CARACTERIZACIÓN DE CAMBIOS CAPTURE SEQUENCE: MARGINAL INCIDENCE FOR PUBLIC EXPENDITURE [1]

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Abstract

In this paper it is proposed a methodology through which we can get profiles of marginal incidence, i.e: there is a series of values for each quintile in accordance to the program size. The empiric case is about the implementation of the Argentinean Education Reform of 1997, whose main objective is to modify the participation choices at the secondary school. Up to now we do not have a methodology to measure the capture sequence of a program. For this I propose to use (no lineal) probability models to consider no proportional cases. I show that the group most benefited whit this Reform varies with the program size. It is also because the response differ with sex and age, in the same way that we do not expect a benefit incidence be constant for everybody, we must not expect marginal incidence be homogeneous for all group of people.

Key Words: BENEFIT INCIDENCE, MARGINAL INCIDENCE, PUBLIC EDUCATION, ARGENTINA, FEDERAL EDUCATION LAW,

JEL Code:H22, H4, H52, I28, C13

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1 Introduction

The analysis of benefit incidence of the public funds are usually components in the evaluations of the distributions of the fiscal policy[1]. From a study of these type we can know who benefit "from public services, and ... the welfare impact on different groups of people or individual households of government spending" (Demery, 2003 pp.2).

This methodology is right when we try to obtain a diagnosis of the situation but it is not usually good when we try to analyze the changes in the different policies [2]. In all the developing countries it is important to know the distribution of the new beneficiaries. It is possible that this distribution does not agree with the distribution of the actual beneficiaries (van de Valle, 2003; Lanjouw and Ravallion, 1999; Younger 2003), and its evaluation is an empiric problem (Lanjouw and Ravallion, 1999). The current methodologies are based on linear regression methods which relate the situation of each group whit the size of the program. In this way, we get a unique value of marginal incidence for each group, whose consistency requires proportional changes in the program size.

In this work it is proposed a methodology through which we can can get profiles of marginal incidence, i.e: there is a series of values for each quintile in accordance to the size of the program. Its consistency not necessarily is based on proportional changes in the program size. The empirical analysis is about the implementation of the Federal Law of Education in Argentina, whose main objective is to modify the participation choices at the secondary school [3]. In this case microdata from two national surveys were used with the same sampling framework, carried out in 1997 and 2001.

The rest of the document is organized as follows. Section 2 presents the methodology to measure the marginal incidence problem. In Section 3 the education reform is presented in itself and in Section 4 there are some brief comments and the final conclusion.

[1] This is sustained in different arguments, as the competition for public funds with other objectives of fiscal policy (van de Valle, 1998) or a politically sustainable fiscal adjustment (Davoodi et al., 2003)

[2] van de Valle, 1998; Demery, 2003 describe the limitations of benefit incidence analysis for theses cases.

[3] "The coverage and the implementation of programs to facilities access... for all residents to the education system..." Art. 5° Education Federal Law Nº 24195/1993

2 Marginal incidence estimation: literature review and proposal

"Benefit incidence tells us who is benefiting from public services, and describes the welfare impact on different groups of people or individual households of government spending" (Demery, 2003). This exercise is used to identify who is benefited with a certain program and analyze its position in the welfare distribution [4]. In the last years, studies on benefit incidence have grown subtancially but at the same time they have been criticized as a solid instrument to evaluate policy changes, that is, the marginal incidence (van de Valle, 2003; Younger, 2003). It has been said that the problem emerges when the changes analyzed have different distributive characteristic to the existing ones [5]

There are various and different strategies to evaluate marginal incidence based on benefit incidence. In van de Valle and Need (1995) we can find the first studies of this type based on a temporal series of exercises of benefit incidence, from which we can derive two measures of marginal incidence[6]: one is the change in the participation of a certain group in the whole benefit (Hammer et al. 1995; Al-Samarrai and Hassan, 2002; Lanjouw et al. 2002) and the other is the participation of the group in the aggregate change of the distributed benefit (Younger, 2002; Glick and Razakamanantsoa, 2001). These measures are not satisfactory because they do not relate theses changes with the size of the program.

