Annex 1 – Estimation of consumption of exempted insurance (Chapter 3)

Consumption of exempt insurance services

Currently exempted insurance services only include life insurance and earthquake insurance. However, there is no disaggregated information indicating the consumption of these particular insurances between the different income levels, so this has been calculated based on the following:

- The Family Budget Survey (INE, 2018) provides data on consumption of insurance on houses but does not specify which type of insurance (theft, fire, earthquake, etc.). In addition, the survey does not contain data on expenditures on life insurance since they are deemed to have an important component of saving (and the survey only focuses on consumption).
- Expenditures on earthquake insurance: this has been calculated using the proportion of earthquake premiums in total general insurance premiums from national statistics (CMF, 2021) and applying it to expenditures on house insurances (maintaining its distribution by quintiles).
- Expenditure on life insurance: national statistics show that amounts paid on life insurance premiums are on average (last 10 years) twice the amount paid on other premiums (CMF, 2021). Assuming a 50% split between insurance and saving component on life insurance premiums, I have used the same amount (2*50%=1) that the survey showed as paid on other insurance premiums (maintaining their distribution by quintiles).

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Annex 2: Analysis of UK VAT litigation (Chapter 3)

The analysis includes all VAT litigation heard by the Court of Appeal or Supreme Court from 2006 until 2022. This led to 100 cases being analysed and categorised in 11 disputed matters. Litigation around definitional issues is shown in **bold** text in the table below.

The 11 disputed matters are the following:

- Definitional Issues (concerning preferentially taxed items): 6 cases;
- Procedural issues: 14 cases;
- Missing Trader fraud: 12 cases;
- Personal Exemption disputes (exemptions related to the type of entity providing the goods and services): 12 cases;
- Financial Services Disputes (both financial services and insurance exemptions): 11 cases;
- Composite supplies issues: 5 cases;
- Place of Supply disputes: 5 cases;
- Input VAT claims by exempt supplier (either total or partially exempt suppliers): 4 cases;
- Voucher Disputes: 3 cases;
- Interests applicable to refunded amounts: 3 cases; and
- Other issues: 25 cases.

	Case	**Disputed matter category**
1	Regency Factors Plc v HM Revenue & Customs [2022] EWCA Civ 103	Other
2	Revenue and Customs Commissioners v Kishore [2021] EWCA Civ 1565	Missing trader fraud
3	Revenue and Customs Commissioners v Ampleaward Ltd [2021] EWCA Civ 1459	Place of supply dispute
4	Awards Drinks Ltd (in liquidation) v Revenue and Customs Commissioners [2021] EWCA Civ 1235	Other
5	Target Group Ltd v Revenue and Customs Commissioners [2021] EWCA Civ 1043	Financial Services Dispute
6	Milton Keynes Hospitals NHS Foundation Trust v Revenue and Customs Commissioners [2021] EWCA Civ 942	Procedural issues
7	Royal Opera House Covent Garden Foundation v Revenue and Customs Commissioners [2021] EWCA Civ 910	Input VAT claims by exempt supplier
8	Heathrow Airport Ltd and others v Her Majesty's Treasury and another [2021] EWCA Civ 783	Other
9	British Telecommunications plc v Revenue and Customs Commissioners [2021] EWHC 1095 (Ch)	Other
10	Balhousie Holdings Ltd v Revenue and Customs Commissioners [2021] 3 All ER 599	Other

