportion of renters in a municipality is associated with a lower level of expenditure. POP is significant and positive, but since the model is not expressed in per capita terms, this fails to support either the "economies of consumption" or "economies of production" arguments.

TABLE 2
RESULTS OF REGRESSION ESTIMATION FOR LOCAL EXPENDITURE AND FISCAL ILLUSION

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CONSTANT	465.79	7330.6	-0.078	2.673***	0.132	2.732***
	(3546.6)	(8081.6)	(2.978)	(0.802)	(2.987)	(0.813)
AREA	-0.308	6.763**	-0.102*	-0.102*	-0.114**	-0.117**
	(1.061)	(3.028)	(0.056)	(0.051)	(0.055)	(0.051)
ROAD	2.167	-0.873	0.217*	0.202*	0.295***	0.293***
	(3.114)	(6.1266)	(0.118)	(0.103)	(0.098)	(0.083)
TAX	-0.838	-5.550**	-0.099		-0.129	
	(1.312)	(2.0665)	(0.096)		(0.093)	
OWN	-46.349	-321.87***	-0.805***	-0.830***	-0.891***	-0.936***
	(30.950)	(44.844)	(0.220)	(0.206)	(0.208)	(0.196)
INC	0.023	0.22597**	0.308		0.307	
	(0.086)	(0.0906)	(0.288)		(0.289)	
POP	0.419***	0.402***	0.816***	0.822***		
	(0.033)	(0.036)	(0.057)	(0.043)		
O65	191.64	755.79***	0.331***	0.299***	0.302***	-0.262***
	(122.18)	(125.46)	(0.103)	(0.094)	(0.101)	(0.092)
HERF	3680.0	5795.7	-0.357	-0.329	-0.401	-0.367*
	(5803.7)	(7186.3)	(0.260)	(0.203)	(0.258)	(0.204)
GRANT	20.473	470.47	0.012		0.004	
	(808.54)	(2904.4)	(0.101)		(0.101)	
UTILITY	447.87	2857.3	0.023		0.001	
	(737.16)	(1956.6)	(0.097)		(0.096)	
DEBT	1639.4*	4732.8***	0.246**	0.23443**	0.219**	0.199**
	(857.83)	(750.43)	(0.110)	(0.098)	(0.107)	(0.097)
INDIRECT	330.08	-1911.0	0.578***	0.590***	0.593***	0.618***
	(779.48)	(4247.3)	(0.103)	(0.093)	(0.103)	(0.094)
ESS	0.87588E+08	0.11620E+17	1.3811	1.4525	1.4363	1.5371
R^2	0.9518	0.9893	0.9714	0.9699	0.8202	0.8076
R^2 adjusted	0.9343	0.9855	0.9610	0.9634	0.7621	0.7722
d.f.	33	33	33	37	33	37
FPE	0.34043E+07	0.45162E+15	0.53680E+01	**0.46938E-01**	0.53266E-01	0.4748E-01
LOG AIC	15.025	33.728	-2.9405	**-3.060**	-2.9448	-3.0509
LOG SC	15.542	34.245	-2.4237	-2.7063	-2.4678	**-2.7329**
GCV	0.36998E+07	0.49082E+15	0.58339E-01	**0.48806E-01**	0.57156E-01	0.4896E-01
HQ	0.40666E+07	0.53949E+15	0.64124E-01	0.53396E-01	0.62907E-01	**0.53302E-01**
RICE	0.43794E+07	0.58099E+15	0.69056E-01	0.51875E-01	0.65288E-01	**0.51237E-01**
SHIBATA	0.29803E+07	0.39538E+15	0.46995E-01	**0.43932E-01**	0.47516E-01	0.45038E-01
SC	0.56182E+07	0.74533E+15	0.88590E-01	0.66786E-01	0.84774E-01	**0.65031E-01**
AIC	0.33509E+07	0.44454E+15	0.52838E-01	**0.46698E-01**	0.52612E-01	0.47315E-01

Values in parentheses are the corresponding standard errors. Asterisk(s) represent the level of significance; * - 90%, ** - 95% and *** - 99%. Bold test denotes the model that is "best" for the criterion. Diagnostic tests may only be valid for unrestricted OLS regressions.

