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The Sraffian Multiplier for the Greek Economy: Evidence from the Supply and Use Table for the year 2010

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ΠΕΡΙΛΗΨΗ

Το παρόν άρθρο εκτιμά τον «στατικό Σραφφαϊανό πολλαπλασιαστή» για την ελληνική οικονομία, χρησιμοποιώντας δεδομένα από τον Πίνακα Προσφοράς-Χρήσεων του έτους 2010. Διαπιστώνεται ότι (i) μια αποτελεσματική πολιτική διαχείρισης της ζήτησης θα μπορούσε να βασιστεί – κυρίως – στον τομέα των υπηρεσιών, και (ii) το σύνολο οικονομικό σύστημα, και ιδιαιτέρως ο βιομηχανικός τομέας του, εξαρτάται σε μεγάλο βαθμό από εισαγόμενα εμπορεύματα. Τα αποτελέσματα φαίνεται να είναι σε συμφωνία με την παρατηρούμενη βαθιά ύφεση της ελληνικής οικονομίας και υποδεικνύουν, περαιτέρω, ότι μία μεταβολή στη διατομεακή δομή της είναι αναγκαία.

The Sraffian Multiplier for the Greek Economy: Evidence from the Supply and Use Table for the year 2010*

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ABSTRACT

This paper estimates the 'static Sraffian multiplier' for the Greek economy using data from the Supply and Use Table for the year 2010. It is found that (i) an effective demand management policy could be mainly based on the service sector; and (ii) the whole economic system, and especially its industry sector, is heavily dependent on imports. The results seem to be in accordance with the observed deep recession of the Greek economy and, furthermore, suggest that a change in its intersectoral structure is necessary.

Key words: Greek economy; Joint production; Management of effective demand; Sraffian multiplier; Supply and Use Tables

JEL classification: C67, D57, E11, E61

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1. Introduction

In October 2012, the International Monetary Fund (2012, pp. 41-43) stated that (i) the projections for the measures applied and/or proposed (from 2010 onwards) to the Greek economy were based on the false premise that the fiscal multiplier was around 0.5; and (ii) the 'actual' fiscal multiplier is in the range of 0.90 to 1.70. In the annual report of the Bank of Greece for the year 2012 is mentioned that: "According to a recent IMF staff report, fiscal adjustment had a substantially larger impact on GDP than initially projected. In particular, during the early years of the crisis, the average fiscal multiplier was 2-3 times higher than the original estimates (0.5; see IMF Report, March 2012, *Greece: Request for Extended Arrangement Under the Extended Fund Facility-Staff report*, p. 15). See Blanchard, O. and D. Leigh (2013), "Growth Forecast Errors and Fiscal Multipliers", IMF Working Paper 13/1; and IMF, *World Economic Outlook*, Autumn 2012. However, the ECB [European Central Bank] and the European Commission voiced their disagreement to both the results of the IMF study and the methodology used to estimate fiscal multipliers. See European Commission (2012), *Autumn Economic Forecasts*, and ECB (2012), *Monthly Bulletin*, December. In this light, the IMF January 2013 report suggests that the average fiscal multiplier for Greece is estimated at around 1 (see *Greece: First and Second Reviews*, IMF Country Report No. 13/20, p. 13)." (Bank of Greece, 2013, pp. 127-128).[1]

One year earlier, we had estimated, on the basis of almost trivial calculations, that the usual Keynesian multiplier of autonomous demand for the Greek economy was around 1.71 and, therefore, an attempt to eliminate the state budget primary deficit would result in cumulative Gross Domestic Product (GDP) losses of about 29% (Mariolis, 2011). It is well-known, however, that the multiplier(s) for an actual economy does not constitute a scalar but a *vector* quantity and, therefore, the aforesaid empirical estimations have not taken into account the intersectoral relations of production. The purpose of this paper is to estimate the 'static Sraffian multiplier' for the Greek economy (for the year 2010). The concept of Sraffian multiplier, for a closed economy of single production with circulating capital, homogeneous labour and two types of income (wages and profits), was introduced by Kurz (1985). This multiplier is an $n \times n$ matrix, where n denotes the number of produced commodities, that depends on the (i) technical conditions of production; (ii) income distribution

[1] For a relevant discussion, see Monokroussos and Thomakos (2012); Illing and Watzka (2014).

(and commodity prices); (iii) savings ratios out of wages and profits; and (iv) consumption patterns associated with the two types of income.[2] Moreover, it includes, as special versions or limit cases, the usual Keynesian multiplier, the multipliers of the traditional input-output analysis, and their Marxian versions.[3]

Our estimation is based on a joint production model of circulating capital, heterogeneous labour, without non-competitive imports, and data from the Supply and Use Table (SUT) of the Greek economy for the year 2010, which is the analysis illustrated in Mariolis (2008b) with the only difference that the latter used a single-product framework and, therefore, Symmetric Input-Output Tables (SIOTs).[4] As is well-known, in the SUTs (SIOTs) there are (are no) industries that produce more than one commodity and (nor) commodities that are produced by more than one industry and, therefore, may be considered as the empirical *counterpart* of joint production (single-product) systems *à la* von Neumann (1945) and Sraffa (1960). Thus, since joint production is the empirically relevant case (Steedman, 1984; Faber *et al.*, 1998; Kurz, 2006), SUTs constitute, doubtless, a *more* realistic 'picture' of the economic system than SIOTs (also see Mariolis and Soklis, 2010, Soklis, 2011, and the references therein).[5]

The remainder of the paper is structured as follows. Section 2 outlines the analytic framework. Section 3 presents the empirical results. Section 4 evaluates and discusses the policy implications of the results. Finally, Section 5 concludes.

[2] Although in a quite different algebraic form, the Sraffian multiplier had been essentially introduced by Metcalfe and Steedman (1981) in a model with the following characteristics: open economy of single production with circulating capital, non-competitive imports, homogeneous labour, and uniform rates of profits (and growth), propensity to save and composition of consumption. Furthermore, Mariolis (2008a) (i) showed the mathematical equivalence between the Sraffian multiplier(s) derived from Kurz (1985) and Metcalfe and Steedman (1981); and (ii) extended the investigation of the latter to the case of pure joint production.

[3] For the Keynesian multiplier, see, e.g. Blanchard *et al.* (2010, ch. 3). For the multipliers of the traditional input-output analysis, see, e.g. Miller and Blair (2009, ch. 6) and ten Raa (2005, ch. 3). Finally, for Marxian versions of the aforesaid multipliers, see, e.g. Hartwig (2004) and Trigg and Philp (2008), respectively.

[4] It should be stressed that the particular structure of the model(s) is *imposed* by the available input-output tables, i.e. they provide no data on fixed capital stocks and non-competitive imports.

[5] There are a number of studies that estimate alternative multipliers for the Greek economy by means of the traditional input-output analysis. The most recent are by Rodousaki (2007), Skountzos *et al*. (2007), Belegri-Roboli *et al*. (2010), Economakis *et al*. (2011), Antonopoulos *et al*. (2014), Athanassiou *et al*. (2014).

2. The Analytic Framework

Consider an open, linear system involving only circulating capital and producing n commodities by n processes (or industries) of pure joint production. Furthermore, assume that (i) the input-output coefficients are fixed; (ii) there are no non-competitive imports; (iii) the net product is distributed to profits and wages that are paid at the end (see Steedman, 1977, pp. 103-105) of the common production period; and (iv) each process uses only one type of labour.

On the basis of these assumptions, the price side of the system is described by[6]

$$\mathbf{pB} = \mathbf{pA}[\mathbf{I} + \hat{\mathbf{r}}] + \mathbf{w}\hat{\mathbf{l}} \tag{1}$$

where $\mathbf{B}$ denotes the $n \times n$ output coefficients matrix, $\mathbf{A}$ the $n \times n$ input coefficients matrix, $\mathbf{I}$ the $n \times n$ identity matrix, $\hat{\mathbf{l}}$ ($l_j > 0$) the $n \times n$ diagonal matrix of direct labour coefficients, $\mathbf{p}\,(> \mathbf{0})$ the $1 \times n$ vector of commodity prices, $\hat{\mathbf{r}}$ ($r_j > -1$ and $\hat{\mathbf{r}} \neq \mathbf{0}$) the $n \times n$ diagonal matrix of the sectoral profit rates, and $\mathbf{w}\,(w_j > 0)$ the $1 \times n$ vector of money wage rates.[7]

Provided that $[\mathbf{B} - \mathbf{A}]$ is non-singular, equation (1) can be rewritten as

$$\mathbf{p} = \mathbf{p}\tilde{\mathbf{H}} + \mathbf{w}\boldsymbol{\Lambda} \tag{2}$$

where $\tilde{\mathbf{H}} \equiv \mathbf{A}\hat{\mathbf{r}}[\mathbf{B} - \mathbf{A}]^{-1}$ may be considered as the '$\hat{\mathbf{r}}-$vertically integrated technical coefficients matrix', and $\boldsymbol{\Lambda} \equiv \hat{\mathbf{l}}[\mathbf{B} - \mathbf{A}]^{-1}$ denotes the matrix of 'additive labour values' (Steedman, 1975, 1976), i.e. of direct and indirect labour requirements per unit of net output for each commodity.[8]

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[6] Matrices (and vectors) are delineated in boldface letters. The transpose of a $1 \times n$ vector $\mathbf{x} \equiv [x_j]$ is denoted by $\mathbf{x}^{\mathrm{T}}$, and the diagonal matrix formed from the elements of $\mathbf{x}$ is denoted by $\hat{\mathbf{x}}$. Finally, $\mathbf{e}$ denotes the summation vector, i.e. $\mathbf{e} \equiv [1,1,...,1]$, and $\mathbf{e}_j$ the $j-$th unit vector.

[7] If an *ad valorem* tax is imposed on a number of commodities, then equation (1) should be replaced by

$$\mathbf{p}[\mathbf{I} + \hat{\mathbf{T}}]^{-1}\mathbf{B} = \mathbf{pA}[\mathbf{I} + \hat{\mathbf{r}}] + \mathbf{w}\hat{\mathbf{l}}$$

where $\hat{\mathbf{T}} \equiv [t_i]$ denotes the diagonal matrix of tax rates, and t_i the tax rate imposed on commodity i (for other types of indirect taxation, see Erreygers, 1989, pp. 152-153).

[8] Both Pasinetti's (1973) $\mathbf{H}\,(\equiv \mathbf{A}[\mathbf{B} - \mathbf{A}]^{-1})$ matrix and $\boldsymbol{\Lambda}$ are not necessarily semi-positive unless $[\mathbf{B} - \mathbf{A}]^{-1} \geq \mathbf{0}$ (also see Sraffa, 1960, pp. 59-61, and Filippini and Filippini, 1982). A commodity is said to be 'separately producible' in system $\{\mathbf{B}, \mathbf{A}\}$ if it is possible to produce a net output consisting of a unit of that commodity alone with a non-negative intensity vector. A system of production is called 'all-productive' if all commodities are separately producible in it. Thus, if $\{\mathbf{B}, \mathbf{A}\}$ is 'all-productive', then $[\mathbf{B} - \mathbf{A}]^{-1} \geq \mathbf{0}$. Furthermore, a process is 'indispensable' within a system of production if it has to be activated whatever net output is to be produced. An 'all-productive system' whose processes are all

The quantity side of the system is described by

$$\mathbf{Bx}^{\mathrm{T}} = \mathbf{Ax}^{\mathrm{T}} + \mathbf{y}^{\mathrm{T}}$$

or

$$\mathbf{x}^{\mathrm{T}} = [\mathbf{B} - \mathbf{A}]^{-1}\mathbf{y}^{\mathrm{T}} \tag{3}$$

and

$$\mathbf{y}^{\mathrm{T}} = \mathbf{c}_w^{\mathrm{T}} + \mathbf{c}_p^{\mathrm{T}} - \mathbf{Im}^{\mathrm{T}} + \mathbf{d}^{\mathrm{T}}$$

or, setting $\mathbf{Im}^{\mathrm{T}} = \hat{\mathbf{m}}\mathbf{Bx}^{\mathrm{T}}$,

$$\mathbf{y}^{\mathrm{T}} = \mathbf{c}_w^{\mathrm{T}} + \mathbf{c}_p^{\mathrm{T}} - \hat{\mathbf{m}}\mathbf{Bx}^{\mathrm{T}} + \mathbf{d}^{\mathrm{T}} \tag{4}$$

where $\mathbf{x}^{\mathrm{T}}$ denotes the activity level vector, $\mathbf{y}^{\mathrm{T}}$ the vector of effective final demand, $\mathbf{c}_w^{\mathrm{T}}$ the vector of consumption demand out of wages, $\mathbf{c}_p^{\mathrm{T}}$ the vector of consumption demand out of profits, $\mathbf{Im}^{\mathrm{T}}$ the import demand vector, $\mathbf{d}^{\mathrm{T}}$ the autonomous demand vector (government expenditures, investments and exports), and $\hat{\mathbf{m}}$ the diagonal matrix of imports per unit of gross output of each commodity.