Lanjouw and Ravallion (1999) (LandR hereafter) make up a political economy model to identify the conditions under which the different groups that constitute the society appropriate of the changes in the coverage of a program. They show that depending on the form of benefit and cost function adopt with relation to the coverage rate we will see if those people who finance the program participate with greater intensity when the program begins, called "early capture" or when it has already expanded, called "later capture". We will also observe that poor people choices are residual. In this way, the marginal incidence of each program varies in accordance with the different levels of added coverage rate.

As it is not possible to know previously the sequence of appropiation of the benefits, the problem es how to estimate it. So LandR propose to relate the partic-

[4] van de Valle (1998) discuss the welfare relevant for this type of exercises.
[5] Selden and Wasilenko (1995) is one of some many cases in that is shown this situation clearly.
[6] Glick and Sahn (2006), with a similar strategy to that of Selden and Wasylenko (1995), motives these two measures from the demand change from a price change.

ipation of a certain sub region with the added coverage in the area. The different regional coverages are used as an approximation to realize which would be the specific coverage under alternative rates. This strategy [7] allows them to obtain for each quintile what would be the change in the specific coverage rate when the program size changes. Although this method is an important advance, up to now we can not evaluate what would be the marginal incidence int the different levels of coverage. Using this method we have a unique marginal incidence value for each group when the theoretical model predicts that the marginal incidence is a sequence of values as the size program changes.

This item has a double importance. First, because as it is an average expansion of different regions we have the possibility of getting the wrong answer when the change is focalized in a certain region. And, second, when we estimate a unique value for each quintile, we lose the possibility to evaluate what would happen in those cases different to the averages ones. Therefore, it is impossible to say if the program characterizes as late or early capture. This proposal of LandR implies to consider only those cases in which the changes are proportional, situation, as we have seen, wants to be avoided.

For all these reasons, it is proposed an alternative methodology which consists in recognizing that the LandR model tries to estimate the probability that a certain group could modify its participation when the size program changes (Younger, 2003)[8]. In this paper Younger uses a lineal probability model which allow him to obtain (like LandR) to have an only relevant value but as it is based on microdata it improves the efficiency of the estimates . In the next section it is shown not only a more general form to consider the problem including LandR case, but also those cases in which the marginal incidence changes with the size program

2.1 Estimation of marginal incidence sequence

To obtain a sequence of marginal incidence I propose to estimate non lineal probability models. In these models the marginal effects are variable and depended on the specific values of independent variables. So they permit us to compute marginal effects for each quintile which varies with the program size and therefore, we do not need the proportional assumption of changes. In the results section,

[7] According to the data that they dispose: a cross section for quintile and region.

[8] Younger (2003) consider in a footnote that this estimation can be make with non lineal model but he do not evaluate its consequences.

Section 3, I apply this methodology only to show as it works.

The LandR model can be interpreted as a probability model for certain group (quintile q) to obtain greater coverage when the program coverage increases. An alternative is to use a probability model to participate among multiple alternatives, which are influenced by common variables, which includes the size program[9] as an independent variable. This methodology is based on participation models which originate the demand estimation methods through the variation compensated estimation[10]

The greater flexibility of these models allows us to adopt various specifications and, therefore, to analyze the problem of marginal incidence profiles from diverse perspectives. In particular, we can evaluate marginal effects to different values of size program.

One possible specification is to follow LandR one of estimating one equation for each income group. That is,

$$Y_{iqt} = \alpha_q + \beta_q \times Cov_{pt} + \delta_q \times X_{iqt} + \eta \times Year_t + u_{iqpt} \tag{1}$$

Where Y_{iqt} is a multinomial variable which identifies with 0 if certain people i from quintile q do not assist to the education system in the year t, with 1 if he goes to private sector and with 2 if he goes to a public one; X_{iqt} is a characteristic individual vector; Cov_{pt} is the total regional coverage; $Year_t$ is a binary variable which reflects the year and u_{iqpt} are the usual errors.

