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A social accounting matrix for Iraq

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Abstract

This paper deals with the challenges associated with the generation of a social accounting matrix (SAM) in conditions where up-to-date measured data are particularly scarce and provides future researchers of economic systems with the first SAM for Iraq. It delivers a unique and updated countrywide database for use in modeling and policy analysis and applies this database to the empirical investigation into the expected effects of economic diversification in Iraq as stated in the recent Iraq National Development Plan 2013–2017.

Keywords: Social accounting matrix (SAM), Semi-input–output analysis, Iraq, Economic system

1 Background

Iraq is an oil-exporting economy with a GDP per capita of around 6500 USD and a low inflation rate (below 2 % in 2014), which attracts more than 1 billion dollars a year in foreign direct investment. However, the economy is strongly dependent on its oil sector, and almost a quarter of its population is poor (Table 1; Fig. 1). The increasing perception of oil dependency as a structural problem of the economy has recently led the international community to support efforts for an inclusive diversification of the economy (IMF 2015). To assess the expected quantitative effects of such a diversification effort on its economy, we need a social accounting matrix (SAM) for the country.

From their inception, SAMs have been instrumental in considering how different counterfactuals can affect the economy in terms of its total production, the participation of different sectors and production factors in its value added, its pattern of international trade, and the distribution of income among its institutions. SAMs record the transactions that take place in an (usually national) economy during a period of time (usually a year). As documented by Kehoe (1996), the origin of SAMs can be traced back at least until Quesnay's (1759) Tableau économique. Subsequent contributions from Kuznets (1937), Leontief (1941), and Meade and Stone (1941) paved the ground for Stone (1947) to set the main conventions for social accounting, embedded in the United Nations System of National Accounts that is used until present.

Against this historical background, the first SAM was generated by the Cambridge Growth Project (Stone et al. 1962) and was used to inform the Cambridge Growth model (Stone and Brown 1962), which in turn allowed investigating the implications

Table 1 Macro-indicators of Iraq—2014. *Source*: IMF Article IV (2015)

Indicator	2014
GDP (billion dollars)	223.5
Exports of goods (% of GDP)	37.4
Imports of goods (% of GDP)	30.9
Trade balance (% of GDP)	6.6
Foreign direct investment (billion dollars)	1.0
Consumer price inflation (%)	1.6
Population (millions, 2013)	33.4
GDP per capita (USD)	6520
Poverty rate (%, 2013)	23.0

Fig. 1 Sector shares in Iraq's value added 2012. *Source*: author's based on CSO (2013)
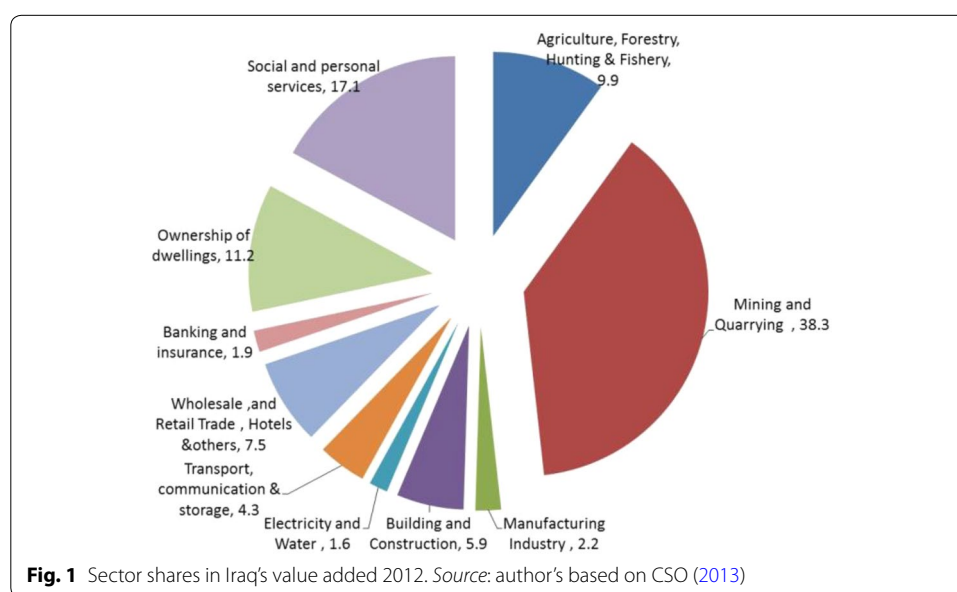
of different growth strategies in the UK with assumptions that diverged from the well-established neoclassical paradigm (Ramanathan 1982). As documented by Round (2003), SAMs were then "further developed and used to help address poverty and income distribution issues in developing countries" by many researchers. In particular, after the seminal work conducted by Pyatt and Thorbecke (1976) at the ILO, a large number of SAM-based multiplier studies followed, some of the earliest being for Sri Lanka (Pyatt and Round 1979), Botswana (Hayden and Round 1982), Korea (Defourny and Thorbecke 1984), Indonesia (Thorbecke et al. 1992) and, more recently, Ghana (Powell and Round 2000) and Vietnam (Tarp et al. 2002). In all of these studies, the aim has been to examine the nature of the multiplier effects of an income injection in one part of an economic system on the economic structure and the functional and institutional distribution in general and on the incomes of socioeconomic groups of households in particular. More recently, SAMs were extended to account for environmental issues, including for developing economy settings such as Indonesia (Resosudarmo and Thorbecke 1996), China (Xie 2000), and Brazil (Lenzen and Schaeffer 2004).