If $\mathbf{c}^{\mathrm{T}}$ denotes the uniform consumption pattern (associated with the two types of income), s_w denotes the saving ratio out of wages, and s_p denotes the saving ratio out of profits, where $0 \le s_w < s_p \le 1$, then the consumption demands out of wages and out of profits, in physical terms, amount to (see equations (2) and (3), which imply that $\hat{\mathbf{l}}\mathbf{x}^{\mathrm{T}} = \mathbf{\Lambda y}^{\mathrm{T}}$ and $\mathbf{A}\hat{\mathbf{r}}\mathbf{x}^{\mathrm{T}} = \tilde{\mathbf{H}}\mathbf{y}^{\mathrm{T}}$)

$$\mathbf{c}_w^{\mathrm{T}} = (1 - s_w)\sum_{j=1}^{n}(w_j l_j x_j)(\mathbf{pc}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}} = (1 - s_w)(\mathbf{w}\hat{\mathbf{l}}\mathbf{x}^{\mathrm{T}})(\mathbf{pc}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}}$$

or

$$\mathbf{c}_w^{\mathrm{T}} = (1 - s_w)(\mathbf{w\Lambda y}^{\mathrm{T}})(\mathbf{pc}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}} \tag{5}$$

and

$$\mathbf{c}_p^{\mathrm{T}} = (1 - s_p)(\mathbf{pA}\hat{\mathbf{r}}\mathbf{x}^{\mathrm{T}})(\mathbf{pc}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}} = (1 - s_p)(\mathbf{p}\tilde{\mathbf{H}}\mathbf{y}^{\mathrm{T}})(\mathbf{pc}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}} \tag{6}$$

respectively.[9]

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indispensable is called 'all-engaging'. Thus, if $\{\mathbf{B}, \mathbf{A}\}$ is 'all-engaging', then $[\mathbf{B} - \mathbf{A}]^{-1} > \mathbf{0}$. These two types of systems retain all the essential properties of single-product systems (Schefold, 1971, 1978).

[9] In the (more realistic) case of direct taxation, the term $(1 - s_z)$, $z = w, p$, should be replaced by $(1 - s_z)(1 - t_z)$, where t_z denotes the tax rate.

Substituting equations (5) and (6) into equation (4) leads to (take into account equations (1) and (3) and that $(\mathbf{w\Lambda y}^{\mathrm{T}})\mathbf{c}^{\mathrm{T}} = (\mathbf{c}^{\mathrm{T}}\mathbf{w\Lambda})\mathbf{y}^{\mathrm{T}}$, $(\mathbf{p\tilde{H}y}^{\mathrm{T}})\mathbf{c}^{\mathrm{T}} = (\mathbf{c}^{\mathrm{T}}\mathbf{p\tilde{H}})\mathbf{y}^{\mathrm{T}}$):

$$\mathbf{y}^{\mathrm{T}} = \mathbf{Ky}^{\mathrm{T}} + \mathbf{d}^{\mathrm{T}} \tag{7}$$

where

$$\mathbf{K} \equiv (\mathbf{pc}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}}[\mathbf{p} - (s_w\mathbf{w\Lambda} + s_p\mathbf{p\tilde{H}})] - \hat{\mathbf{m}}\mathbf{B}[\mathbf{B} - \mathbf{A}]^{-1}$$

Provided that $[\mathbf{I} - \mathbf{K}]$ is non-singular (consider Mariolis, 2008a, pp. 660-661 and 663), equation (7) can be uniquely solved for $\mathbf{y}^{\mathrm{T}}$:

$$\mathbf{y}^{\mathrm{T}} = \mathbf{Md}^{\mathrm{T}} \tag{8}$$

where $\mathbf{M} \equiv [\mathbf{I} - \mathbf{K}]^{-1}$ is the Sraffian multiplier linking autonomous demand to net output. For $\hat{\mathbf{m}} = \mathbf{0}$, the Sraffian multiplier reduces to

$$\mathbf{M}_0 \equiv [\mathbf{I} - (\mathbf{pc}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}}[\mathbf{p} - (s_w\mathbf{w\Lambda} + s_p\mathbf{p\tilde{H}})]]^{-1}$$

In that case the Sherman-Morrison formula[10] implies that

$$\mathbf{M}_0 = \mathbf{I} + [(s_w\mathbf{w\Lambda} + s_p\mathbf{p\tilde{H}})\mathbf{c}^{\mathrm{T}}]^{-1}\mathbf{c}^{\mathrm{T}}[\mathbf{p} - (s_w\mathbf{w\Lambda} + s_p\mathbf{p\tilde{H}})] \tag{8a}$$

and $\mathbf{y}^{\mathrm{T}}$ is not uniquely determined when

$$(s_w\mathbf{w\Lambda} + s_p\mathbf{p\tilde{H}})\mathbf{c}^{\mathrm{T}} = 0 \tag{8b}$$

From equations (2) and (8a) it follows that when both $\mathbf{w\Lambda}$ and $\mathbf{p\tilde{H}}$ are semi-positive, (i) $\mathbf{M}_0$ is semi-positive; (ii) its diagonal elements are greater than or equal to 1; and (iii) its elements are non-increasing functions of s_w and s_p (as in the single production case; see Kurz, 1985, pp. 133 and 135-136).[11]

Finally, from equations (3) and (8) it follows that the volumes of employment, $\mathbf{L}^{\mathrm{T}} \equiv \hat{\mathbf{l}}\mathbf{x}^{\mathrm{T}}$, associated with $\mathbf{d}^{\mathrm{T}}$ are given by

$$\mathbf{L}^{\mathrm{T}} \equiv \mathbf{\Lambda Md}^{\mathrm{T}} \tag{9}$$

Thus, the employment effects of $\mathbf{d}^{\mathrm{T}}$ can be decomposed (*à la* Kahn, 1931) into 'primary employment' effects, i.e.

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[10] Let $\boldsymbol{\chi}$, $\boldsymbol{\psi}$ be arbitrary n-vectors. Then

$$\det[\mathbf{I} - \boldsymbol{\chi}^{\mathrm{T}}\boldsymbol{\psi}] = 1 - \boldsymbol{\psi}\boldsymbol{\chi}^{\mathrm{T}}$$

and, iff $\boldsymbol{\psi}\boldsymbol{\chi}^{\mathrm{T}} \neq 1$,

$$[\mathbf{I} - \boldsymbol{\chi}^{\mathrm{T}}\boldsymbol{\psi}]^{-1} = \mathbf{I} + (1 - \boldsymbol{\psi}\boldsymbol{\chi}^{\mathrm{T}})^{-1}\boldsymbol{\chi}^{\mathrm{T}}\boldsymbol{\psi}$$

(see, e.g. Meyer, 2001, p. 124).

[11] In the case of homogeneous labour and for $s_w = 0$, $s_p = 1$, $\mathbf{M}_0$ reduces to a Marxian multiplier defined by Trigg and Philp (2008).

$$\mathbf{L}_{\mathrm{I}}^{\mathrm{T}} \equiv \mathbf{\Lambda d}^{\mathrm{T}} \tag{9a}$$

and 'secondary employment' effects, i.e.

$$\mathbf{L}_{\mathrm{II}}^{\mathrm{T}} \equiv \mathbf{L}^{\mathrm{T}} - \mathbf{L}_{\mathrm{I}}^{\mathrm{T}} = \mathbf{\Lambda}[\mathbf{M} - \mathbf{I}]\mathbf{d}^{\mathrm{T}} \tag{9b}$$

3. Empirical Results

The application of the previous analysis to the SUT of the Greek economy for the year 2010 ($n = 63$) gives the following results:[12]

(i). The matrix $[\mathbf{B} - \mathbf{A}]$ is non-singular and, therefore, $[\mathbf{B} - \mathbf{A}]^{-1}$ exists.

(ii). The matrix $[\mathbf{B} - \mathbf{A}]^{-1}$ (and, therefore, $\mathbf{\Lambda}$) contains negative elements. Consequently, the system under consideration is not 'all-productive' and, therefore, it does *not* have the properties of a single-product system.

(iii). The matrix $\hat{\mathbf{r}}$ contains one negative element that corresponds to industry 47 ('Scientific Research and Development').

(iv). The matrix $\tilde{\mathbf{H}}$ contains negative elements, although some of its columns are positive.

(v). The vector $\mathbf{p}\tilde{\mathbf{H}}$ $(= \mathbf{e}\tilde{\mathbf{H}}$, since $\mathbf{p}$ is identified with $\mathbf{e})$ contains one negative element that corresponds to commodity 23 ('Repair and installation services of machinery and equipment'), while all of its remaining elements are semi-positive and less than 1 (see equation (2)). It then follows that there exist values of s_w, s_p, for which $\mathbf{M}_0$ (see equation (8a)) is not semi-positive.

(vi). For every positive value of s_w, s_p, it holds $(s_w \mathbf{w\Lambda} + s_p \mathbf{p}\tilde{\mathbf{H}})\mathbf{c}^{\mathrm{T}} > 0$ and, therefore, $\mathbf{M}_0$ is uniquely determined (see equation (8b)).

(vii). The changes on (a) the money value of net output, Δ_y^i ('output multiplier'); (b) the money value of imports, Δ_{Im}^i ('import multiplier'); and (c) total employment, Δ_L^i ('employment multiplier'), induced by the increase of one unit of the autonomous demand for commodity i, are given by

$$\Delta_y^i \equiv \mathbf{pMe}_i^{\mathrm{T}}$$

$$\Delta_{Im}^i \equiv \mathbf{p\hat{m}B}[\mathbf{B} - \mathbf{A}]^{-1}\mathbf{Me}_i^{\mathrm{T}}$$

[12] For the available input-output data as well as the construction of the relevant variables, see Appendix I. *Mathematica 7.0* is used in the calculations, while the precision in internal calculations is set to 16 digits. All the analytical results are available on request from the authors.

and

$$\Delta_L^i \equiv \mathbf{e}\mathbf{\Lambda}\mathbf{M}\mathbf{e}_i^{\mathrm{T}}$$

respectively (see equations (4), (8) and (9)). Table 1 reports the estimations for Δ_y^i, Δ_{Im}^i and Δ_L^i for the case where $s_w = 0$ and $s_p = 1$.[13] It also reports the respective estimations for the changes on primary employment, $\Delta_{LI}^i \equiv \mathbf{e}\mathbf{\Lambda}\mathbf{e}_i^{\mathrm{T}}$ (primary employment multiplier; see equation (9a)), and for $\Delta_{LII}^i(\Delta_L^i)^{-1}$, where $\Delta_{LII}^i \equiv \mathbf{e}\mathbf{\Lambda}[\mathbf{M}-\mathbf{I}]\mathbf{e}_i^{\mathrm{T}}$ (see equation (9b)). Finally, the last two rows of Table 1 give the arithmetic mean, *AM*, and the standard deviation, *SD*, of the respective changes.

Table 1. *Output, import and employment multipliers for $s_w = 0$ and $s_p = 1$*

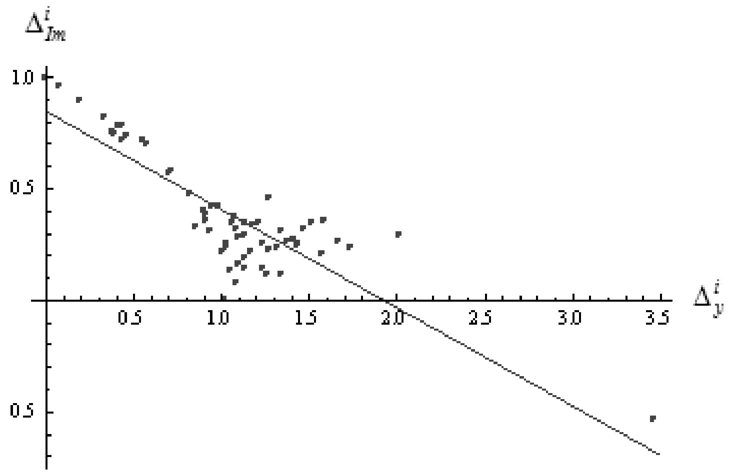
	Multipliers			Decomposition of employment multipliers	
i	Δ_y^i	Δ_{Im}^i	Δ_L^i	Δ_{LI}^i	$\Delta_{LII}^i(\Delta_L^i)^{-1}$ (%)
1	0.93	0.31	62.3	71.2	–14.3
2	**1.21**	**0.35**	**85.9**	**97.5**	**–13.5**
3	1.00	0.22	21.4	21.8	–1.6
4	0.18	0.90	3.6	19.5	–441.6
5	0.89	0.41	25.1	31.3	–24.7
6	0.45	0.74	12.9	31.6	–146.7
7	0.98	0.43	32.6	37.7	–15.8
8	0.57	0.70	11.8	21.1	–78.2
9	**1.17**	**0.34**	**37.6**	**34.2**	**8.9**
10	0.38	0.75	5.7	17.1	–198.8
11	0.32	0.82	6.0	18.1	–204.5
12	0.37	0.76	6.6	17.1	–158.2
13	0.54	0.72	14.1	25.2	–78.2
14	0.94	0.43	17.1	17.6	–2.8
15	0.71	0.58	13.0	17.8	–37.2
16	0.70	0.57	18.0	25.7	–42.7

[13] All the numerical results reported hereafter correspond to this case. For the general case, see the figures on the Appendix II, which depict Δ_y^i, Δ_{Im}^i, Δ_L^i , the 'marginal propensities for imports', $\Delta_{Im}^i / \Delta_y^i$, and their arithmetic means, which are denoted by a bar (i.e. $\bar{\Delta}^i$), as functions of the saving ratios, for (a) $s_w = 0$ and $0 \le s_p \le 1$; (b) $0 \le s_w \le 1$ and $s_p = 1$; and (c) $s_w = s_p = s$. We consider that this parametric analysis also captures the case of direct taxation (see footnote 9). Finally, typical findings in many empirical studies suggest that $s_w < s_p$ and the difference between s_w and s_p is significant (say, in the range of 30% to 50%; see, e.g. Bowles and Boyer, 1995, Naastepad, 2003, Naastepad and Storm, 2007, Hein and Vogel, 2008, Onaran and Galanis, 2012). Thus, we presume that the results for the polar case, $s_w = 0$ and $s_p = 1$, are sufficiently representative.