Model 5 is a per capita form of the log-linear model described in Model 1 (Munley & Greene, 1978; Baker, 1983; Logan, 1986; Feenburg & Rosen, 1987; Misiolek & Elder, 1988). Tests for heteroskedasticity fail to reject the null hypothesis of homoskedasticity and a Ramsay RESET specification test favours the functional form over that presented in Models 1 and 3. In terms of the illusion variables, the renter illusion hypothesis is supported by the positive and significant sign on OWN, as is the debt illusion hypothesis with DEBT, and the measure of indirectness with INDIRECT. The hypothesis of revenue-complexity (HERF) and the flypaper effect (GRANT and UTILITY) are inconclusively supported by their respective negative and positive, though insignificant, signs on these coefficients.

Using the per capita data, a Hausmann specification procedure was run to test for the endogeneity of the tax-price of public goods (TAX), in accordance with questions raised by Oates (1988) and Marshall (1989). The results reject the null hypothesis of exogeneity and we may conclude that inclusion of TAX in OLS estimates is likely to involve simultaneity. Similar problems have prompted past studies to adopt the Two-Stage Least Square (2SLS) approach such as in Clotfelter (1976), Feenburg and Rosen (1987), Marshall (1989) and Grossman (1990).

A further Hausmann specification test is run on the measure of revenue-complexity (HERF) about which Oates (1988, p. 79) has argued that "... the likelihood of endogeneity ... seems to me quite high" and which Marshall (1989, p. 3) noted has therefore "... compromised existing empirical studies of fiscal illusion". The test fails to reject the null hypothesis, and we may conclude that the Herfindahl index is exogenously determined to the level of expenditure.[21]

Model 6 is a 2SLS approach with TAX treated as endogenous (Clotfelter, 1976; Marshall, 1989). The illusion variable of OWN (renter illusion) is negative and significant, thereby supporting the hypothesis, as is HERF (revenue-complexity). The qualitative variable constructed for the debt illusion hypothesis (DEBT) is positive and significant, supporting the hypothesis that reliance on debt is associated with higher levels of expenditure. In terms of INDIRECT, the measure of indirectness of the revenue system, the *ex ante* coefficient significantly corresponds with the *ex post* outcome. In general, the models examined support Munley and Greene (1978, p. 97) that tests for fiscal illusion are "... sensitive to the specification of those [expenditure] equations". Using econometric analysis, it was concluded that the log-linear per capita regression model is preferred to the other forms discussed, supporting the

studies of Baker (1983), Logan (1986), Feenburg and Rosen (1987) and Misiolek and Elder (1988). In terms of particular illusion hypotheses, renter illusion (OWN) is strongly supported regardless of functional form, as is debt illusion (DEBT). The measure of indirectness of the revenue system (INDIRECT) also strongly supports the presumed influence of the visibility of the revenue system on expenditure. The evidence supporting the revenue-complexity hypothesis (HERF) however, remains inconclusive. Despite this, the present results reject the "alternative hypothesis" of Oates (1988) of revenue-diversification as against that of revenue-complexity, on the basis of revenue structure proven to be determined exogenously to the level of expenditure. Given the strong evidence supporting revenue-visibility, it may well be that the Herfindahl index is an inappropriate proxy measure for the issue of revenue-complexity.

4. CONCLUDING REMARKS

This paper has sought to provide an empirical evaluation of fiscal illusion on local expenditure by examining the cross-sectional effects of revenue-complexity, renter illusion, the flypaper effect and debt illusion on 1991 data drawn from 46 local government authorities in Tasmania.

In broad terms, the results suggest that the format of the tests is appropriate econometrically, and that significant support for the revenue-complexity, renter illusion, debt illusion and the degree of indirectness of the revenue system hypotheses does exist at the local level. The study itself augments existing empirical literature on the theory of fiscal illusion in at least two ways. Firstly, it represents the first empirical analysis of fiscal illusion based on Australian data, and accordingly complements existing US and Canadian work with evidence derived from an alternative jurisdiction of roughly similar institutional structure. And secondly, unlike most previous studies, few of which have attempted to statistically test more than two illusionary hypotheses simultaneously (Wagner, 1976; DiLorenzo, 1982; Martinez-Vazquez, 1988; Grossman, 1990), the present paper subjects four putative forms of fiscal illusion to the same data.

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NOTES

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1. Goetz (1977, p. 177) explains why this may be the case:

> It is not that the issue of over- or under- valuation of the benefits of public goods is not a trenchant one. Quite the contrary. In the last analysis [the benefits of public goods], however, assessments of the relative values of goods are intrinsically subjective and highly personal ... there is little hope for establishing the truth or falsity of J.K. Galbraith's contention that the preference of Americans for automobiles over public goods is symptomatic of illusion.