The *marginal incidence* for the quintile q will be the product between the coefficient for the Cov_{pt} variable and a transformation of the equation (1) which will vary on the independent variables values, the $g()$ function [11]:

$$IM_q = g(\alpha_q + \beta_q \times Cov_{pt} + \delta_q \times X_{iqt} + \eta \times Year_t) \times \beta_q \tag{2}$$

Other specification is to estimate only one equation using interaction terms between coverage rate and quintile that disappear when we control for quintile.

[9] It is possible that the correlation problem between the aggregate coverage rate and residual will be minimal. If this not will be true the IV approach is the right one.

[10] Selden and Wasylenko (1995) shows a common framework to the benefit incidence and compensated variations.

[11] It is usual to consider normal or logistic distributions but would be other. (Wooldrige, 2002, pp. 458)

This version permits us to increase the efficiency of the estimates because we use all information available. That is:

$$Y_{it} = \alpha + \beta \times CQ_{iqt} + \delta \times X_{it} + \eta \times Year_t + u_{iqt} \quad (3)$$

Now Y_{it} is the same variable but for all population, X_{it} is a vector of individual characteristic, CQ_{iqt} is an interaction term between the coverage of the public system and the quintile q, $Year_t$ is the same variable like as before to capture year specific effects and u_{it} are the errors. As previously, the marginal incidence is the result between the coefficient for coverage, β, and the transformation for the lineal index.

In both specifications, equations (1) or (3) [12], it is possible to compute, through the $g()$ function a different value for each size program or individual characteristic [13]. It is this property of the non lineal probability model which allows us to approximate the marginal changes sequence in the program participation followed by a program size change.

3 Empirical estimates

3.1 Recent changes in the secondary school in the Argentina

At the beginning of decade of the 90's the Argentinean education system is modified in two fundamental dimensions. In the year 1992, the national government ends the transfer process to the 24 sub national governments (*provinces*) [14]. Also, for the Education Federal Law (Ley Federal de Educación) (LFE hereafter) Nº 24.195, in 1993 the levels of the education system were changed to include more years in the levels of basic education[15].

As a result of this reform, the attendance rate increases in the secondary level. Only recently it has broken the threshold of 90%, reducing the gap with the primary level coverage from 19.6% in 1992 to 7.1% in 2003. At 2001 this difference was of 7.6%. This improvements are based on an increase of 22.6%, between 1992

[12] In the full version of the paper I also estimate these models for each year
[13] Wooldrige (2002, pp 458)
[14] For details of this process see Carciofi et al.,1996
[15] A detailed analysis of this law and its effects on attendance and its quality can be founded in Crosta (2007).

and 2001, in the attendance for the people of lower incomes CEDLAS (2005)[16].

An explication to this evolution can be found in the increase in the enrollment to the public sector, which represents the 77% of the total expansion of the education system between 1997 and 2001. The increase in the public matriculation between those years is of 13.9%, with an absolute increase of 245 thousand enrolled. In the same period the public expenditure in the basic education[17] has grow from 7516 million of Argentinean pesos to 9003.4 million, with an increase in its participation in the Consolidate Social Public Expenditure (GPSC) [18] of nearly 1 point (See Table I). However, the enrollment increase and the intra province expenditure have heterogeneities in their intensity (See Table II). For example, at least 4 provinces do not increase the enrollment, in other 9 their increases are within standards and in the remaining 10 provinces the increase is greater than a 20%.

An analysis of the evolution of the public expenditure shows a similar image: only 2 provinces decrease their expenditure, 16 increase it but least than the average and the remaining provinces increase the public resources more than the average. A preliminary view does not show common elements, but in 18 provinces the increase in the public enrollment is related to some public expenditure increase. These cases represent the 79.4% of the total public enrollment, 73.6% of the public expenditure in secondary education. Also, in 62.5% of all provinces the public expenditure increases more than the enrollment. In short, in the last years we can see a strong increase in the enrollment at the secondary level which is accompanied with increases in the public expenditure, although in an unequal way.

3.2 The data

To implement the methodology proposed I use two household surveys which are conducted in similar ways and under the same sample framework. At the year 1997 I use the survey known as " Encuesta de Desarrollo Social (EDS)" and for 2001 that known as "Encuesta de Condiciones de Vida (ECV)" [19]. With 73,410 observations, each survey covers towns with more than 5000 inhabitants, repre-

[16]This statistics, usual in the Argentina, must be carefully used. They refer to urban agglomerates form a sample that until 1998 consider only 14 of them and then increase to 29.