17	0.07	0.96	1.4	20.4	–1360.6
18	0.43	0.72	6.7	15.6	–132.2
19	0.43	0.79	6.5	13.9	–113.8
20	0.18	0.90	3.0	16.2	–438.0
21	–0.01	1.00	–4.3	–53.7	–1138.5
22	0.54	0.72	20.5	43.1	–109.8
23	**3.46**	**–0.53**	**160.0**	**109.7**	**31.4**
24	0.90	0.36	8.6	8.8	–1.4
25	**1.40**	**0.28**	**27.0**	**18.5**	**31.4**
26	1.07	0.38	19.9	18.0	9.8
27	**1.12**	**0.30**	**32.2**	**29.9**	**7.2**
28	1.23	0.15	22.6	17.7	22.1
29	1.31	0.24	20.0	13.8	31.1
30	**1.43**	**0.25**	**60.2**	**51.6**	**14.2**
31	**1.05**	**0.35**	**28.2**	**27.6**	**2.0**
32	0.85	0.33	9.0	12.9	–43.0
33	0.81	0.48	14.2	17.5	–23.2
34	0.41	0.79	9.9	26.8	–170.4
35	**1.51**	**0.35**	**38.3**	**28.3**	**26.0**
36	**1.13**	**0.15**	**25.8**	**23.9**	**7.4**
37	1.02	0.26	12.9	11.4	11.6
38	1.13	0.35	24.3	21.9	9.8
39	1.09	0.17	8.1	5.5	31.6
40	1.08	0.32	20.0	17.8	10.8
41	1.33	0.31	20.3	12.8	37.0
42	0.91	0.39	14.5	14.5	–0.3
43	1.25	0.12	19.3	14.1	26.8
44	1.01	0.005	0.6	0.5	17.3
45	1.12	0.19	24.9	22.6	9.3
46	**1.16**	**0.22**	**28.3**	**25.2**	**10.9**
47	1.26	0.46	30.6	26.4	13.8
48	1.13	0.30	25.6	23.2	9.7
49	1.09	0.29	23.2	21.6	6.9
50	1.02	0.24	14.8	13.5	8.9
51	1.33	0.12	22.7	16.1	29.2
52	**1.26**	**0.23**	**25.8**	**20.5**	**20.4**
53	**1.43**	**0.26**	**28.5**	**19.8**	**30.6**
54	**1.66**	**0.27**	**35.4**	**22.5**	**36.6**
55	**1.73**	**0.24**	**43.0**	**28.3**	**34.1**
56	**1.23**	**0.26**	**27.4**	**23.1**	**15.5**
57	**1.58**	**0.36**	**56.5**	**45.2**	**20.0**
58	1.08	0.08	12.7	10.8	14.7
59	**1.46**	**0.32**	**55.6**	**46.4**	**16.4**
60	**1.37**	**0.27**	**26.5**	**19.2**	**27.3**
61	1.04	0.14	17.8	16.9	4.9
62	**1.57**	**0.21**	**35.1**	**23.9**	**32.1**
63	**2.01**	**0.30**	**86.9**	**66.6**	**23.3**
AM	1.03	0.39	25.8	24.7	–68.1
SD	0.53	0.27	25.0	21.4	236.9

From Table 1 and the associated numerical results it is deduced that:

(i). There is a significant negative linear correlation between the output and import multipliers (see Figure 1).



$$\Delta^i_{Im} = 0.85 - 0.44\Delta^i_y,\ R^2 \cong 0.74$$

Figure 1. *Output versus import multipliers*

(ii). The commodity 21 is characterized by negative output and employment multipliers, while the commodity 23 is characterized by a negative import multiplier. Since the system under investigation does not have the properties of single-product systems, this is not an unexpected finding and its rationale is that an increase in the autonomous demand for the commodity 21 (23) could be met only by the operation of some processes on a lower level, which in turn results in a negative change in total net output and employment (in total imports).[14]

(iii). There exist twenty commodities that are simultaneously characterized by a 'high' output multiplier, 'low' import multiplier and 'high' employment multiplier.[15] These commodities, which we shall call '*key-commodities*', are denoted by bold characters in Table 1: One of them belongs to primary production, four belong to industry and fifteen (or $15/20 = 75\%$) belong to services.

[14] Also consider footnote 8.

[15] Hereafter, the term 'high' ('low') shall mean 'higher (lower) than the arithmetic mean of the economy'.

(iv). Setting $\hat{\mathbf{m}} = \mathbf{0}$ (see equation (8a)), the arithmetic mean of (a) output multipliers becomes 1.71 (*SD* = 0.28); (b) employment multipliers becomes 39.3 (*SD* = 24.9); (c) primary employment multipliers becomes 24.7 (*SD* = 21.4); and (d) $\Delta^i_{L\text{II}}(\Delta^i_L)^{-1}$ becomes 37.8% (*SD* = 12.8%; setting aside commodity 21, $\Delta^i_{L\text{II}} > 0$). Thus, it follows that the import 'leakages' dampen the arithmetic mean of output (employment) multipliers by 39.8% (34.4%) and, at the same time, widen the dispersion of these two multipliers, as can be judged by the increase in the relevant coefficients of variation, $SD(AM)^{-1}$. More specifically, as Table 2 indicates, those leakages dampen the arithmetic mean of output (employment) multipliers for (a) primary production commodities by 31.4% (24.3%); (b) industrial commodities by 57.7% (47.8%); and (c) services by 27.8% (26.9%). Finally, for $\hat{\mathbf{m}} = \mathbf{0}$, we detect seventeen key-commodities: One of them belongs to primary production (the commodity 2), six belong to industry (the commodities 6, 7, 9, 13, 22 and 23) and ten (or $10/17 \cong 59\%$) belong to services (the commodities 30, 34, 35, 47, 54, 55, 57, 59, 62 and 63).

Table 2. *The arithmetic means of multipliers for primary production commodities, industrial commodities and services*

Commodities	$\hat{\mathbf{m}} = \mathbf{0}$		$\hat{\mathbf{m}} \neq \mathbf{0}$		
	$\bar{\Delta}^i_y$	$\bar{\Delta}^i_L$	$\bar{\Delta}^i_y$	$\bar{\Delta}^i_L$	$\bar{\Delta}^i_{Im}$
Primary Production	1.53	74.6	1.05	56.5	0.29
Industry	1.75	38.7	0.74	20.2	0.58
Services	1.69	36.8	1.22	26.9	0.27

(v). When we take into account *ad valorem* taxes,[16] there is no significant differentiation of the results. For instance, for $\hat{\mathbf{m}} = \mathbf{0}$, the arithmetic mean of output (employment) multipliers becomes 1.76 (43.2) and their standard deviation becomes 0.28 (25.5).

4. Evaluation and Policy Implications

From the previous analysis, it follows that an effective demand management policy could be based, primarily, on the service sector and, secondarily, on primary production, while there are only *a few* industrial commodities that could significantly

[16] See footnote 7.

affect output and employment.[17] Furthermore, the results suggest that the Greek economy, and especially its industry sector, is heavily dependent on imports. In order to further analyze the demand management capabilities of the system, we should take into account the *current* composition of autonomous demand. Table 3 reports the following indices:

(i). The final consumption expenditure by government for commodity *i* as a per cent of the economy's total gross output of commodity *i*, δ_G^i.

(ii). The gross investments in commodity *i* as a per cent of the economy's total gross output of commodity *i*, δ_I^i.

(iii). The exports of commodity *i* as a per cent of the economy's total gross output of commodity *i*, δ_{Ex}^i. It can be considered as an index of the export performance of commodity *i*.

(iv). The imports of commodity *i* as a per cent of the economy's total gross output of commodity *i*, δ_{Im}^i. It can be considered as an index of the import penetration of commodity *i* in the economy.

[17] A notable exception is the industrial commodity 23, which is characterized by the highest output and employment multipliers in the economy.

Table 3. *Government consumption expenditure, gross investment and foreign trade indices*

	Government consumption expenditure and investment indices		Foreign trade indices	
i	δ_G^i (%)	δ_I^i (%)	δ_{Ex}^i (%)	δ_{Im}^i (%)
1	0	0.9	12.9	15.0
2	**0**	**1.4**	**4.7**	**19.1**
3*	0	0	28.1	7.8
4	0	0	12.3	622.9
5	0	0	9.4	30.3
6	0	0	36.8	159.6
7	0	0.6	3.0	20.9
8	0	0	10.7	94.4
9	**0**	**0**	**0.2**	**0.8**
10	0	0	24.5	38.4
11	0	0	41.8	215.9
12	0	0	40.7	226.7
13	0	0	23.9	64.9
14	0	0	10.8	21.4
15*	0	0	43.3	40.1
16	1.6	4.0	6.1	42.4
17	0	1145.8	0	1678.7
18	0	31.0	64.6	125.3
19	0	225.7	42.2	196.6
20	0	194.3	11.8	573.0
21	0	1213.6	252.0	1606.0
22	0	42.7	10.0	125.8
23	**0**	**7.8**	**0**	**0**
24	0	0	2.1	15.4
25	**0**	**0**	**0**	**0**
26	0	0	9.2	21.1
27*	**0**	**84.6**	**2.3**	**1.1**
28*	0.03	6.6	6.6	0
29*	0.05	9.4	9.5	0
30*	**0.05**	**9.4**	**9.4**	**0**
31*	**14.4**	**0**	**2.8**	**2.2**
32*	0	0	96.2	0.4
33*	0	0	17.8	12.9
34	0	0	27.4	221.8
35	**0**	**0**	**1.1**	**1.8**
36	**0**	**0**	**0**	**0**
37	0	19.2	3.9	14.0
38	11.7	12.4	4.9	13.9
39	0	0	3.1	4.3
40	1.1	39.3	16.9	19.6
41	0	0	3.1	13.5
42	0	0	15.5	42.3
43	0	0	0	0

44	0	0.5	0	0
45	0	5.9	3.9	6.0
46	**0**	**0**	**2.2**	**2.9**
47	51.6	0	12.2	18.3
48*	0	0	4.3	3.8
49	0	0	6.7	8.7
50	0	0	3.3	12.5
51	0	0	0	0
52	**0**	**0**	**0**	**0**
53	**0**	**0**	**1.2**	**1.5**
54	**96.9**	**0**	**0**	**0**
55*	**66.4**	**0**	**0.2**	**0.1**
56*	**52.2**	**0**	**0.3**	**0.2**
57	**65.5**	**0**	**0**	**0**
58	8.3	**0**	0.6	3.0
59	**13.4**	**0**	**0.2**	**0.6**
60	**0**	**0**	**0**	**0**
61	0	0	4.4	5.5
62	**0**	**0**	**0**	**0.0003**
63	**0**	**0**	**0**	**0**
AM	6.1	48.5	15.3	101.2
SD	18.7	210.2	35.0	304.2

Note: the key-commodities are denoted by bold characters, the symbol '*' indicates that the net exports are positive, and the last two rows of the Table give the arithmetic mean and the standard deviation of the respective indices.

Now, it is useful to separate the commodities into two groups and, each group, into two categories:

Group A: Twenty key-commodities.

Category A.1: Nine commodities that are not exported.[18]

Category A.2: Eleven commodities that are exported. This category is divided into:

Category A.2.1: Five commodities with positive net exports.

Category A.2.2: Six commodities with negative net exports.

Group B: Forty-three non key-commodities.

Category B.1: Four commodities that are not exported.

Category B.2: Thirty nine commodities that are exported. This category is divided into:

Category B.2.1: Seven commodities with positive net exports.

Category B.2.2: Thirty two commodities with negative net exports.

[18] It should be noted that the key-commodities 36 and 52, which are related to tourism activities, display zero exports and imports because the SUT record only the total travel receipts and payments and not the respective payments for each commodity. These exports-receipts (imports-payments) constitute the 19.5% (3.0%) of the total exports (imports) of the economy.

Table 4 reports the arithmetic means of the three multipliers for each group and category. Furthermore, Table 5 reports the respective values for the fourteen commodities with positive government consumption expenditures: The category A.2.2. includes only the commodity 59, while the category B.1 does not exist. The values in parentheses correspond to the commodities that exhibit high government consumption indices. Finally, the values in square brackets correspond to the commodities that are *most* related to government activities (i.e. commodities 54, 55, 56 and 57), which also exhibit the highest government consumption indices.

Table 4. *The arithmetic means of commodity multipliers for each group and category*

	$\overline{\Delta}_y^i$	$\overline{\Delta}_{Im}^i$	$\overline{\Delta}_L^i$
Group A	1.50	0.24	47.2
Category A.1	1.72	0.17	53.2
Category A.2	1.32	0.29	42.3
Category A.2.1	1.31	0.28	38.2
Category A.2.2	1.32	0.31	45.7
Group B	0.81	0.46	15.8
Category B.1	0.92	0.30	11.0
Category B.2	0.80	0.47	16.4
Category B.2.1	1.00	0.33	18.0
Category B.2.2	0.76	0.51	16.0

Table 5. *The arithmetic means of multipliers for each group and category of commodities with positive government consumption expenditures*

	$\overline{\Delta}_y^i$	$\overline{\Delta}_{Im}^i$	$\overline{\Delta}_L^i$
Group A	1.44	0.29	43.8
Category A.1 [Commodities 54* and 57*]	1.62	0.32	46.0
Category A.2 [30, 31*, 55*, 56* and 59*]	1.38	0.28	42.9
Group B [16, 28, 29, 38*, 40, 47* and 58*]	1.11	0.31	21.2
Groups A and B	1.28 (1.35) [1.55]	0.30 (0.30) [0.28]	32.5 (34.9) [40.6]

Note: The symbol ‘*’ indicates that the corresponding commodity is characterized by high expenditures.