The economy of Iraq lacks a SAM, making it difficult—if not impossible—to assess in a quantitative way the expected countrywide effects of relevant counterfactuals such as the diversification strategy proposed by the recent Iraq National Development Plan 2013–2017 (IMoP 2013), or different scenarios regarding conflict in the country. This paper seeks to fill this gap. The novelty of the work is not on analytical methods, but on dealing with the challenges associated with a particular application of SAM generation in a context where up-to-date measured data are scarce. Our paper is organized in the following ways. In Sect. 2, we explain our approach to estimating the SAM for Iraq based on the best available information, which includes the use of sensitivity analysis to assess the role of uncertainty in the measurement of its underlying data, in Sect. 3, we analyze the structure of the Iraqi economy based on the resulting SAM, in Sect. 4, we consider the effects of the present government's economic diversification strategy via conducting a SAM-based semi-input–output analysis, and the final section concludes.

2 Methodology for generating the SAM for Iraq

2.1 Design of the SAM

The SAM for Iraq takes account of a variety of payments among its economic actors. As usual, the payments in the SAM go from columns to rows, as listed in Table 2. Consistently with the high relevance of oil extraction in the generation of value added in Iraq and the emphasis on agriculture of the Iraq National Development Plan 2013–2017 (IMoP 2013), the disaggregated set of production sectors in the SAM identifies crude oil separately from other production and provides significant detail on agriculture.[1] To allow future researchers of the Iraqi economic structure to conduct a detailed analysis of the functional distribution of income and allow looking into gender issues, the production factors are disaggregated into land, capital (separated into agricultural, oil, and rest), and labor, separated by gender and three skill levels: unskilled (who did not finish primary school), semiskilled (who finished primary but not secondary school), and skilled (who finished secondary school). Finally, to capture interestingly different characteristics of households' incomes and expenditures patterns and the particularly disfavored group of female-headed households in the country (UN 2013), we disaggregate households according to urban versus rural status, region of residence (*Baghdad*, *Kurdistan* and *other governorates*), female-headed household status, and quintiles of per capita expenditure. Given the reduced number of female-headed households in the sample, and the disadvantaged characteristic of this group as a whole, these households are split only according to region and urban status but not according to per capita expenditure quintile. While the presence of religious-related conflict in Iraq makes disaggregating households by religion (Shia, Sunni, and Kurd) potentially interesting as a devise to look into the differences in their pattern of incomes and expenses, the lack of availability of the needed data precludes us to do so.

2.2 Estimation of the SAM

To estimate the cells of the SAM, we follow a series of major steps that leads to an estimated macro-consistent and disaggregated SAM for a countrywide economy. Table 3

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[1] For a detailed description of the information used and steps followed and to access the final SAM for Iraq, please see Debowicz (2013).