11	Eynsham Cricket Club v Revenue and Customs Commissioners [2021] EWCA Civ 225	Personal exemption dispute
12	**Revenue and Customs Commissioners v News Corp UK & Ireland Ltd [2021] EWCA Civ 91**	**Definitional issues**
13	DCM (Optical Holdings) Ltd v Commissioners for HM Revenue and Customs [2021] SC 123	Other
14	Revenue and Customs Commissioners v Northumbria Healthcare NHS Foundation Trust [2020] EWCA Civ 874	Other
15	Revenue and Customs Commissioners v KE Entertainments Ltd [2020] 4 All ER 441	Procedural issues
16	Rank Group plc v Revenue and Customs Commissioners [2020] EWCA Civ 550	Procedural issues
17	NHS Lothian Health Board v Revenue and Customs Commissioners [2020] CSIH 14	Procedural issues
18	Zipvit Ltd v Revenue and Customs Commissioners [2020] 3 All ER 1017	Other
19	Leisure, Independence, Friendship and Enablement Services Ltd v Revenue and Customs Commissioners; The Learning Centre (Romford) Ltd v Revenue and Customs Commissioners [2020] EWCA Civ 452	Personal exemption dispute
20	Revenue and Customs Commissioners v Frank A Smart & Son Ltd [2020] 1 All ER 97	Other
21	National Car Parks Ltd v Revenue and Customs Commissioners [2019] EWCA Civ 854	Other
22	**Fortyseven Park Street Ltd v Revenue and Customs Commissioners [2019] EWCA Civ 849**	**Definitional issues**
23	Butt v Revenue and Customs Commissioners [2019] EWCA Civ 554	Missing trader fraud
24	Lloyds Banking Group plc and others v Revenue and Customs Commissioners and another [2019] EWCA Civ 485	Procedural issues
25	SAE Education Ltd v Commissioners for Her Majesty's Revenue and Customs [2019] 3 All ER 934	Personal exemption dispute
26	Praesto Consulting UK Ltd v Revenue and Customs Commissioners [2019] EWCA Civ 353	Other
27	Metropolitan International Schools Ltd v Revenue and Customs Commissioners [2019] EWCA Civ 156	Composite supplies issues
28	Adecco UK Ltd and others v Revenue and Customs Commissioners [2018] EWCA Civ 1794	Other
29	Totel v Revenue and Customs Commissioners [2018] UKSC 44	Procedural issues
30	**SiBCAS Ltd v Revenue and Customs Commissioners [2018] CSIH 49**	**Definitional issues**
31	Taylor Clark Leisure plc v Revenue and Customs Commissioners [2018] 4 All ER 817	Procedural issues
32	Bratt Autoservices Company Ltd v Revenue and Customs Commissioners [2018] EWCA Civ 1106	Procedural issues

33	Wakefield College v Revenue and Customs Commissioners [2018] EWCA Civ 952	Personal exemption dispute
34	Revenue and Customs Commissioners v Newey trading as Ocean Finance [2018] EWCA Civ 791	Financial Services Dispute
35	Revenue and Customs Commissioners v Chancellor, Master and Scholars of the University of Cambridge [2018] EWCA Civ 568	Input VAT claims by exempt supplier
36	ING Intermediate Holdings Ltd v Revenue and Customs Commissioners [2017] EWCA Civ 2111	Financial Services Dispute
37	Iveco Ltd v Revenue and Customs Commissioners [2017] EWCA Civ 1982	Procedural issues
38	United Biscuits (Pension Trustees) Ltd and another v Revenue and Customs Commissioners [2017] EWHC 2895 (Ch)	Financial Services Dispute
39	CCA Distribution Ltd (in administration) v Revenue and Customs Commissioners [2017] EWCA Civ 1899	Missing trader fraud
40	Littlewoods Retail Ltd and others v Revenue and Customs Commissioners [2018] AC 869	Interests applicable to refund
41	Revenue and Customs Commissioners v Citybank NA and another [2017] EWCA Civ 1416	Missing trader fraud
42	Revenue and Customs Commissioners v Findmypast Ltd [2017] CSIH 59	Other
43	BPP Holdings Ltd v Revenue and Customs Commissioners [2017] 4 All ER 756	Composite supplies issues
44	Colaingrove Ltd v Commissioners for Her Majesty's Revenue and Customs [2017] EWCA Civ 332	Composite supplies issues
45	Investment Trust Companies (in liquidation) v Revenue and Customs Commissioners [2017] UKSC 29	Other
46	Associated Newspapers Ltd v Revenue and Customs Commissioners [2017] EWCA Civ 54	Voucher Disputes
47	G B Housley Ltd v Revenue and Customs Commissioners [2016] EWCA Civ 1299	Procedural issues
48	Wiltonpark Ltd v Revenue and Customs Commissioners [2016] EWCA Civ 1294	Voucher Disputes
49	Finmeccanica Global Services SpA v Revenue and Customs Commissioners [2016] EWCA Civ 1105	Place of Supply disputes
50	Revenue and Customs Commissioners v Infinity Distribution Ltd (In Administration) [2016] EWCA Civ 1014	Missing trader fraud
51	Revenue and Customs Commissioners v GMAC (UK) plc [2016] EWCA Civ 1015	Other
52	Longridge on the Thames v Revenue and Customs Commissioners [2016] EWCA Civ 930	Personal exemption dispute
53	ELS Group Ltd v The Commissioners for Her Majesty's Revenue and Customs [2016] EWCA Civ 663	Other
54	University of Huddersfield Higher Education Corporation v Revenue and Customs Commissioners [2016] EWCA Civ 440	Input VAT claims by exempt supplier