The Greek economy faces serious fiscal *and* external imbalances along with prolonged recession and high unemployment. The results in Table 4 suggest that an autonomous demand management policy should basically be structured as follows:

(i). Increase in domestic demand for the commodities of Category A.1. Taking into account the government consumption and investment indices, this policy could be based on government consumption of commodities 54 and 57, and investments in commodity 23.

(ii). Increase in foreign demand for the commodities of Category A.2. Taking into account the export performance indices, this policy could be based, primarily, on commodities 30 and 2.[19]

(iii). Decrease in domestic demand for the commodities of Category B.1. However, taking into account the indices of government consumption-investments and exports-imports, it seems that there is little room for such a policy. The data rather indicate the 0need for import substitution of commodity 17.

(iv). Increase in foreign demand for the commodities of Category B.2.1. Taking into account the export performance indices, this policy could be based, primarily, on commodities 32, 15 and 3 ($\bar{\Delta}_y^i = 0.85$, $\bar{\Delta}_{Im}^i = 0.38$, $\bar{\Delta}_L^i = 14.5$). It is noted that Category B.2.2. includes eleven commodities with high export performance indices (eight of them belong to the industry sector), but with very low output and employment multipliers ($\bar{\Delta}_y^i = 0.48$, $\bar{\Delta}_L^i = 8.8$), and very high import multiplier ($\bar{\Delta}_{Im}^i = 0.71$).

Finally, the results in Table 5 suggest that, on average ($\bar{\Delta}_y^i = 1.28$, $\bar{\Delta}_{Im}^i = 0.30$), an increase of one unit in government expenditures would result in an increase in the fiscal deficit of about 0.55 to 0.62 units (assuming a uniform tax rate of 30% to 35%) and in the trade balance deficit of about 0.38 units. It seems, therefore, that a growth-oriented fiscal policy based on commodities 47 and 54 to 57, could be sustainable only if combined with (i) increase in foreign demand for commodity 47 (is characterized by a considerable export performance); (ii) substitution of government with foreign demand for commodities 28, 29, 30, 38 (they exhibit a not negligible export performance) and 40 (exhibits high export performance); and (iii) selective decrease in government demand for commodities 58 and 59.

[19] However, it is reasonable to assume that this policy could also be based on commodities 36 and/or 52 (see footnote 18).

5. Concluding Remarks

This paper estimated, on the basis of a Sraffian model of joint production, the output, import and employment 'commodity multipliers' for the Greek economy (for the year 2010). It has been found that, in the case where all profits are saved and all wages are consumed, (i) the arithmetic mean of output multipliers is almost 1.03 (with standard deviation 0.53, maximum value 3.46 and minimum value -0.01); (ii) the arithmetic mean of import multipliers is almost 0.39 (with standard deviation 0.27, maximum value 1.0 and minimum value -0.53); (iii) the arithmetic mean of employment multipliers is almost 25.8 (with standard deviation 25.0, maximum value 160 and minimum value -4.3); (iv) the arithmetic mean of primary employment multipliers is almost 24.7 (with standard deviation 21.4, maximum value 109.7 and minimum value -53.7); (v) the commodities with positive government consumption expenditures demonstrate an output multiplier with arithmetic mean of about 1.28, an import multiplier with arithmetic mean of about 0.30, and an employment multiplier with arithmetic mean of about 32.5; (vi) the commodities that are most related to government activities demonstrate an output multiplier with arithmetic mean of about 1.55, an import multiplier with arithmetic mean of about 0.28, and an employment multiplier with arithmetic mean of about 40.6. Given that, in most cases, the output, import and employment multipliers were found to be strictly decreasing functions of the propensities to save, and since the actual propensity to save out of profits (wages) is expected to be less than 1 (is not expected to be high), it follows that the aforesaid estimations can be considered as sufficiently representative.

The Greek governments attempted to correct the imbalances of the economy by the application of contractionary fiscal and internal devaluation policies, such as *indiscriminate* reductions in government expenditures, increases in taxes and cuts in unit labour costs. These policies resulted to a significant improvement of the state budget primary deficit but with a GDP contraction (for the period 2010-2013) of about 22.2% (in constant prices of 2010) and a rate of unemployment of about 27.5%. In the same period, the exports were reduced by 3.3% and the imports by 15.5% (in constant prices of 2010), while the export market share of world's total was reduced by 9.4%. It seems, therefore, that the results of our analysis are not in contrast with the observed deep recession of the Greek economy and, to the extent that they correspond to reality, reveal the intersectoral dimensions of this recession.

According to the findings of this paper, a growth-oriented policy should be directed towards, on the one hand, *redistribution* of government expenditures and, on the other hand, *targeted* increase in foreign demand, i.e. for the exported key-commodities and those exported non-key commodities that are characterized by relative high output multipliers and relative low import multipliers.[20] However, such a policy could be based on only a few industrial commodities, while the reproduction of the Greek economy is heavily dependent on imports. It then follows that, irrespective of the applied effective demand management policy, the *long-term* growth potential of the system is rather limited and, therefore, a change in its intersectoral structure is necessary.

Future research efforts should incorporate into the analysis a more comprehensive modeling of imports, along with their detailed distinction between competitive and non-competitive, as well as fixed capital and the degree of its utilization. Also, it would have a particular interest the intratemporal and intertemporal comparison of the Sraffian multipliers between the countries of the 'North' and the 'South' of Eurozone.

Appendix I: A Note on the Data

The SUT of the Greek economy for the year 2010 is provided via the *EUROSTAT* website, http://epp.eurostat.ec.europa.eu, while the levels of sectoral employment are provided via the website of the National Statistical Service of Greece, http://www.statistics.gr/. The available SUT describes 65 products and industries. However, all the elements associated with the commodities 'Imputed rents of owner-occupied dwellings' and 'Services provided by extraterritorial organisations and bodies' equal zero and, therefore, we remove them from our analysis. Thus, we derive a SUT that describes 63 products. The described products and their correspondence to CPA (Classification of Products by Activity) are reported in Table A.I.1 below.[21] Moreover, the industry that produces as a primary product the commodity 'Services

[20] Whether significant increases in foreign demand are indeed possible without currency devaluation is beyond the present study. For input-output analyses of some available policies for the Greek economy in case it leaves the Eurozone, see Katsinos and Mariolis (2012) and Mariolis (2013).

[21] The commodities 1 to 3 belong to 'Primary production'. The commodities 4 to 27 belong to 'Industry': (i) the commodity 4 corresponds to 'Mining and quarrying'; (ii) the commodities 5 to 23 correspond to 'Processing products'; (iii) the commodity 24 corresponds to 'Energy'; (iv) the commodities 25 and 26 correspond to 'Water supply and waste disposal'; and (v) the commodity 27 corresponds to 'Construction'. Finally, the commodities 28 to 63 belong to 'Services'.

of households as employers; undifferentiated goods and services produced by households for own use' is the only one that does not use intermediate inputs and, therefore, all the elements of the corresponding column of the Use Matrix equal zero.

The elements of the Supply Table are measured at current 'basic prices', while the elements of the Use Table are measured in current 'purchasers' prices'. The derivation of the SUT at basic prices is based on the method proposed by United Nations (1999, ch. 3 and pp. 228-229). The available levels of sectoral employment are quarterly published and correspond to the number of working people in 88 industries of the Greek economy. The total employment of each industry, l_j, is estimated as the arithmetic mean of the sectoral employment of the four quarters of the year. Finally, we apply the necessary aggregations in order to derive the levels of sectoral employment that correspond to the 63 industries that are described in the SUT.

Furthermore:

(i). $\mathbf{p}$ is identified with $\mathbf{e}$, i.e. the physical unit of measurement of each product is that unit which is worth of a monetary unit (in the SUT of the Greek economy, the unit is set to 1 million euro).

(ii). The 63 x 63 Make and Use Matrices, which are directly obtained from the SUT, are considered as the empirical counterpart of $\mathbf{B}$ and $\mathbf{A}$, respectively.

(iii). The 63 x 1 vector of consumption expenditures of the household sector, which is directly obtained from the Use Table, is considered as the empirical counterpart of $\mathbf{c}^{\mathrm{T}}$
.

(iv). The element 'Compensation of employees' from the Use Table, which is an element of the 'Value Added' of each industry, is considered as the empirical counterpart of total wages in industry j, W_j. Thus, the money wage rate for each industry is estimated as $w_j = W_j l_j^{-1}$.

(v). The sectoral 'profit factors' are estimated from

$$1 + r_j = [(\sum_{j=1}^{n} b_j) - w_j l_j](\sum_{j=1}^{n} a_j)^{-1}$$

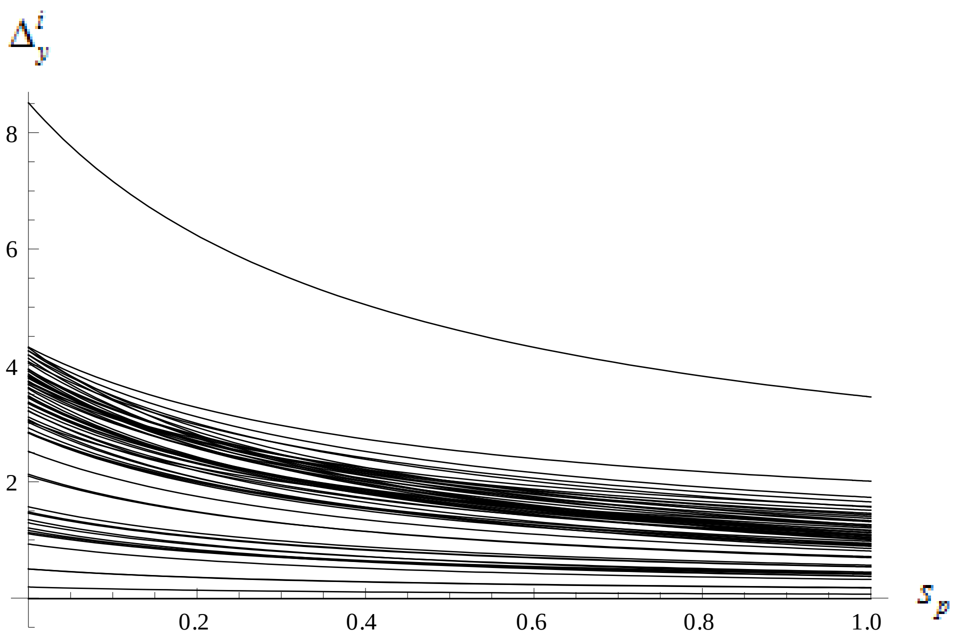
(vi). The 63 x 1 vector of imports, which is directly obtained from the Use Table, is considered as the empirical counterpart of $\mathbf{Im}^{\mathrm{T}}$. Thus, we may obtain the matrix $\hat{\mathbf{m}}$.