Table 2 Schematic social accounting matrix (SAM) for Iraq. *Source:* author's elaboration

	Activities	Commodities	Labor	Capital	Land	Households	Government	Activity tax	Sales tax	Imports tax	Direct tax	Saving–investment	Rest of world
Activities		Supply (make matrix)											
Commodities						Final private consumption	Final public consumption					Investment	Exports
Labor	Value added by labor at factor cost												
Capital	Value added by capital at factor cost												
Land	Value added by land at factor cost												
Households			Payments from factors to households				Transfers from government to households				Remittances to households		
Government			Payments from factors to government					Activity tax	Sales tax	Imports tax			
Activity tax	Activity tax					Activity tax							
Sales tax		Sales tax					Sales tax						
Imports tax		Tariffs											
Direct tax						Direct taxes							

Table 2 continued

	Activities	Commodities	Labor	Capital	Land	Households	Government	Activity tax	Sales tax	Imports tax	Direct tax	Saving–investment	Rest of world
Saving–investment						Households savings	Government savings						Foreign savings
Rest of world		Imports	Payments from factors to nonresidents		Net payments from government to nonresidents								

Households split according to urban indicator, region (*Baghdad, Kurdistan* and *Other Governorates*), gender of household head and, for those headed by males, disaggregated according to quintile of per capita expenditure at market prices. This provides six female-headed and thirty male-headed household groups, totaling thirty-six household groups. Given the reduced number of female-headed households in the sample and the disadvantaged characteristic of this group as a whole, female-headed households were split only according to region and urban status but not according to per capita expenditure quintile

Table 3 Preliminary macro-SAM for Iraq 2011 (in trillions of Iraq Dinars). *Source*: author's estimation

	Act.	Comm.	Labor	Capital and land	Households	Government	Act. tax	Sales tax	Imports tax	Direct tax	Saving–investment	Rest of world	Total
Activities		186.9											186.9
Commodities					60.1	45.9					40.8	96.5	243.2
Labor	38.1												38.1
Capital and land	173.2												173.2
Households			38.1	51.2		10.7						0.1	100.1
Government				121.6			−24.4	−7.3	3.2	6.4			99.5
Activity tax	−24.4												−24.4
Sales tax		−7.3											−7.3
Imports tax		3.2											3.2
Direct tax					6.4								6.4
Saving–investment					33.6	37.8						−30.7	40.8
Rest of world		60.5		0.4		5.1							66.0
Total	186.9	243.2	38.1	173.2	100.1	99.5	−24.4	−7.3	3.2	6.4	40.8	66.0	

Each positive (negative) cell of the SAM represents a payment from the account in the column (row) to the account in the row (column). The data used to generate the macro-SAM are listed in the body of the document

shows the numerical macro-SAM for 2011 that we obtain for Iraq, in domestic currency. The resulting macro-SAM highlights that Iraq has twin (fiscal and external) surplus and a particular low share of private consumption in total domestic production (28.4 %). It also shows the significant activity and commodity subsidies implemented by the Iraqi government (24.4 and 7.3 trillions of Iraq Dinars, respectively).

We explicitly consider the higher uncertainty that is arguably present in the underlying data of the transactions matrix. As a recent study mentions, "in general practice, only a minor proportion of authors actually add uncertainty analysis to their input–output case studies" (Lenzen et al. 2010, p. 44). Given information on the uncertainty of the components of the SAM and using simulation methods, researchers are able to provide estimates of the uncertainty attached to their cells. While the available data for Iraq are silent in regard to measured uncertainty, given that the underlying input–output matrix dates back to 1988, the uncertainty associated with the transactions matrix is arguably above the rest of the information underlying the SAM. Reflecting this, we carry out sensitivity analysis on the standard deviation of the cells in the transaction matrix. In order to assess the role that the higher uncertainty on the transactions matrix of Iraq may be playing in the generation of the resulting SAM, and given the absence of data on the standard deviation of the point estimations publicly provided, we conduct sensitivity analysis. In particular, we assume that the standard deviation of the error with which the data in the transaction matrix are observed is much higher than that of the rest of the matrix. We increase the standard deviation of the additive errors for the cells located in the transaction matrix first by 50 % and then by 100 %. As shown in Figs. 2, 3, and 4, while this experiment does increase the balancing changes in the transactions matrix, the increases are rather small, providing further evidence of the validity of the resulting matrix.