55	Airtours Holidays Transport Ltd v Revenue and Customs Commissioners [2016] 4 All ER 1	Financial Services Dispute
56	**IFX Investment Company Ltd and others v Revenue and Customs Commissioners [2016] EWCA Civ 436**	**Definitional issues**
57	Davis & Dann Ltd v Revenue and Customs Commissioners [2016] EWCA Civ 142	Missing trader fraud
58	Revenue and Customs Commissioners v Open University [2016] EWCA Civ 114	Personal exemption dispute
59	Finance and Business Training Ltd v Revenue and Customs Commissioners [2016] EWCA Civ 7	Personal exemption dispute
60	R v Harvey [2016] 4 All ER 521	Other
61	Leeds City Council v Revenue and Customs Commissioners [2015] EWCA Civ 1293	Procedural issues
62	Isle of Wight Council and others v Revenue and Customs Commissioners [2015] EWCA Civ 1303	Personal exemption dispute
63	Revenue and Customs Commissioners v Brockenhurst College [2015] EWCA Civ 1196	Composite supplies issues
64	Revenue and Customs Commissioners v Mercedes-Benz Financial Services UK Ltd [2015] EWCA Civ 1211	Composite supplies issues
65	Volkswagen Financial Services (UK) Ltd v Revenue and Customs Commissioners [2015] EWCA Civ 832	Financial Services Dispute
66	**Revenue and Customs Commissioners v Rank Group plc [2015] 4 All ER 77**	**Definitional issues**
67	Pendragon plc v Revenue and Customs Commissioners [2015] UKSC 37	Other
68	Fonecomp Ltd v Revenue and Customs Commissioners [2015] EWCA Civ 39	Missing trader fraud
69	**Sub One Ltd (t/a Subway) (in Liq) v Revenue and Customs Commissioners [2014] EWCA Civ 773**	**Definitional issues**
70	Birmingham Hippodrome Theatre Trust Ltd v Revenue and Customs Commissioners [2014] EWCA Civ 684	Procedural issues
71	Secret Hotels2 Ltd v Revenue and Customs Commissioners [2014] All ER 685	Other
72	Esporta Ltd v Revenue and Customs Commissioners [2014] EWCA Civ 155	Other
73	Reed Employment Ltd v Revenue and Customs Commissioners [2014] EWCA Civ 32	Procedural issues
74	Revenue and Customs Commissioners v Aimia Coalition Loyalty UK Ltd [2013] 4 All ER 94	Voucher Disputes
75	WHA Ltd v Revenue and Customs [2013] 2 All ER 907	Financial Services Dispute
76	Revenue and Customs Commissioners v Sunico A/S [2013] EWHC 941 (Ch)	Missing trader fraud
77	Vehicle Control Services Ltd v Revenue and Customs Commissioners [2013] EWCA Civ 186	Other

78	BAA Ltd v Revenue and Customs Commissioners [2013] EWCA Civ 112	Other
79	Royal Bank of Scotland v Revenue and Customs Commissioners [2012] EWHC 9 (Ch)	Other
80	Revenue and Customs Commissioners v AXA UK plc [2011] EWCA Civ 1607	Financial Services Dispute
81	London Clubs Management Ltd v Revenue and Customs Commissioners [2011] EWCA Civ 1323	Input VAT claims by exempt supplier
82	John Wilkins (Motor Engineers) Ltd v Revenue and Customs Commissioners [2011] EWCA Civ 429	Interests applicable to refund
83	Revenue and Customs Commissioners v Arachchige [2010] EWCA Civ 1255	Place of Supply disputes
84	Revenue and Customs Commissioners v Millichap (Liquidator of Gloucester Foods Ltd) [2011] BPIR 145	Procedural issues
85	Chamberlin v Revenue and Customs Commissioners [2010] EWHC 2589 (Ch)	Place of Supply disputes
86	Infinity Distribution Ltd (in administration) v Revenue and Customs Commissioners [2010] EWHC 1393 (Ch)	Missing trader fraud
87	Mobilx Ltd (in Administration) and others v Revenue and Customs Commissioners and others [2010] EWCA Civ 517	Missing trader fraud
88	Larkfield Ltd v Revenue and Customs Prosecution Office and others [2010] EWCA Civ 521	Missing trader fraud
89	Commissioners for Her Majesty's Revenue and Customs v Atrium Club Ltd [2010] EWHC 970 (Ch)	Personal exemption dispute
90	InsuranceWide.com Services Ltd v Revenue and Customs Commissioners [2010] EWCA Civ 422	Financial Services Dispute
91	F J Chalke Ltd v Revenue and Customs Commissioners [2010] EWCA Civ 313	Interests applicable to refund
92	American Express Services Europe Ltd v Revenue and Customs Commissioners [2010] EWHC 120 (Ch)	Place of Supply disputes
93	Portsmouth City Football Club Ltd v Revenue and Customs Commissioners [2010] EWHC 75 (Ch)	Other
94	Megtian Ltd (in administration) v Revenue and Customs Commissioners [2010] EWHC 18 (Ch)	Missing trader fraud
95	Joppa Enterprises Ltd v Commissioners for HM Revenue and Customs [2009] CSIH 17	Other
96	Revenue and Customs Commissioners v The Royal Bank of Scotland plc [2008] CSIH 49	Financial Services Dispute
97	Revenue and Customs Commissioners v Board of Governors of Robert Gordon University [2008] CSIH 22	Personal exemption dispute
98	Revenue and Customs Commissioners v Empowerment Enterprises Ltd [2007] SC 123	Personal exemption dispute
99	Scottish Exhibition Centre Ltd v Revenue and Customs Commissioners [2006] SC 702	Financial Services Dispute