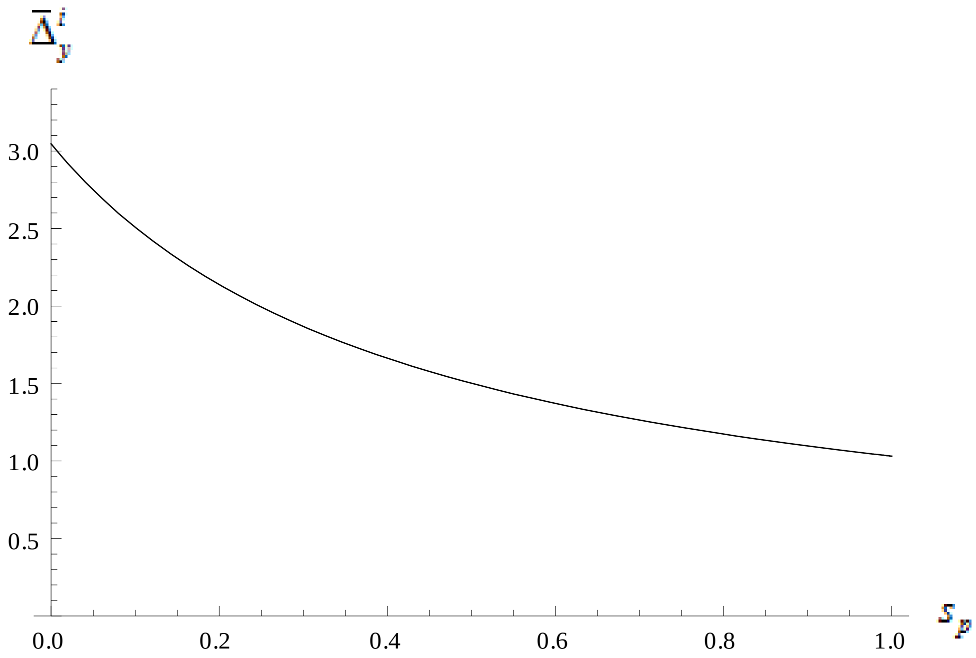
Table A.I.1. Product Classification

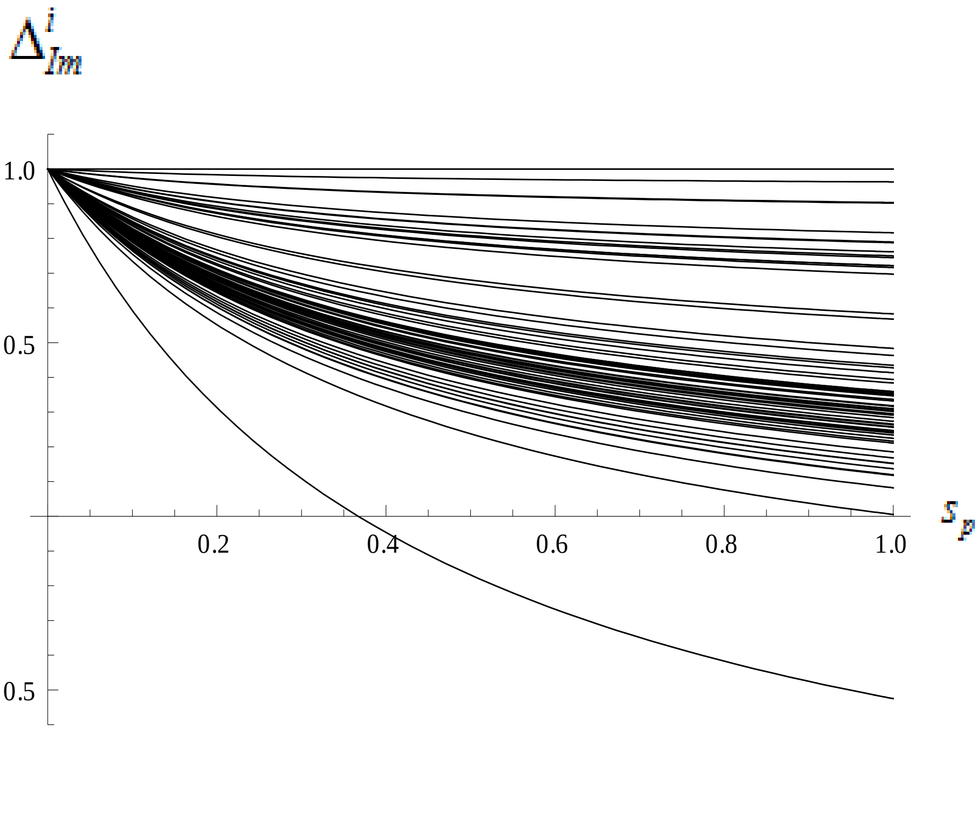
No	CPA	Nomenclature
1	A01	Products of agriculture, hunting and related services
2	A02	Products of forestry, logging and related services
3	A03	Fish and other fishing products; aquaculture products; support services to fishing
4	B	Mining and quarrying
5	C10-C12	Food products, beverages and tobacco products
6	C13-C15	Textiles, wearing apparel and leather products
7	C16	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials
8	C17	Paper and paper products
9	C18	Printing and recording services
10	C19	Coke and refined petroleum products
11	C20	Chemicals and chemical products
12	C21	Basic pharmaceutical products and pharmaceutical preparations
13	C22	Rubber and plastics products
14	C23	Other non-metallic mineral products
15	C24	Basic metals
16	C25	Fabricated metal products, except machinery and equipment
17	C26	Computer, electronic and optical products
18	C27	Electrical equipment
19	C28	Machinery and equipment n.e.c.
20	C29	Motor vehicles, trailers and semi-trailers
21	C30	Other transport equipment
22	C31-C32	Furniture; other manufactured goods
23	C33	Repair and installation services of machinery and equipment
24	D35	Electricity, gas, steam and air-conditioning
25	E36	Natural water; water treatment and supply services
26	E37-E39	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
27	F	Constructions and construction works
28	G45	Wholesale and retail trade and repair services of motor vehicles and motorcycles
29	G46	Wholesale trade services, except of motor vehicles and motorcycles
30	G47	Retail trade services, except of motor vehicles and motorcycles
31	H49	Land transport services and transport services via pipelines
32	H50	Water transport services
33	H51	Air transport services
34	H52	Warehousing and support services for transportation
35	H53	Postal and courier services
36	I	Accommodation and food services
37	J58	Publishing services
38	J59-J60	Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services
39	J61	Telecommunications services
40	J62-J63	Computer programming, consultancy and related services; information services
41	K64	Financial services, except insurance and pension funding
42	K65	Insurance, reinsurance and pension funding services, except compulsory social security
43	K66	Services auxiliary to financial services and insurance services
44	L68B	Real estate services (excluding imputed rent)
45	M69-M70	Legal and accounting services; services of head offices; management consulting services
46	M71	Architectural and engineering services; technical testing and analysis services
47	M72	Scientific research and development services

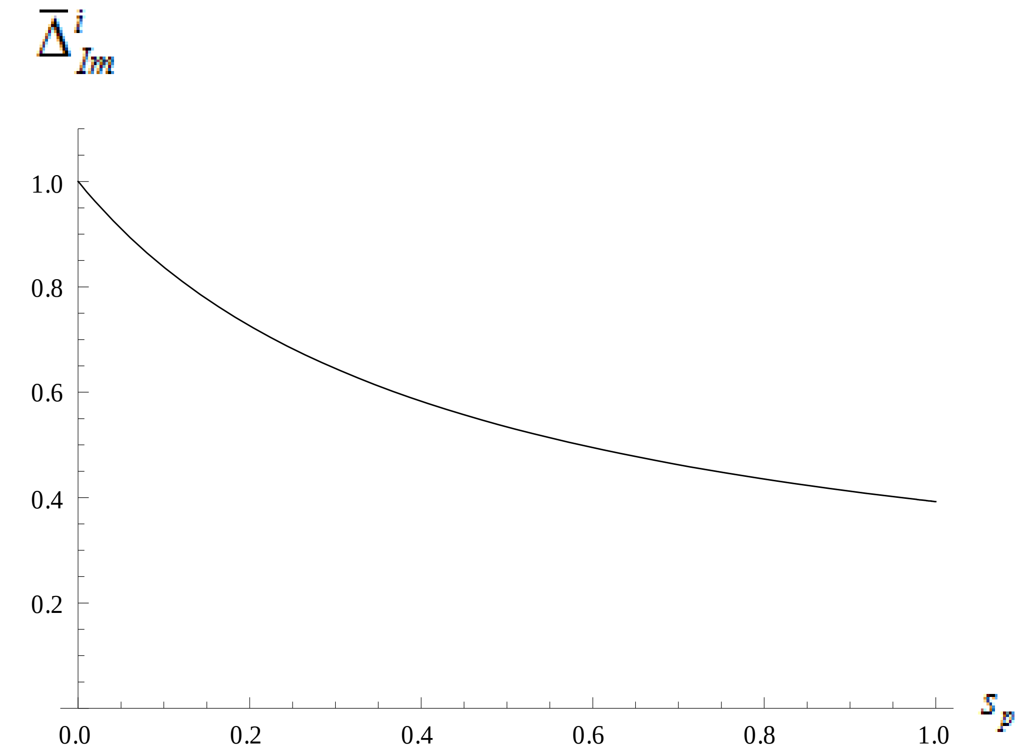
48	M73	Advertising and market research services
49	M74-M75	Other professional, scientific and technical services; veterinary services
50	N77	Rental and leasing services
51	N78	Employment services
52	N79	Travel agency, tour operator and other reservation services and related services
53	N80-N82	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
54	O84	Public administration and defence services; compulsory social security services
55	P85	Education services
56	Q86	Human health services
57	Q87-Q88	Social work services
58	R90-R92	Creative, arts and entertainment services; library, archive, museum and other cultural services; gambling and betting services
59	R93	Sporting services and amusement and recreation services
60	S94	Services furnished by membership organisations
61	S95	Repair services of computers and personal and household goods
62	S96	Other personal services
63	T	Services of households as employers; undifferentiated goods and services produced by households for own use

Appendix II: The Multipliers as Functions of the Savings Ratios

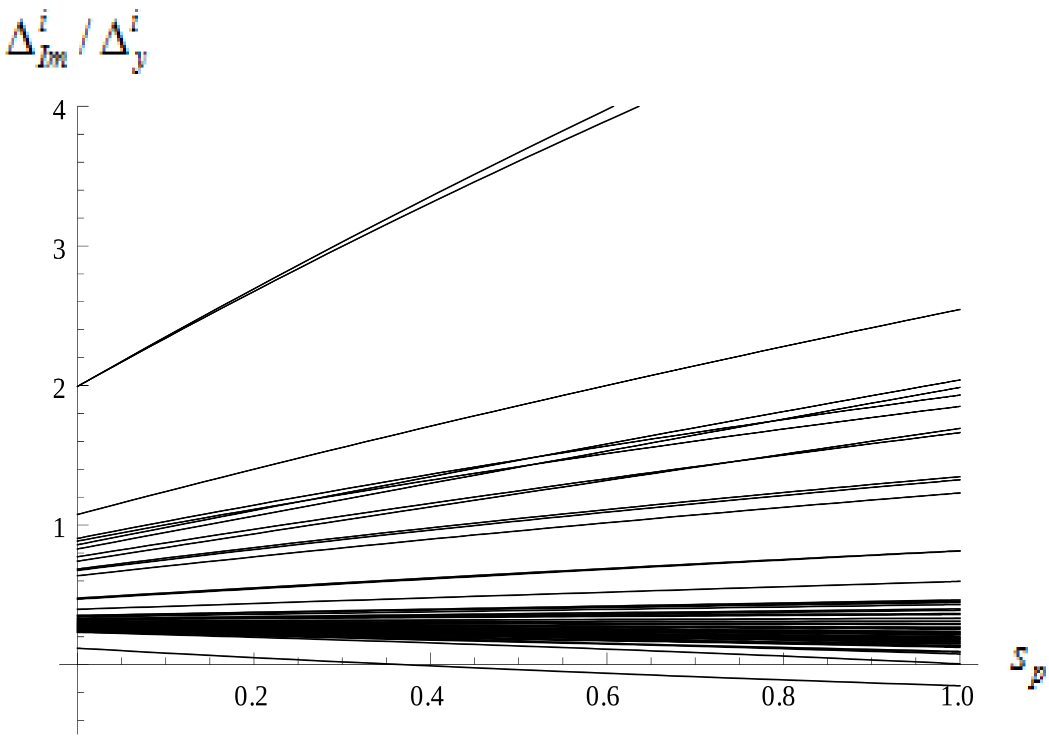



$\bar{\Delta}_y^i$
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.2
0.4
0.6
0.8
1.0
s_p

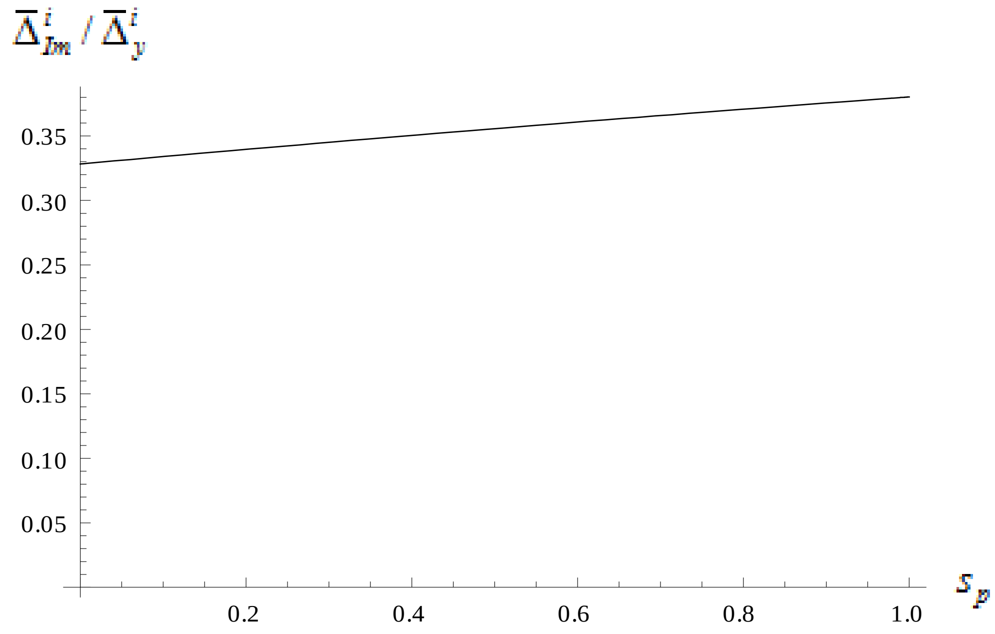

Δ_{Im}^i
1.0
0.5
0.2
0.4
0.6
0.8
1.0
s_p
0.5



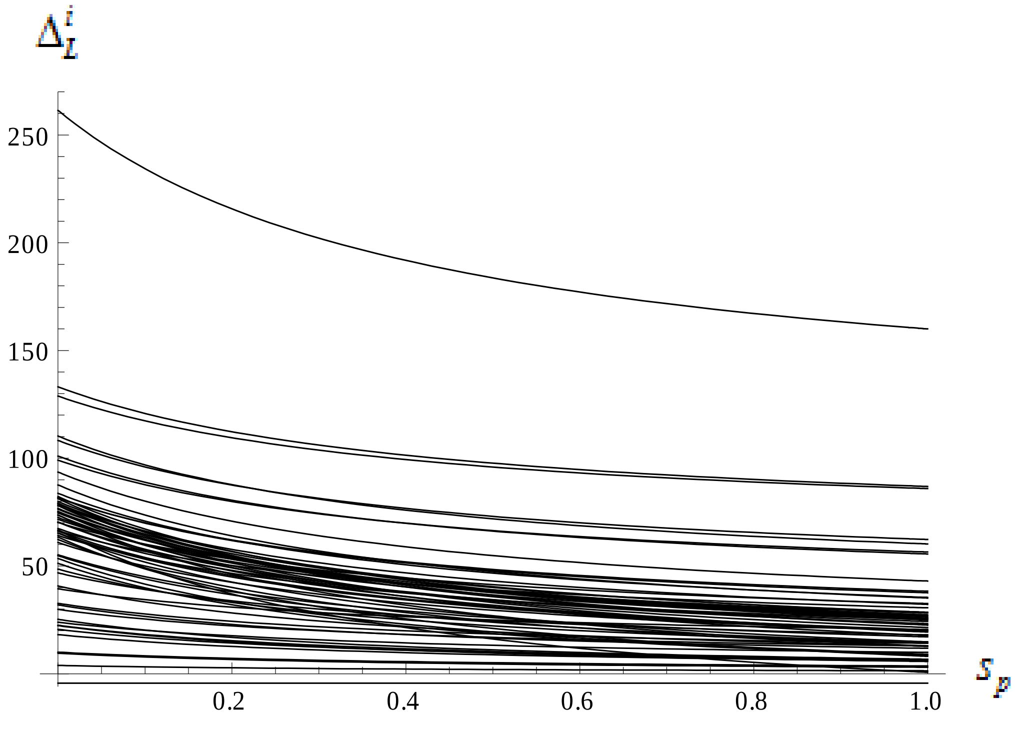
$\overline{\Delta}^{i}_{Im}$
1.0
0.8
0.6
0.4
0.2
0.0
0.2
0.4
0.6
0.8
1.0
s_p