2. Figure 1 is drawn from Wagner (1976, p. 54).

3. Municipal data was selected from Tasmania for three reasons. The first is that Tasmania does not have in force "rate ceilings" as found in, say, NSW. Municipal decisions on expenditure thus tend to be more disassociated from state control. Secondly, it would be unwise to cross state borders in selecting data sets, as substantial differences in the regulation, revenue raising and administration of local governments exist. Thirdly, Tasmania was the only state to provide concise published data on a local government basis for the 1991 Australian Census.

4. Some studies have argued convincingly that substantial variation in public good demand may be found within local expenditure. In this manner evaluation of total local public goods may well obscure some of the peculiar conditions surrounding components of this expenditure, such as police, health and education in the United States (Bergstrom & Goodman, 1973; Martinez-Vazquez, 1983; Grossman, 1990).

5. Derivation of more suitable measures of public provision brings with it further complications. In US studies of local education expenditure (Hamilton, 1983), use of educational performance is more likely to be an indicator of the socio-economic profile of the community rather than public good demand. In this manner, expenditure as output removes, at the least, the question of endogeneity (Wildasin, 1989, p. 359).

6. Rateable area and rateable area roads, rather than municipal area and municipal area roads, were selected since many Tasmanian LGAs encompass sizeable wilderness (state-funded) and national park (federally funded) regions. Rateable area and rateable area roads are likely to give a more accurate indication of local fiscal responsibilities.

7. Bergstrom and Goodman (1973) cite the life-cycle hypothesis as providing the basis for this coefficient: that is, "... persons over 65 years of age tend to spend a larger portion of their current income on current consumption than younger people. If demand for public goods as a fraction of total demand does not diminish with age then one would expect an aged person to demand a larger quantity of public goods than a younger person with the same income and tax share" (Bergstrom & Goodman, 1973, p. 290). An equally likely argument may be advanced that an increase in age is accompanied by a rising portion of total demand directed to the public good (Marshall, 1989).

8. This is largely a problem associated with the homogeneity assumption of the median voter model. Nevertheless, elasticities are expected to be positive, and "... the error in the income elasticity, is however, not likely to be very large" (Wildasin, 1988, p. 375).

9. Despite this, Romer and Rosenthal (1979, p. 162) accept that a median voter model is superior to any based upon mean variables.

10. Marshall (1989, p. 122) also proposes that larger populations, by diminishing the tax-price of the public good may obscure the marginal cost of activity, regardless of the revenue structure. Borcherding (1985, p. 373) argues that these populations are also associated with increases in the size of the "illusion-enhancing" bureaucracy. Oates (1988, p. 71) posits that larger population bases are explicitly associated with a wider diversity of public services. All three propositions would be associated with a positive coefficient when regressed against expenditure.

11. The calculation of the median voter's tax-price remains computationally difficult. At the local level Crane (1990, p. 97) argues that the tax-price should include changes in gross-of-tax housing costs, change in tax-payments and the change in household income. Wildasin (1989, p. 362) likewise maintains that the distortionary effect of property taxation must be included in the price of public good provision. The result of ignoring such qualifiers may well be substantial bias in the estimation of price elasticity (Wildasin, 1989, p. 375). The approach used in this study, and that of Oates (1972), Bergstrom and Goodman (1973), Pommerehne and Schneider (1978) and Epple and Schipper (1981), is the tax-price of housing of median value in the jurisdiction. This is likely to provide an accurate assessment of local government costs since most non-grant revenues are sourced from property rates. Excluded would be fines and licences since they are of an insignificant nature and are unpredictably distributed across the electorate. Using gazetted rates and charges for 1991, and the median assessed annual value (AAV) for each municipality (the basis for rate assessment in Tasmania), a median municipal contribution was calculated. Wagner (1976), Munley and Greene (1978), Misiolek and Elder (1988) and Marshall (1989; 1991) utilised the average salary of a municipal/state employee which is likely to understate significantly the cost of public good provision.

12. At the local level in Australia, revenue is primarily derived from municipal rates and the usage of municipal services and does not

relate directly to income levels within a municipal area. Accordingly, the revenue-elasticity hypothesis is not relevant.