100	Edinburgh's Telford College v Customs and Excise Commissioners [2006] CSIH 13	Personal exemption dispute

Annex 3 – Measuring the Distributional Impact of the VAT reform (Chapter 3)

The distributional impact of the proposed reforms has been assessed with the following methodology.

1. From mean quintiles income to mean deciles income:

First, the information on income by quintiles income was transformed into income by deciles, to make the distributional assessment more meaningful. For that purpose, the mean income by quintile from the family budget survey (*Encuesta de Presupuestos Familiares*) was allocated to the deciles contained in the quintile using statistical information about the income distribution from the income survey prepared by the national statistics office (*Encuesta Suplementaria de Ingresos*).

For example: the family budget survey estimates that the mean household income in the first quintile is of CLP358m, but it does not provide information disaggregated for each decile. The income survey, at the same time, estimates that the bottom decile receives 2.7% of national income, while the second decile receives 4.7%. Thus, the mean income of the bottom quintile was allocated to each decile in the same proportion: CLP261m to the bottom decile and CLP455m to the second decile. The same exercise was done with the rest of the deciles.

2. Allocation of new tax burdens:

The second step was to allocate the estimated new tax burdens and new tax breaks to each decile. The starting point is the information from the family budget survey showing us the incidence of the tax reforms between the different quintiles. With that, we allocate the new tax burdens (or tax breaks) in proportion to each decile's share in the mean income of the respective quintile.

For example: the family budget data allows to estimate that the second quintile, on average, will be burdened with CLP18.3m additional tax from the base broadening reform. This data also tells us that the additional tax burden is decreasing with income. The data from the income survey indicates that mean income of decile 3 is 91% of the mean income of the second quintile. The corresponding percentage of decile 4 is 109%. Thus, we allocate CLP16.6m additional tax burden to decile 3 (91% of CLP18.3m) and CLP19.9m to decile 4 (109% of CLPm18.3). The overall result of the allocation is the following:

New tax burden per Family Budget Survey	**Allocation to deciles in proportion to shares in quintile's income**
Quintile 1: CLP14,098	Decile 1: CLP13,221
	Decile 2: CLP14,974
Quintile 2: CLP18,278	Decile 3: CLP16,643
	Decile 4: CLP19,913
Quintile 3: CLP23,674	Decile 5: CLP22,281
	Decile 6: CLP25,067
Quintile 4: CLP42,408	Decile 7: CLP38,891
	Decile 8: CLP45,925
Quintile 5: CLP110,808	Decile 9: CLP74,204
	Decile 10: CLP147,412

3. Allocation of tax break from preferential regime:

The method described above was not suitable for allocating tax breaks to deciles within the quintiles, as the rate of reduction in the value of tax breaks with income was much lower that the rate of increase of new taxes with income (especially in the first 3 quintiles). Thus, using the same method would have led to non-monotonically decreases in the value of the tax breaks (e.g. the value of tax breaks would be decreasing overall, but it would increase from decile 2 to 3 and 4 to 5). For this reason, we followed a different approach: we allocated in proportion to the share of each decile's income in the quintile's income ***only*** the portion of the tax break that was being reduced from one quintile to the next.