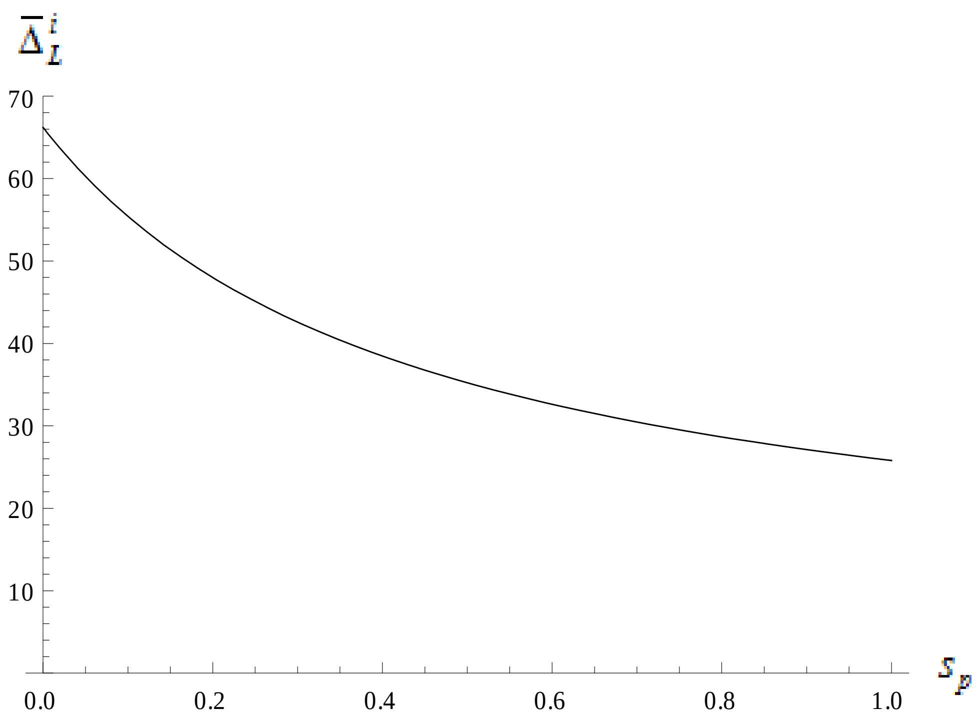
$\Delta^{i}_{Im} / \Delta^{i}_{y}$
4
3
2
1
0.2
0.4
0.6
0.8
1.0
s_p



$\overline{\Delta}^i_{Im} / \overline{\Delta}^i_y$
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.2
0.4
0.6
0.8
1.0
s_p

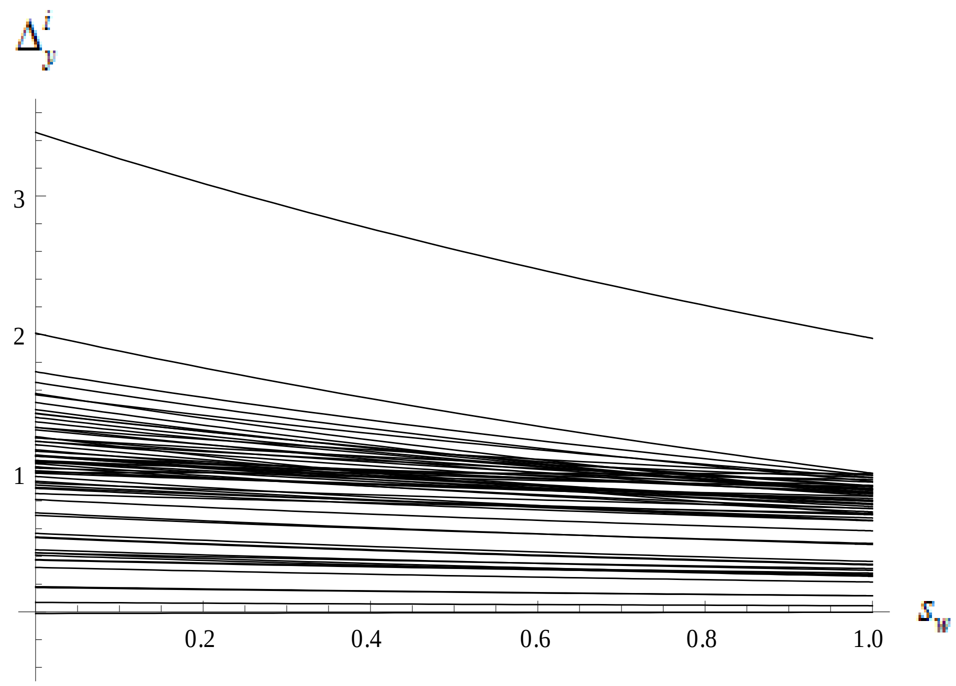


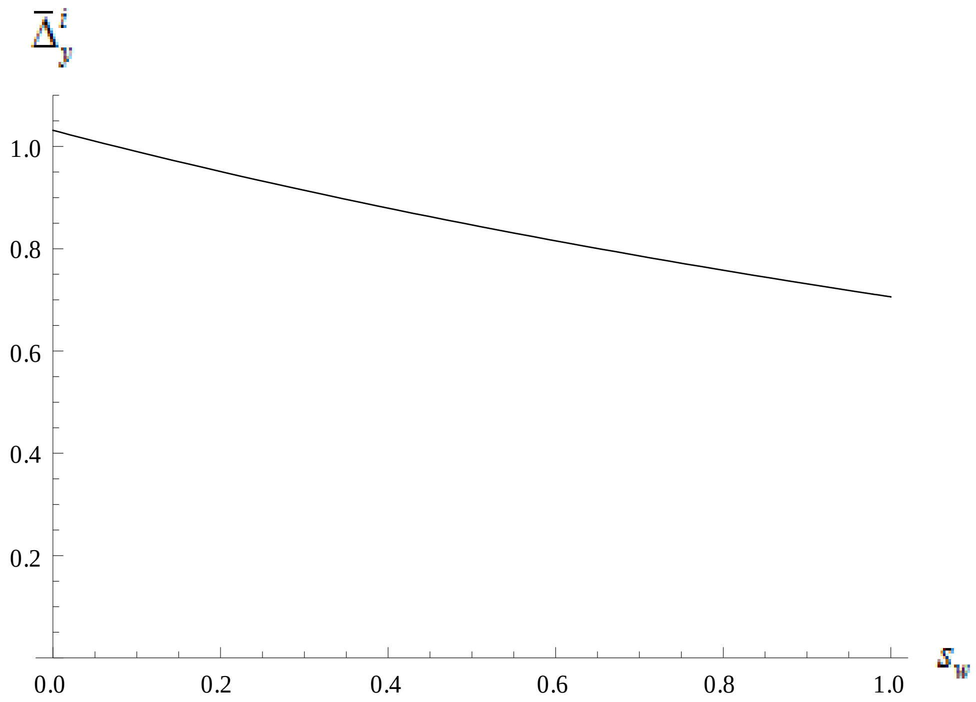
Δ^i_L
250
200
150
100
50
0.2
0.4
0.6
0.8
1.0
s_p

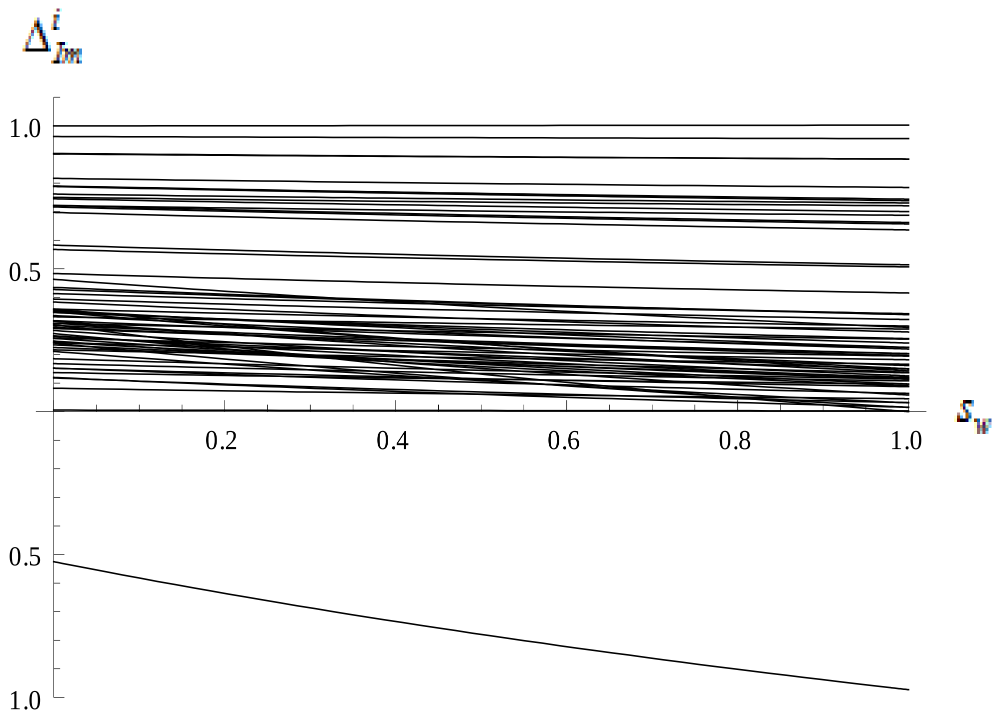


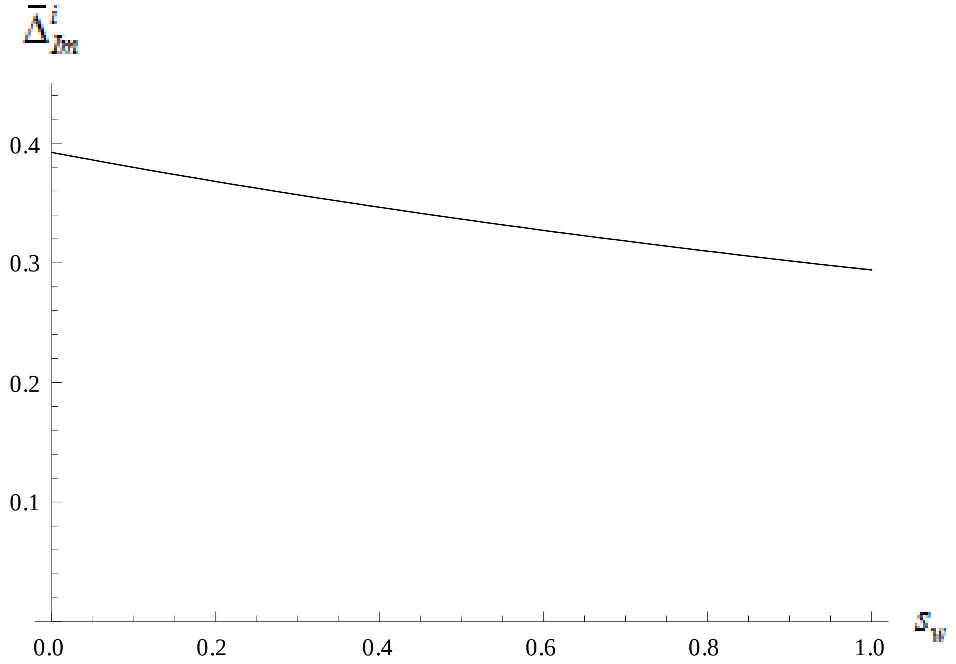
$s_w = 0$ and $0 \le s_p \le 1$

(a)