3 Structure of the Iraq economy and multiplier analysis

The structure of the Iraq economy in terms of its aggregate demand composition—listed in Table 4—confirms the stylized facts commented at the beginning of the analysis in light of the macro-SAM. Iraq export value exceeds substantially its import value, leading to a significant trade superavit of 36 trillions of Iraq Dinars, or 19.3 % of its GDP (gross domestic product) at market prices. The participation of private consumption in GDP is only 46.8 %, a reflection of the high relation between the fiscal and current account surplus, on the one hand, and the gross domestic product, on the other hand. Table 4 also shows the sizable indirect subsidies existent in the Iraqi economy, which exceed indirect taxes in 25 trillions of Iraq Dinars, that is, more than 13 % of its GDP at market prices.

The domestic production of Iraq is clearly dominated by oil, leaving agriculture and other industry with relatively low participation in the generation of domestic value added (Table 5). The production of crude oil accounts for almost half of the value added of the economy (47.9 %). Almost all the crude oil that is extracted in Iraq is exported (99.8 %), allowing the sector to explain the vast majority of the country's export value (98.0 %), as well as the main source of finance for the public sector.[2] Around 40 % of the value added in the country is generated by (non-traded) services, a significant part of

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[2] The oil sector in Iraq is characterized by the preeminence of the state (Iraq National Development Plan 2013–2017, p. 59).
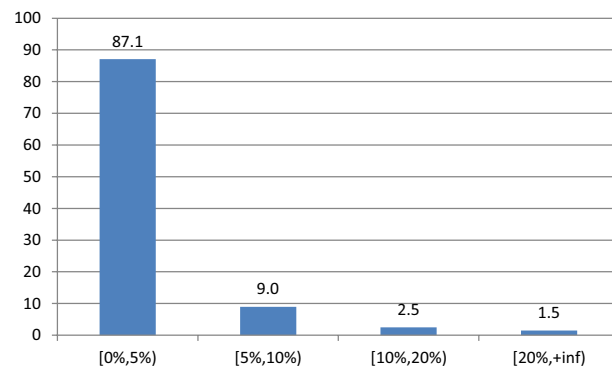
Fig. 2 Histogram of absolute value of percentage differences generated in the transactions matrix by cross-entropy balancing process. *Source*: author's based on Table A5. Heights reflect number of cells changing as stated in category as percentage of total nonzero cells in the transactions matrix (201). Percentages are rounded at one decimal point

Fig. 3 Histogram of absolute value of percentage differences generated in the transactions matrix by cross-entropy balancing process—SDs in additive errors increased 50 %. *Source*: author's calculation. Heights reflect number of cells changing as stated in category as percentage of total nonzero cells in the transactions matrix (201). Percentages are rounded at one decimal point
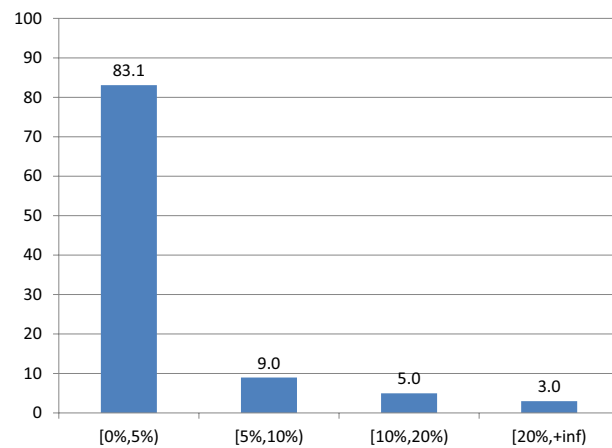

Fig. 4 Histogram of absolute value of percentage differences generated in the transactions matrix by cross-entropy balancing process—SDs in additive errors increased 100 %. *Source*: author's calculation. Heights reflect number of cells changing as stated in category as percentage of total nonzero cells in the transactions matrix (201). Percentages are rounded at one decimal point
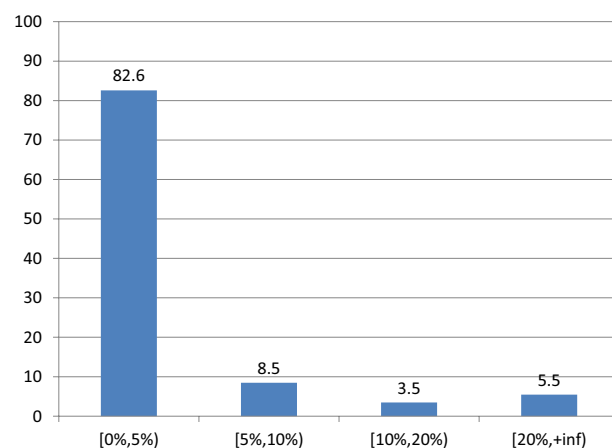
Table 4 Gross domestic product and aggregate demand components (trillions of Iraq Dinars and percentage of GDP). *Source*: **author's elaboration based on social accounting matrix for Iraq 2011**