For example: the tax break for the 2nd quintile was only 2% lower than the tax break for the 1st quintile, so we only allocated a 2% of the tax break for the 1st quintile in proportion to the income shares of deciles 1 and 2. For the last quintile, we assumed that the rate of decrease of the tax break would have been constant, and used that portion to allocate in proportion to the income shares of the 9th and 10th decile. The final result of the allocation of the tax break was the following:

Tax benefit from preferential regime per Family Budget Survey	**Allocation to deciles in *partial* proportion to shares in quintile's income**
Quintile 1: CLP11,020	Decile 1: CLP11,080
	Decile 2: CLP10,960
Quintile 2: CLP10,830	Decile 3: CLP10,878
	Decile 4: CLP10,782
Quintile 3: CLP10,260	Decile 5: CLP10,375
	Decile 6: CLP10,145
Quintile 4: CLP8,341	Decile 7: CLP8,535
	Decile 8: CLP8,147
Quintile 5: CLP5,985	Decile 9: CLP6,815
	Decile 10: CLP5,155

4. Allocation of tax break from threshold introduction:

The data on places on consumption by income levels was the most incomplete in the analysis. Thus, we have only used data that gave some indication of part of the effect that the introduction of the threshold could have. The data used is that provided in Anigstein (2019) in relation to the lowest decile acquiring more than 12% of their food consumption from farmers' markets and neighbourhood corner stores, while the richest decile acquires less than 1% of their total food from those retailers. The allocation was done on the assumption that these would be the only retailers benefitting from the threshold, and that the consumption on those places decreases in inverse proportion with income. Thus, the increase of consumption from small firms is higher on those deciles were income decreases more steeply from the decile above, as it is the case with the 9th decile (where expenditure is only 50% of decile's 10th expenditure).

From these percentages of expenditure in small traders, we have estimated the value of tax break by using an assumption of 40% of value added to sales (as used in Ebrill et al., 2001).

The allocation percentage of consumption on those retailers and the resulting tax break is the following:

Decile	Expenditure % in small retailers	Value of tax break
Decile 1	12.4%	CLP 5,298
Decile 2	11.2%	CLP 5,355
Decile 3	10.1%	CLP 5,204
Decile 4	8.9%	CLP 5,466
Decile 5	7.8%	CLP 4,908
Decile 6	6.7%	CLP 4,702
Decile 7	5.4%	CLP 4,553
Decile 8	4.2%	CLP 4,170
Decile 9	3.1%	CLP 3,409
Decile 10	1.0%	CLP 2,218

5. Calculation of Kakwani index:

To calculate the Kakwani index we used the R statistical software to calculate the Gini coefficient of net economic impact of the reforms proposed and of the initial income distribution that was used as a starting point for the distributional analysis.
We started by applying the gini.wtd function to the information on mean incomes by deciles, which resulted in a Gini coefficient of 40.6%.[1]
We then calculated the Gini concentration of the net new tax burdens by decile (the aggregate value of the new tax burden from base broadening reforms and the tax breaks from the preferential regime and the introduction of a threshold). This resulted in a Gini coefficient for the new net tax burden of 70.6%.
The resulting Kakwani index was very positive at 30% (70.6% minus 40.6%), suggesting a very progressive reform.

6. Calculation of Reynolds-Smolensky index:

The starting point is the same Gini coefficient for the initial information on mean incomes by deciles. We then allocated the effects of the reforms in four stages to the mean incomes by deciles, and calculated the Gini coefficient at each stage with the same gini.wtd function in R used for the Kakwani index calculation.

First, we allocated the new tax burden from the base-broadening reform to the mean income information. The resulting Gini coefficient was 40.5% (i.e. a reduction of 0.1%). Secondly, the value of the tax break from the preferential regime was allocated to the mean income information (which already included the new tax burden from the base-broadening reform). The resulting Gini coefficient was 40.1% (i.e. an additional 0.4% reduction in the Gini index). We then allocated the value of the tax break from the introduction of the threshold, and this led to a Gini coefficient of 39.9% (i.e. an additional 0.2% reduction in the Gini coefficient).

Lastly, we allocated the net additional tax revenues from the proposed reforms to each mean income by deciles, as an equal lump sum transfer. The net effect of the base-broadening reform and the preferential regime was an additional tax burden of CLP326m from the 10 representatives

[1] Note that this is not a reliable measure of the overall inequality in Chile, as it is only based on the information on income by deciles from the family budget survey, which is not intended to measure inequality. But it is appropriate to measure the Kakwani index, as it is on this income distribution baseline that the distributional effect of the policy is estimated.

households of each decile.[2] We allocated CLP32.6m (a 10% of the additional revenues) to each decile's mean income, and we calculated the Gini coefficient of the resulting income distribution. This resulted in a Gini coefficient of 38.8% (a 1.1% reduction in the Gini coefficient).

The overall Reynolds-Smolensky index was of 1.8%. The tax reforms themselves accounted for 0.7% reduction, and the lump-sum transfer of the additional revenues for 1.1%.