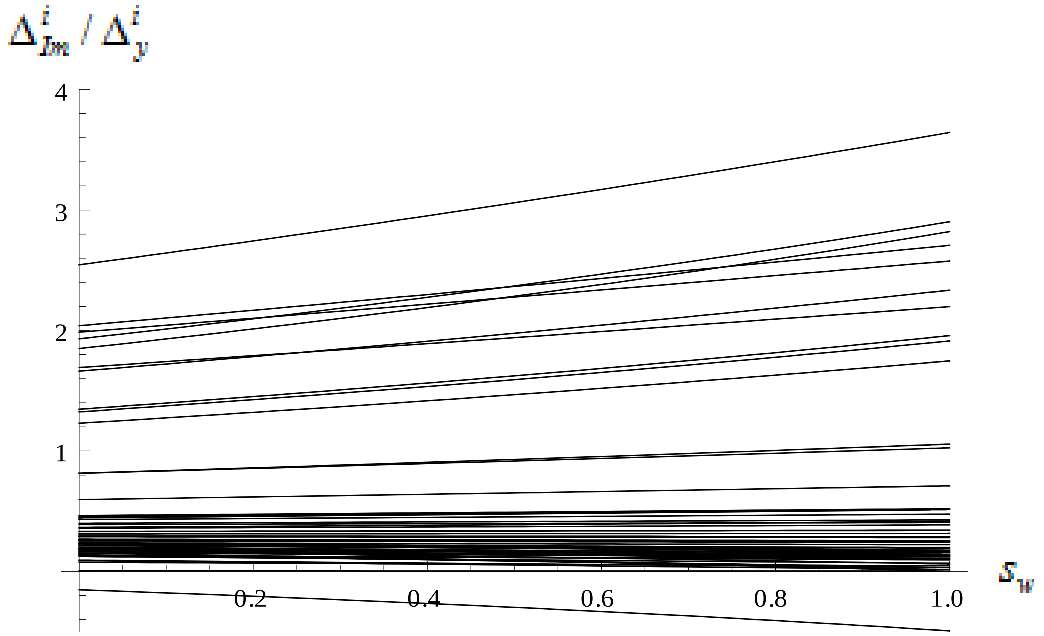



$\bar{\Delta}_y^i$
1.0
0.8
0.6
0.4
0.2
0.0
0.2
0.4
0.6
0.8
1.0
s_w

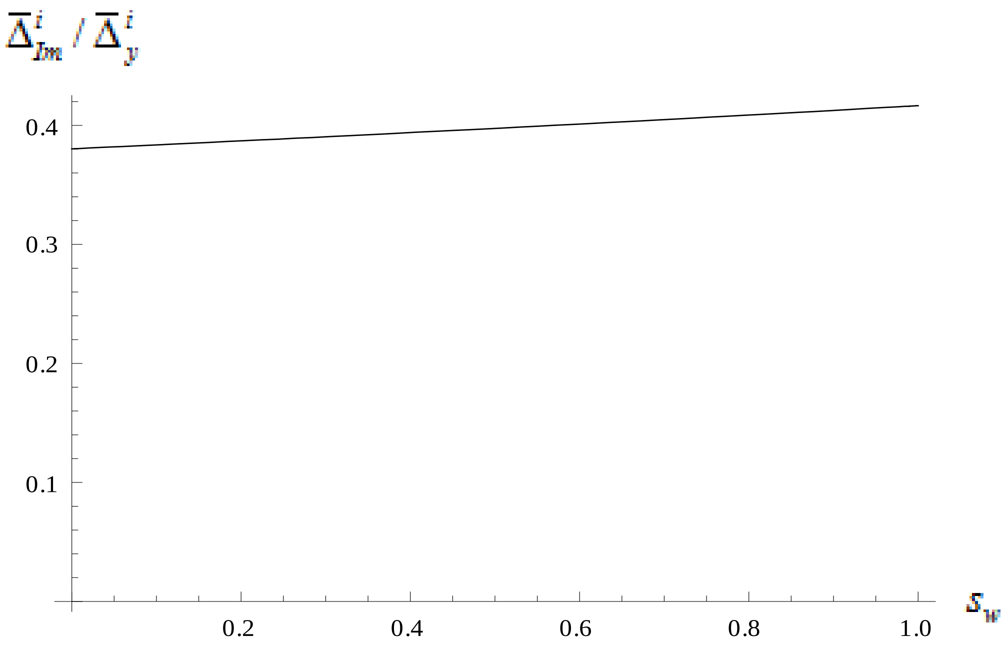

Δ_{Im}^i
1.0
0.5
0.2
0.4
0.6
0.8
1.0
s_w
0.5
1.0



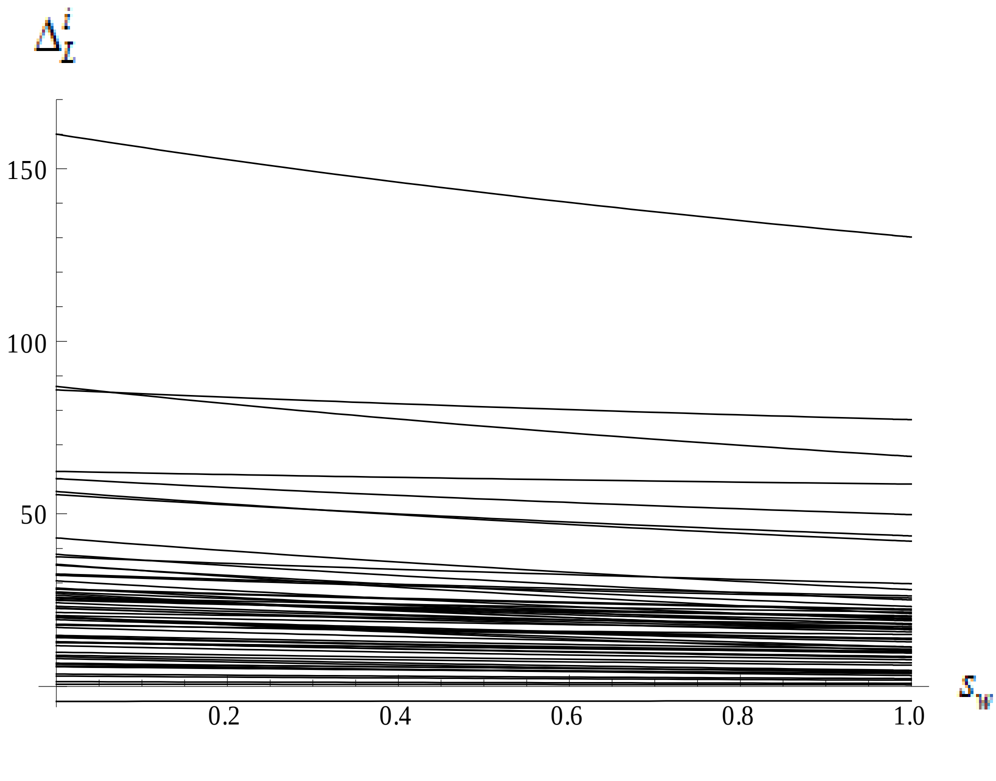
$\bar{\Delta}^i_{Im}$
0.4
0.3
0.2
0.1
0.0
0.2
0.4
0.6
0.8
1.0
s_w



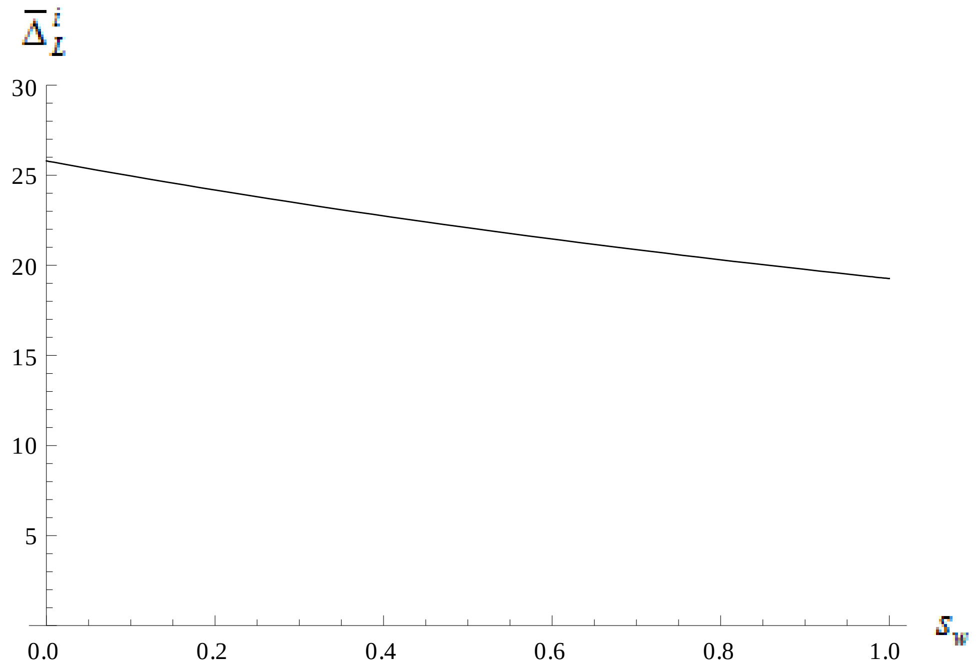
$\Delta^i_{Im} / \Delta^i_y$
4
3
2
1
0.2
0.4
0.6
0.8
1.0
s_w



$\overline{\Delta}^{i}_{Im} / \overline{\Delta}^{i}_{y}$
0.4
0.3
0.2
0.1
0.2
0.4
0.6
0.8
1.0
s_w

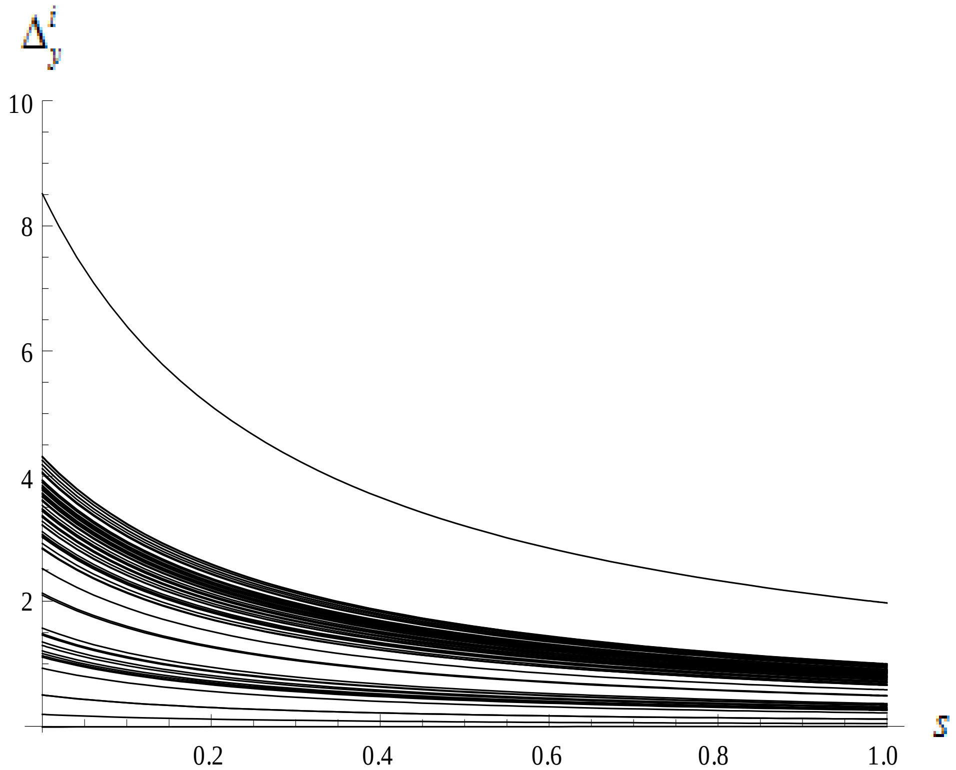


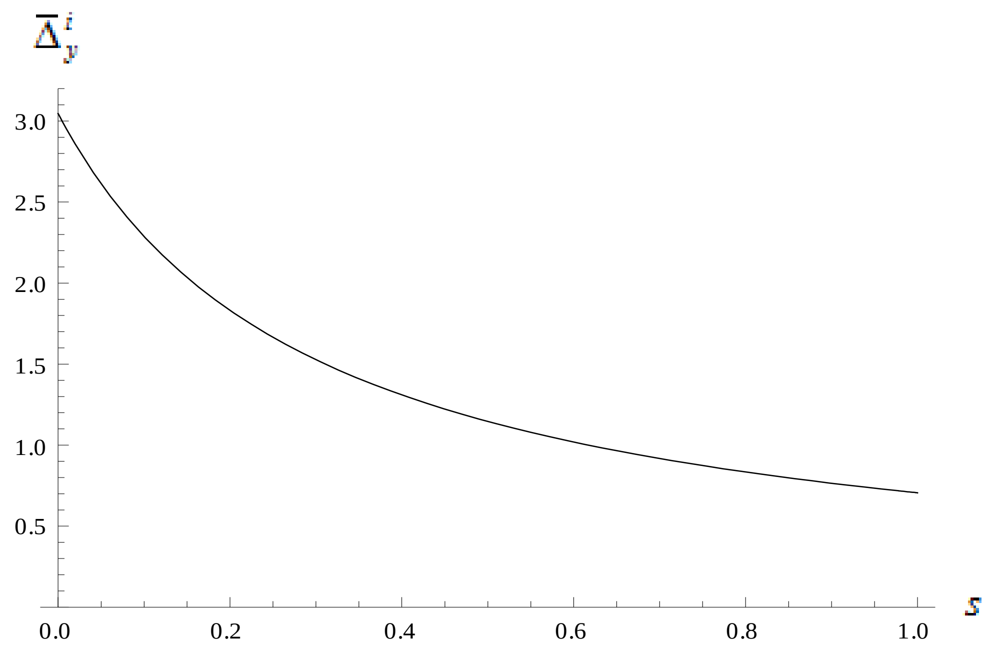
Δ^{i}_{L}
150
100
50
0.2
0.4
0.6
0.8
1.0
s_w