[17]Since the LFE implementation we can not identify the resources assigned to secondary schools of the others expenditures on basic education

[18]It is the expenditure of the all government levels from the perspective of executor level. See (DAGPyPS, 2005) for details

[19]See SIEMPRO (1997, 2003) for details.

senting 96% of the whole urban population and 84% of the total population.

As welfare measure, following the common strategy in Argentina, I use the current household income adjusted by demography [20] net of monetary transfers by the government as those for the Social Security System [21]. Also, in both surveys are questions about assistance, level of assistance and institution type to which they go. So we can identify those people who do not go to school, those who assist to private institutions and those who assist to public facilities. Because the LandR methodology is based on coverage rate, this paper is focus on that people with ages between 13 and 17 years old. In Table III we can see basic results about absolute population and total and public coverage rates in the secondary school.

The use of information from public budgets is a standard choice to assign the benefit value (van de Valle, 1998 and Demery, 2003) but this implies that the benefit does not vary for each people. In this situation, as in our case, the benefit incidence exercise changes to participation one (Younger, 2002, 2003). Also, remember that in Section 3.1 we can see that there is a positive correlation between enrollment and expenditure in the public sector.

3.3 Econometric results

To estimate the marginal incidence, the equation (1) and (3) were estimated using multinomial logistic models with non assistant individuals as base category [22]. From these estimates, the marginal changes of total coverage rate were computed [23]. Table IV shows the results from equation (1). From these two issues emerge: first, the coefficients are consistent in the sense that their addition(weighted) is near to 1; that is, all the change is distributed. Second, the marginal effect increases with the level of income. This result suggests that, probably, the public education system in secondary level is at the point from which benefits (additional) would be appropriate for high income quintiles. Or, in LandR terminology, the pro-

[20] Although the consensus in the literature is to use permanent consumption (Deaton, 1997), for the Argentinean case this is not feasible (Gasparini, 2005).

[21] Various chapters of Bourguignon and da Silva (2003) evaluate the issue of contra factual income and social program evaluation.

[22] All models of this section also were estimated with provinces fix effects, which show multicollinearity with province coverage rate. This result suggests that the assumption about a similar political process across provinces is plausible.

[23] I use the command *mfx* from STATA, and a sequence for coverage rate which began in 0, increase by 0.05 and finish at 0.99

gram has *later capture*[24]. This result is very intuitive if you consider that the past enrollment increase has been biased to low income quintiles.

This effect would be clear if we computed the marginal effects for each quintile to each *possible* coverage rate. Figure 1 shows that exercise. We can see that when the coverage rate is low the greater effect is for low income quintiles (1 and 2); then, when coverage rounds 40% all effects are similar and near to 1 (proportionality case). Since this point a third stage emerges where the marginal effect relevant are for high income quintiles (4 and 5).

As you can see, the methodology proposed here allows us to solve some problems of dynamic evaluation of incidence consider by LandR. In this sense, *for this program*, the capture from high income quintiles tend to be later but this not imply that poor people appropriate earlier of it: quintile 2 is that which has a greater increase in participation when coverage rate is low, when the later increases people at quintile 3 are most beneficiaries and when the coverage rate is near universality people at quintile 5 are most beneficiaries. For poor people, quintile 1, like people at quintile 4, the marginal effects tend to be less intensive but whit greater (relatively) stability.

In these cases we compute 1 equation for each quintile. This strategy, although consistency, is inefficient because in each case we use only 20% of all information available. To improve the estimation in this sense I also compute equation (3), which includes an interaction term between coverage rate and quintiles. So when we estimate marginal effects for each quintile, the specification is like that of equation (1) but including data for all population.

The marginal effects were computed for all people and for different categories as: year, age or sex. See Table V.a to V.c. As previously, the property of full distribution of change is carried out. Also, general dynamics are very similar to those previously mentioned: a greater effect for quintile 2 and, in general, the system is at that point where the coverage increases are pro poor and slightly less for men than women.