7. Testing alternative reform:

The substantive effect of the lump-sum transfer led to the question of whether it would not be more progressive a reform that only focused on raising new revenues and giving a larger lump-sum transfer to household. We tested this hypothesis by replicating the previous analysis but without the introduction of the preferential regime, which meant that the additional tax revenues from the reformed were larger (CLP419m compared with CLP326m). This produced two offsetting effects: (i) loss of the progressive effect of the preferential regime (i.e. a reduction of 0.4% of Gini, as mentioned above), and (ii) an increase in the progressive effect of the lump-sum transfer, as the additional revenues were larger. The net effect of these two changes, however, was a reduction in the progressivity of the reform: although the Reynolds-Smolensky index for the lump sum transfer increased to 1.4%, the increase was insufficient to offset the loss of the progressive effect of the preferential regime. The overall effect on the distribution of income in this case was of 1.7%, compared with 1.8% under the original proposal.

8. Note on Gini coefficient for underlying income:

The Gini coefficient for the underlying income distribution used for this analysis should not be taken as an accurate measure of the income inequality in Chile, as is based on the information from a survey on consumption which is not trying to measure inequality.

However, the use of this Gini index seems appropriate for the analysis done here as the tax incidence estimation is also based on information from the same survey. Using a different Gini index (likely higher if coming from a income inequality study) would require using that same income distribution to measure the tax incidence, which would not be possible as inequality studies do not (usually) provide information on the consumption patterns to assess the incidence of a consumption tax.

Notwithstanding the foregoing, the resulting Kakwani and R-S indexes (if we had consumption data from income inequality studies) are likely to be similar to those calculated here, as the increase in the income Gini index is likely to be offset by a similar increase in the new tax Gini index.

[2] No loss of revenue is considered in the introduction of the threshold. The idea behind the usual policy recommendation is that tax administration resources are inefficiently used when enforcing VAT on small businesses. Thus, the argument goes, the forgone tax revenue should be compensated with the savings in administrative resources and from additional VAT revenues from reassigning part of this tax administration resources to larger businesses.

Annex 4 – Details on tobacco taxation literature (Chapter 5)

Historically, tobacco taxation was justified as an easy source of revenues, and it continues to be so in many countries (Chaloupka, Yurekli and Fong, 2012). It was considered an efficient tax as it was claimed that tobacco's demand was relatively price inelastic, and it was administratively easy to enforce as there are usually few tobacco producers or importers in a country. Thus, tobacco taxation was considered as an efficient tax creating few distortions in consumption and little administrative costs. In addition, tobacco was not considered a "*necessity"* so it could be heavily taxed without raising strong ethical or equity considerations. This efficiency argument was later challenged both from the perspective of optimal commodity taxation and from the more modern optimal taxation literature, which pointed that the inverse-elasticity rule was, in fact, suboptimal.[1] However, the challenges to the inverse-elasticity rule did not lead to reduce on tobacco excises, as awareness of the negative effects of tobacco consumption offered different justification based on its externalities.

The study of tobacco uses also led to a better understanding of the evolution of the tobacco epidemic. Indeed, these studies showed that the tobacco epidemic usually goes through four stages, with the distribution of tobacco consumption changing (Hiscock *et al.*, 2012). Thus, in the first two stages of the epidemic, tobacco consumption was relatively uniform among the income distribution and was more prevalent among men, so equity concerns did not emerge. However, later stages bring a pattern consumption that becomes negatively correlated with income, producing the emergence of serious equity concerns. Indeed, on the third stage of the epidemic, tobacco consumption is widely spread in the population but starts to decline among men, which makes tobacco taxation a source of horizonal and gender inequality. In the fourth stage, tobacco use continues to decline but the decline is lower or inexistent among groups of low socioeconomic status (SES), which triggers vertical equity concerns regarding the burden of its taxation.

The understanding of the tobacco epidemic also contributed to the shift in the rationale behind its taxation (from the efficiency based on inverse-elasticity rule), increasingly justifying it as an effective mechanism to reflect the externalities of tobacco (i.e., increased public health costs, second-hand tobacco use imposed on other, higher life-insurance policies, etc.). This move towards Pigouvian justifications, made, in turn, equity considerations less powerful: if the excise is only bringing externalities into the consideration of the consumer, the tax is not only efficient (as it brings consumption closer to socially optimal levels) but it also seems fair (as it imposes the cost of externalities on those producing them) regardless of the patterns of consumption throughout the income distribution.

The move towards a Pigouvian justification soon led to an increased interest from economics on measuring the externalities of tobacco to assess what levels of taxation would be justified. Surprisingly, most of the economic studies came to conclude that *net* negative externalities were actually quite small (or even negative, according to some studies such as Pekurinen, 1991), and therefore the classic externalities argument was clearly insufficient to support high levels of tobacco taxation (Mannit et al and Viscusi). These results were partly explained as tobacco use, while imposes negative effects on the rest of society, also results in savings in the form of reduced pensions and age-related health costs due to premature deaths of tobacco users. These findings also resulted in vertical equity concerns regaining force, as the justification of high taxes from a Pigouvian perspective was weakened.