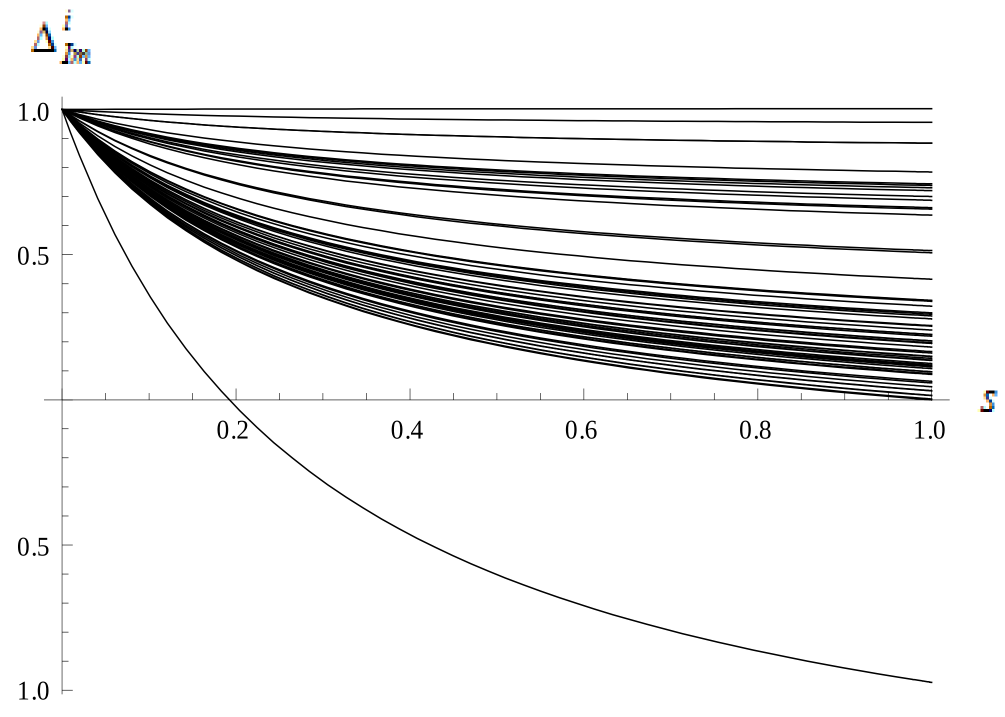


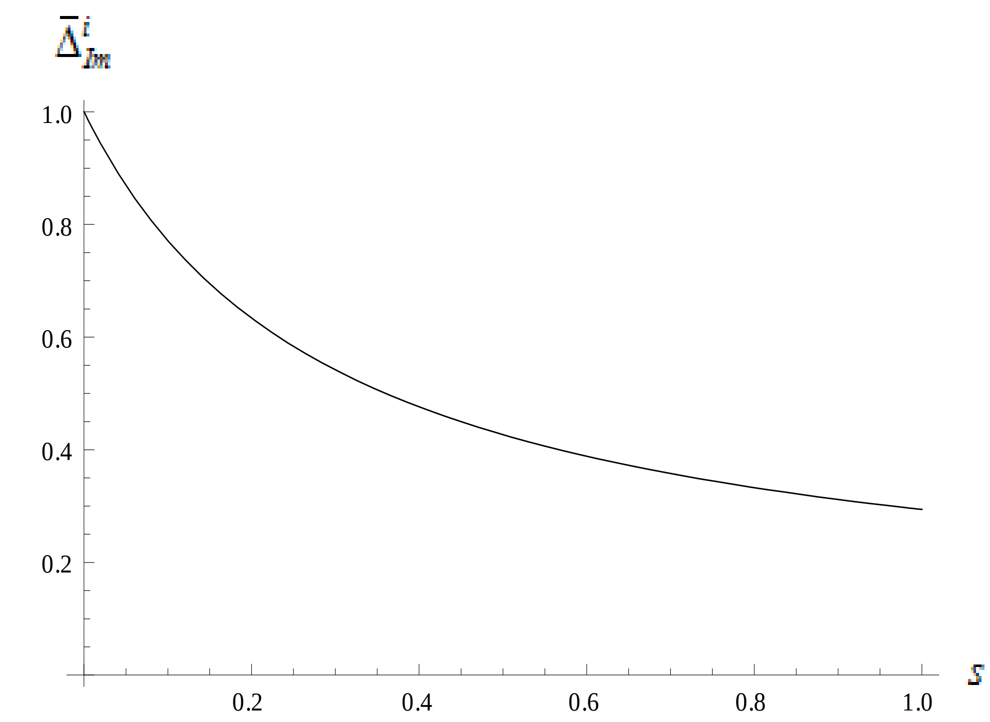
$0 \leq s_w \leq 1$ and $s_p = 1$

(b)

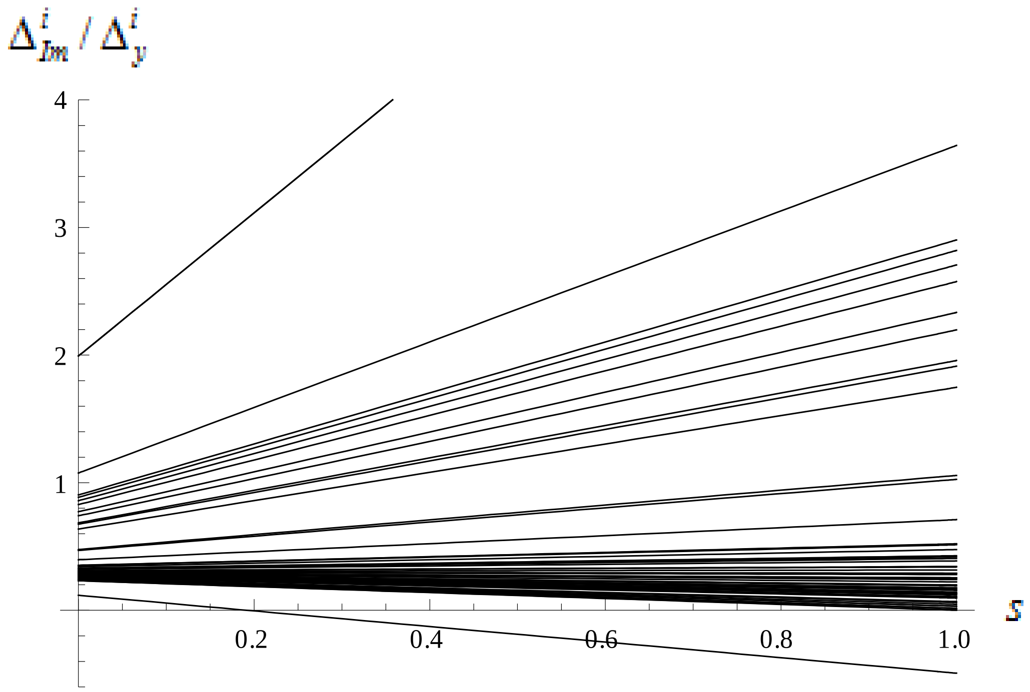



$\overline{\Delta}_y^i$
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.2
0.4
0.6
0.8
1.0
s

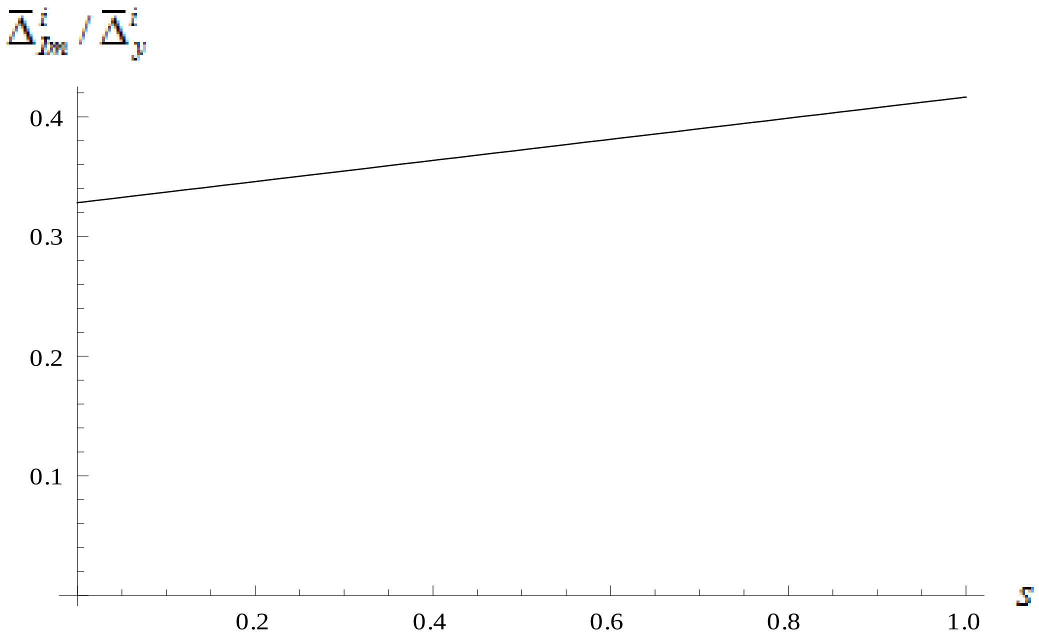

Δ_{Im}^i
1.0
0.5
0.2
0.4
0.6
0.8
1.0
s
0.5
1.0



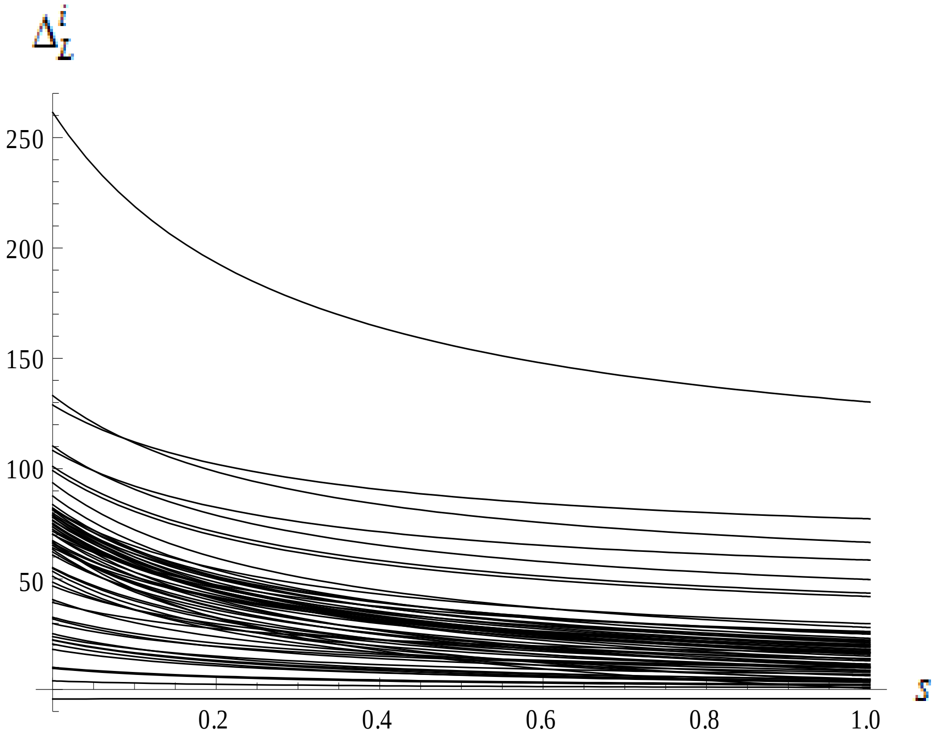
$\bar{\Delta}^i_{Im}$
1.0
0.8
0.6
0.4
0.2
0.2
0.4
0.6
0.8
1.0
s



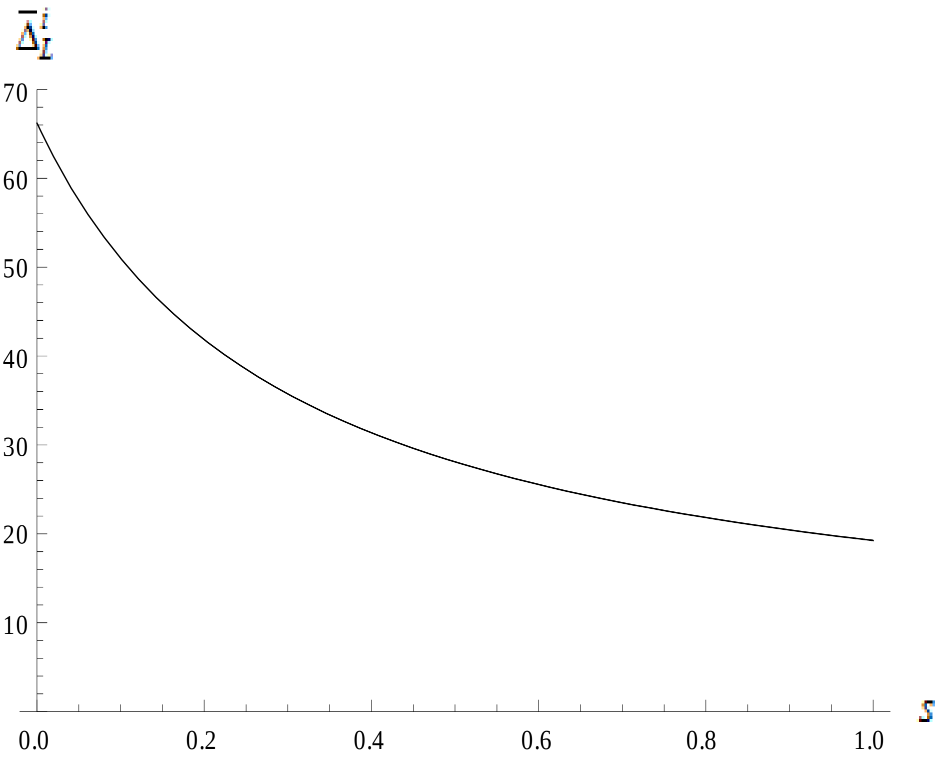
$\Delta^i_{Im} / \Delta^i_y$
4
3
2
1
0.2
0.4
0.6
0.8
1.0
s



$\overline{\Delta}^i_{Im} / \overline{\Delta}^i_y$
0.4
0.3
0.2
0.1
0.2
0.4
0.6
0.8
1.0
s



Δ^i_L
250
200
150
100
50
0.2
0.4
0.6
0.8
1.0
s



$s_w = s_p = s$

(c)

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