If we evaluate these effects with references to age, we can see a qualitative change as income increase. While for low income quintiles the effects increase with age, the difference between a man of 13 and another of 17 is of 0.361, this difference reduces from 0.151 to quintile 2 up to - 0.021 for quintile 5.

[24] See Crosta (2006) for a comparison of the results for this case of the various methods showed in Section 2.

In this way, the relevance of the methodology proposed in this paper is exposed if we consider that between 1997 and 2001, in average, the system tends to be less pro poor in its increases. However, when we include individual and regional heterogeneities it emerges clearly that increases in total coverage rate, specially in certain points, will be in favor of groups, especially, vulnerable ones.

The results from a non lineal probability model expose the difficulties to use a unique average value as a proxy for the marginal incidence. The differences in the coverage rate between provinces or observable individual characteristics, which are potential sources to focus on potential increases in the resource programs, are relevant for the evaluation of marginal effects.

4 Final remarks

In this paper I consider a methodology to estimate the capture sequence for public expenditure program, i.e., its marginal incidence. The Argentinean education reform of 1997, which affected education participation choices, is the empirical case on which it is implemented. Although the literature has focused on this problem, until now we do not have a methodology to measure the capture sequence of a public program. For this I propose to use probability (non lineal) models to make analysis which includes proportionality in some changes or not.

I show that the group which is the main beneficiary of the program size change varies with it. Also, because the responses differ in sex and age, I suggest that in the same way as we not expect that benefit (mean) incidence be constant for all people, nor we must expect that marginal incidence be homogeneous between groups or individuals.

5 Tables and Figures

Table I. Enrollment and Public Expenditure
Argentina, 1997 and 2001

	1997	2001
Public expenditure in secondary education		
i. Million of current pesos	7516.0	9003.4
ii. Of Consolidated Social Public Expenditure	5.0	5.8
Total Enrollment		
i. Students	2463608	2782020
ii. Of total population	7.1	7.7
Public Enrollment		
i. Students	1765038	2010286
ii. Of total population	71.6	72.3

Source: Author elaboration based on Economy Ministry and Education, Science and Technology Ministry

Table II. Enrollment and public expenditure by province
Argentina, 1997 and 2001

Provinces	1997		2001		Var	
	Students	Pub. Exp.	Students	Pub. Exp.	Students	Pub. Exp.
Bs Aires	672968	2460.70	785514	2931.96	16.7	19.2
Catamarca	19609	124.33	24048	116.91	22.6	-6.0
Chaco	51439	213.29	67977	233.35	32.2	9.4
Chubut	27311	120.60	30720	138.11	12.5	14.5
C. Bs Aires	110553	635.30	104040	764.82	-5.9	20.4
Córdoba	123305	597.31	120868	853.42	-2.0	42.9
Corrientes	51462	195.27	58738	219.45	14.1	12.4
Entre Rios	59525	270.68	67721	315.58	13.8	16.6
Formosa	29465	118.38	37662	133.73	27.8	13.0
Jujuy	45713	155.87	56495	190.29	23.6	22.1
La Pampa	14672	107.00	18656	121.62	27.2	13.7
La Rioja	16608	108.33	20150	138.90	21.3	28.2
Mendoza	80721	294.11	97388	403.42	20.6	37.2
Misiones	39880	156.78	50386	165.97	26.3	5.9
Neuquén	31343	182.09	36108	210.92	15.2	15.8
Río Negro	31975	142.72	36522	174.39	14.2	22.2
Salta	71658	192.55	85574	182.48	19.4	-5.2
San Juan	31936	143.89	34185	184.19	7.0	28.0
San Luis	19312	71.15	22626	124.77	17.2	75.4
Santa Cruz	13043	116.86	13304	132.20	2.0	13.1
Santa Fe	136429	636.96	155959	742.25	14.3	16.5
Sgo del Estero	32893	154.44	32662	176.46	-0.7	14.3
T del Fuego	5843	61.84	7035	68.00	20.4	10.0
Tucumán	47375	255.60	45948	280.22	-3.0	9.6
Total	1765038	7516.0	2010286	9003.4	13.9	19.8

Source: Author elaboration based on "Relevamientos Anuales" Education Ministry and Bureau of Public Expenditure Analysis and Social Programs- Economy Ministry.