More recently, behavioural economics have added an additional layer of complexity by providing evidence that tobacco consumers are not entirely rational in their consumption decisions (Gruber and Köszegi, 2001; Gruber and Köszegi, 2008). This has led to an expansion of the concept of externalities of tobacco taxation to also include *internalities,* which reflects the harm that the behaviour entails for the consumers' future that is not properly included in the costs/benefit calculus (Gruber, 2001). This line of reasoning is consistent with several particularities of tobacco consumption that justify its (high) taxation beyond a paternalistic view of the state. Indeed, addictive properties of tobacco and time-inconsistencies in consumers' preferences[2] might reduce the rationality of their consumers, justifying treating at least part of the harmful effects on the consumer as externalities.

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[2] The term "time inconsistent preferences" is used to explain individual choices that would not have been made if it had been contemplated from a removed, dispassionate, long-term perspective (Hoch and Loewenstein, 1991). Tobacco consumers show a high degree of it. For instance, there is evidence showing that smokers predicting that they would quit in the future have *worst* quitting rates than respondents which predict they would continue to smoke (Cherukupalli, 2010).

Annex 5 – Estimating overall revenues and distribution of reform package (Conclusion section)

Starting point:

The revenue implication and distributional analysis started with the income information by quintiles from the Family Budget Survey (INE, 2018). This income distribution by quintiles was then transformed into a distribution by deciles as indicated in Annex 3 (point 1). Decile 10 was then split into 6 sub-groups (percentiles 91th-95th, 96th percentile, 97th percentile, 98th percentile, 99th percentile and 100th percentile), to improve the distributional allocation of new tax liabilities from direct taxes. This division of decile 10 was done based on the information on top incomes from the Supplemental Income Survey conducted by Chilean statistics office (INE, 2020) and from the tax authority (SII, 2022).

Allocation of tax burdens

The allocation of additional tax burdens was done sequentially in the order that the reforms were presented in the thesis.

I. **VAT:** Thus, the first taxes allocated were those arising from the VAT reform in Chapter 4, and this was done as indicated in Annex 3.

II. **Excises:** Then, new excise burdens from the reform proposed in chapter 5 were allocated based on the consumption data from INE (2018).

- **Alcohol:** The new tax liabilities were allocated according to the data on consumption of beer, alcohol and wine by each deciles. On the top decile's subgroup, the allocation was proportional to their total income (i.e. if we know that the top decile spends 1% of their income in beer, we apply that percentage to the income of each sub-group and allocate the additional tax based on that consumption. This assumes that consumption of alcohol is stable within the top decile -as a % of their income-).
- **Fuel:** The allocation of fuel revenues was done differently. The starting point was the revenues from fuel taxation reported by the tax authority SII (2022). It was assumed that half of the fuel revenues came from households,[1] and these were allocated to the different deciles based on consumption patterns of gasoline and diesel reported in the Family Budget Survey (INE, 2018).
- **Tobacco:** The additional tax on tobacco only arises on high-price cigarettes. Thus, we assumed that price of cigarettes consumed was proportional to income of each decile, which meant that the additional tax only arises to decile IX and X (i.e. we analysed the tobacco market and determined a price-range for cigarettes. We then assumed that each decile consumed cigarettes within such price-range based on how their income level). Based on the assumption of price

[1] This seems a reasonable (conservative) assumption as much of the fuel excise is credited to transport and carriage companies, so it is not reflected in fuel revenues.

of cigarettes consumed, we estimated the additional tax burden on each decile (2% additional tobacco excise for decile IX and 12% to decile X). The amounts were, in any case, low as the baseline excise on tobacco was limited.

III. **Personal Income tax reforms:** The additional revenues were allocated in two stages.

- **General PIT:** Additional tax liabilities were allocated in accordance to change in ATR at each income level as reported in Chapter 6 Figure 15. Allocation was done by applying pp increases in ATR to their level of income.[2]
- **Dual income tax:** The allocation of additional tax liabilities was done in 4 stages.
  (i) First, I allocated the loss of tax credits from repealing the corporate tax credit as a consequence of ending the integration of the CIT and PIT. The total value of the corporate tax credit was allocated to the different percentiles of the income distribution based on corporate wealth holdings by level of income reported in Ministerio de Hacienda (2022).
  (ii) A similar allocation was done of the current value of the mortgage interest deduction based on the allocation of real property holdings per percentile.
  (iii) The allocation of the revenues from the DIT on dividends was made starting on an aggregated basis. Based on the value of the current corporate tax credits, we estimated that additional revenues from DIT on dividends would by around 19.9% of current PIT revenues. This amount was then allocated by percentile in proportion to their holders of total corporate wealth.
  (iv) A similar exercise was done for allocating additional revenues from rental income, although the starting aggregate value in this case was the valuation of the current tax exemption of rental income from a tax expenditure report published by the tax authority (SII, 2021). This was then allocated based on the holding of real property within different percentiles.