13. Where the Herfindahl index of revenue complexity is $HERF_j = \sum_{i=1}^{n} (REV_i)^2$ such that the index for the j-th LGA is the sum of the squared proportions of total expenditure of eight revenue classifications; rates, licences/fees/fines, grants, charges, interest, utility transfers, loans, other income.

14. There is no longer unanimity on the nature of the flypaper effect in the literature. In a pathbreaking new paper Brennan and Pincus (1993, p. 2) argue that "...standard models of intergovernmental grants *in a federal system* have no features which distinguish them from models of resource transfers between entirely autonomous states. That is, those models are models of *international aid* — not of *federal grants*" (original emphasis). They conclude that a flypaper effect is not at all suprising, contrary to conventional wisdom. They observe that "...if there is no increase in state income on average associated with increased federal grants, we should on the standard analysis expect *no* increase in state public spending; therefore any increase *at all* that is detected empirically represents a challenge to the prevailing orthodoxy" (Brennan & Pincus, 1993, p. 3) (original emphasis).

15. Where INDIRECT is the summed proportion of revenue derived from five relatively "invisible" sources; interest, loans, utility transfers, other income and grants.

16. The OLS estimator in the presence of multicollinearity remains unbiased and is in fact still BLUE (Best Linear Unbiased Estimator). The R^2 is unaffected, and the classical linear regression assumptions are still met. The primary undesirable characteristic is that variances are high, and therefore parameter estimates are imprecise and hypothesis testing is not powerful. Detection may be accomplished by the examination of the correlation matrix, though this method may not identify correlations between more than two specific variables (Kennedy, 1992).

17. The diagnostic tests employed for testing heteroskedasticity are derived from Breusch-Pagan-Godfrey [1978/1979], ARCH [1982], Harvey [1976] and Glejser [1969] (White 1993, p. 174).

18. The correction for heteroskedasticity employed by Munley and Greene (1978) in the GLS technique must be examined in the context of "... before correcting for heteroskedasticity, each variable should be examined for possible transformations (i.e. changing aggregate to per capita) ... that might be appropriate in the context of the relationship in question" (Kennedy, 1992, p. 127). Subsequent to the GLS regression, Munley and Greene (1978) did examine possible transformations, in common with the present paper.

19. Marshall (1981) has posited that the reason why public good expenditure is not significantly or positively related to income in empirical studies is that it ignores redistributive consequences (as income falls, demand for redistribution increases) and that a significant substitution effect may exist (from public to private goods as income increases). Accordingly, "the theoretical and empirical case for a positive and significant income effect is not yet conclusive" (Marshall, 1991, p. 1341).

20. The technique employed compares the Error Sum of Squares (ESS) from the log-linear model with the transformed unit free ESS from the linear form (Ramanthan, 1989). The chi-squared test rejected the null hypothesis that the two models were equivalent. Since H^0 was rejected, sufficient evidence existed for selection of the log-linear form over the linear model on the basis of the adjusted ESS.

21. The question of, and testing for, endogeneity deserves some attention. Firstly, if an endogenous variable is incorporated into a regression the "... assumptions of the classical linear regression are violated" (Greene, 1993, p. 579) and therefore it is likely to invoke simultaneous equation bias. Some studies have used this argument to offer *prima facie* support for the use of the 2SLS technique (Clotfelter, 1976; Marshall, 1989; 1991) though econometric studies have indicated that "... in spite of its shortcomings, OLS still performs relatively well in this context" (Kennedy, 1992, p. 163). As for testing for endogeneity, the tests employed "... cannot reject endogeneity, but they can find ... that [it] is of sufficiently minor statistical concern that it is unlikely to produce inconsistent coefficient estimates" (Beggs, 1983, p. 95).

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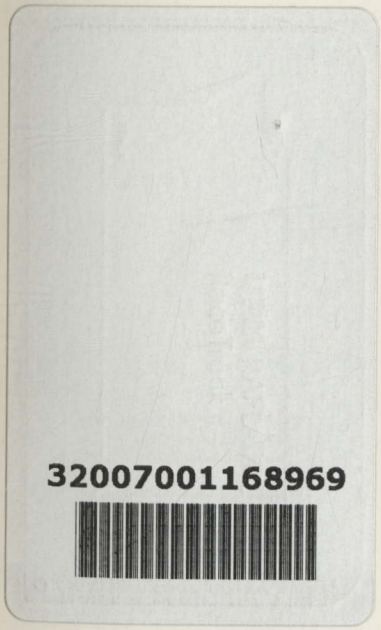

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