Table III. Objective population and assistant to secondary level

Argentina, 1997 and 2001

	1997	2001
Objective population	2375136	2362969
... total population	9.9	9.2
Assistant at secondary level		
i. 13 to 17 years	1618444	1796914
... Objective population	68.1	76.0
ii. All	2119936	2334622
Assistant at public secondary level		
i. 13 to 17 years	1183610	1322949
... Objective population	49.8	56.0
ii. All	1599140	1803521

Notes

(a)-Coverage rate refer to the relevant objective population.

(b)-Enrollment data is from administrative data and objective population and assistance data is from surveys.

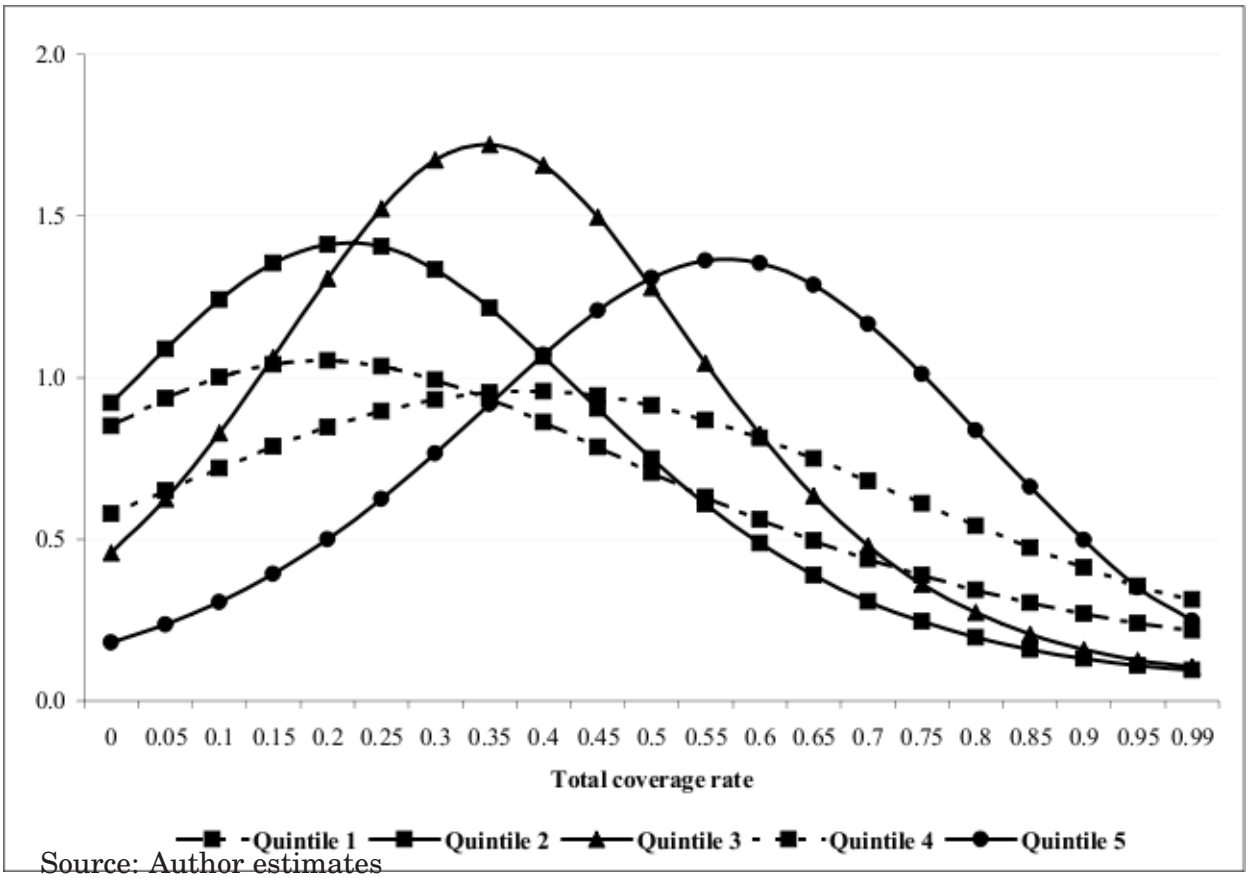
Source: Author elaboration based on EDS 1997 and ECV 2001-SIEMPRO