An assumption made for the purposes of allocating the DIT liabilities was that there was perfect correlation between the wealth and the income distribution.

IV. **Taxes on wealth reforms**

- **Inheritance tax:** to allocate the additional revenues from the IHT reforms I started with the aggregate value estimated for the overall reform that was a 0.86% of total current revenues.[3] This was then allocated to the deciles IX and

[2] This is arguable the less conservative estimation as we assume that the increase in ATR applies to all the income in each group. However, the income of each group is based on statistics from surveys and from the income reported to the tax authority, so it should very closely match income from labour. Income from the informal economy should not be an important issue, as much of that arises to people outside the top quintile, and the new tax burden from direct taxes arises exclusively to people on the quintile.

[3] This estimation already incorporates the effects of tax planning/avoidance/evasion as the 0.86% extra revenues were estimated based on *current* inheritance tax revenues (on which tax avoidance is a factor). There could be additional tax

X (the only ones with any significant wealth). The allocation to decile IX was done in proportion to their share of national wealth (3% of total wealth). Within the top decile, the distribution was divided in the 6 groups mentioned above (91th-95th, 96th, 97th, 98th, 99th and 100th) based on their share of national wealth as reported in Ministerio de Hacienda (2022).

- **Property tax:** The allocation exercise was very similar to the above, except that the aggregate value was different (based on estimation of additional revenues from reform of property taxes, which resulted in around 4% additional revenues)[4] and the allocation to the different centiles (also only within the top 2 deciles) was done in proportion to their share of national real property (not overall wealth).

V. Kakwani index:

To calculate the Kakwani index we used the R statistical software to calculate the Gini coefficient of net economic impact of the reforms proposed (additional tax revenue) and of the initial income distribution that was used as a starting point for the distributional analysis.
We started by applying the gini.wtd function to the information on mean incomes by deciles (and percentiles at the top), which resulted in a Gini coefficient of 44.4%.[5]

We then calculated the Gini concentration of the net new tax burdens by deciles (and percentiles at the top). This resulted in a Gini coefficient for the new net tax burden of 76%.
The resulting Kakwani index was very positive at 32%.

VI. Calculation of Reynolds-Smolensky index:

The starting point is the same Gini coefficient for the initial information on mean incomes by deciles (and percentiles at the top), which is of 44.4. We then calculated the Gini coefficient for the income distribution after each reform with the same gini.wtd function in R used for the Kakwani index calculation. This lead to 43.7 Gini after the VAT reform, a 43.8 after the Excise reform, a 41.7 after the reforms to PIT and a 40.7 after the reform to taxes on wealth. The overall impact under the R-S index was then 3.7 (44.4 - 40.7).

Lastly, we allocated the net additional tax revenues from the proposed reforms to each mean income by deciles, as an equal lump sum transfer to each percentile in the income

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avoidance after the reform, and this is not accounted for. However, we did not estimate additional revenues from some of the less relevant proposals (i.e. phasing out of the exemption on life insurance proceeds, limiting the incentives for splitting inheritance by applying marginal tax rates to distant inheritors), so the overall estimation seems reasonable.

[4] Similar to IHT, these estimations also account for current tax planning/avoidance/evasion, but additional tax avoidance schemes could arise for the reform. Similarly to IHT, the estimations seem reasonable because there are also 'minor' reform proposals on property tax for which we do not attempt to estimate the additional revenue (i.e. moving to updating the exempt amount by the change in the Consumer Price Index, and I have not accounted that moving towards market valuation would increase the share of properties subject to the tax).

[5] Note that this Gini coefficient is higher than that calculated for the original income distribution in Annex 3. This is because for the purposes of allocating new tax burdens from direct taxes we split the top decile into the six sub-groups previously mentioned. As the groups at the top receive a large share of national income, this increased the starting Gini coefficient.

distribution. I then calculated the Gini coefficient of the resulting income distribution, which was 37.6% (an additional 3.1% reduction in the Gini coefficient).

The overall Reynolds-Smolensky index was of 6.8%. The tax reforms themselves accounted for 3.7% reduction, and the lump-sum transfer of the additional revenues for 3.1%.