Table IV. Multinomial models by quintile: Marginal effects for coverage rate changes
Argentina, 1997 and 2001

Income Quintile	Panel	
	Marginal Effect	Mean Coverage
1	0.644	0.541
2	0.645	0.536
3	1.132	0.531
4	0.887	0.531
5	1.339	0.522
Mean marginal effect	0.930	

Source: Author estimates

Figure 1. Multinomial models by quintile: Marginal effects for coverage rate changes
Argentina, Panel for 1997 and 2001



Source: Author estimates

Table V.a. Multinomial models with interaction term: Marginal effects by individual characteristics
Argentina, Panel for 1997 and 2001

	Quintile					Mean
	1	2	3	4	5	Effect
	Panel					
All	1.093	1.141	1.020	0.889	0.686	0.966
Woman	1.213	1.243	1.111	0.959	0.736	1.053
13 year	0.936	1.080	0.969	0.882	0.701	0.914
14 year	1.132	1.204	1.078	0.947	0.735	1.019
15 year	1.223	1.246	1.114	0.959	0.735	1.055
16 year	1.248	1.247	1.114	0.950	0.723	1.056
17 year	1.241	1.230	1.098	0.932	0.707	1.042
Men	0.957	1.030	0.922	0.815	0.635	0.872
13 year	0.650	0.860	0.774	0.742	0.607	0.727
14 year	0.857	0.992	0.890	0.811	0.645	0.839
15 year	0.970	1.033	0.925	0.813	0.631	0.874
16 year	1.010	1.030	0.921	0.793	0.608	0.872
17 year	1.011	1.011	0.903	0.770	0.586	0.856

Source: Author estimates

Table V.b. Multinomial models with interaction term: Marginal effects by individual characteristics
Argentina, Panel for 1997 and 2001

	Quintile					Mean
	1	2	3	4	5	Effect
			2001			
All	0.919	0.951	0.840	0.743	0.488	0.788
Woman	0.987	1.001	0.889	0.764	0.504	0.829
13 year	0.897	1.025	0.885	0.893	0.575	0.855
14 year	0.977	1.031	0.907	0.826	0.540	0.856
15 year	0.985	0.993	0.883	0.752	0.497	0.822
16 year	0.961	0.948	0.848	0.697	0.464	0.784
17 year	0.926	0.904	0.810	0.656	0.437	0.747
Men	0.857	0.909	0.799	0.732	0.478	0.755
13 year	0.741	0.930	0.787	0.883	0.559	0.780
14 year	0.842	0.953	0.824	0.823	0.530	0.794
15 year	0.856	0.898	0.791	0.714	0.467	0.745
16 year	0.832	0.837	0.745	0.631	0.417	0.692
17 year	0.797	0.784	0.702	0.576	0.383	0.648

Source: Author estimates

Table V.c. Multinomial models with interaction term: Marginal effects by individual characteristics
Argentina, Panel for 1997 and 2001

	Quintile					Mean
	1	2	3	4	5	Effect
			1997			
All	1.260	1.336	1.235	1.072	0.975	1.176
Woman	1.426	1.485	1.363	1.194	1.058	1.305
13 year	0.996	1.179	1.130	0.934	0.969	1.041
14 year	1.280	1.386	1.290	1.109	1.036	1.220
15 year	1.443	1.496	1.371	1.204	1.060	1.315
16 year	1.522	1.546	1.406	1.248	1.067	1.358
17 year	1.555	1.566	1.419	1.265	1.068	1.374
Men	1.028	1.135	1.064	0.907	0.869	1.001
13 year	0.603	0.857	0.864	0.666	0.820	0.762
14 year	0.867	1.044	1.006	0.825	0.872	0.923
15 year	1.049	1.146	1.070	0.917	0.866	1.010
16 year	1.146	1.193	1.095	0.960	0.850	1.049
17 year	1.190	1.211	1.102	0.977	0.838	1.064

Source: Author estimates

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