	Trillions of Iraq Dinars	Share of GDP at market prices
Domestic absorption	150.3	80.7
Private final consumption	87.2	46.8
Fixed investment	37.7	20.2
Public final consumption	25.5	13.7
Exports	96.5	51.8
Imports	−60.5	−32.5
Gross domestic product at market prices	186.3	100.0
Net indirect taxes	−25.0	−13.4
Gross domestic product at factor cost	211.3	113.4

Domestic absorption equals the sum of private final consumption, fixed investment, and public final consumption. Gross domestic product at factor cost equals gross domestic product at market prices minus net indirect taxes, which in the case of Iraq are negative, given that indirect subsidies exceed indirect taxes. Private (public) final consumption captures the sum of the payments from households (government) to commodities in the SAM. Fixed investment (exports) captures the sum of the payments from the saving–investment (rest of world) account to commodities in the SAM. Imports capture the sum of the payments from the commodities account to the rest of world account in the SAM. Net indirect taxes captures the sum of the payments (some of which are negative) from the sales tax and tariff accounts to the government account

Table 5 Economic structure: sector shares in value added, domestic absorption, exports and imports. *Source*: **author's elaboration based on social accounting matrix for Iraq 2011**

Sector	Value added	Absorption	Export	Import	Export intensity	Import intensity
Crops	9.1	16.3	0.1	11.7	0.003	0.131
Livestock	0.6	4.0		3.0		0.139
Crude	47.9	0.0	98.0		0.998	
Other mining	1.4	2.3	0.1	0.1	0.012	0.005
Oil refining	0.5	1.1	0.8	3.9	0.349	0.640
Processed food	0.3	14.4		16.5		0.207
Other manufacturing	1.4	13.7	0.9	64.0	0.112	0.849
Electricity and water	1.7	1.8		0.1		0.015
Construction	5.3	7.8		0.7		0.017
Trade	6.8	5.1				
Transport	3.7	5.9				
Financial services	2.0	1.3				
Housing	7.9	5.5				
Public services	11.5	20.8				
Total	100.0	100.0	100.0	100.0	0.252	0.182

Domestic absorption is the sum of domestic intermediate consumption plus domestic final consumption, domestic investment, and domestic public consumption. Export intensity: ratio between export and output value. Import intensity: ratio between import and domestic absorption value

which is provided by the public services. In contrast, agriculture and industry generate less than 15 % of the domestic value added and have negative international trade positions.

As listed in Table 6, the share of capital in domestic income is nearly three times that of labor (73.3 vs. 24.0 %), leaving labor with a share of domestic income that is strikingly low at international level (Karabarbounis and Neiman 2013). This high participation of capital in the domestic income is explained by the combination of a high participation of

Table 6 Composition of value added (percentages). *Source*: **author's elaboration based on social accounting matrix for Iraq 2011**

	Labor	Capital	Land	Total
Agriculture	62.0	9.7	28.3	100.0
Crops	64.3	7.1	28.6	100.0
Livestock	27.4	48.4	24.2	100.0
Industry	3.2	96.8		100.0
Crude	0.9	99.5		100.0
Other mining	0.7	99.3		100.0
Oil refining	15.8	84.2		100.0
Processed food	48.1	51.9		100.0
Other manufacturing	84.1	15.9		100.0
Services	42.0	58.0		100.0
Electricity and water	61.6	38.4		100.0
Construction	60.5	39.5		100.0
Trade	10.1	89.9		100.0
Transport	37.0	63.0		100.0
Financial services	9.0	91.0		100.0
Housing		100.0		100.0
Public services	85.5	14.5		100.0
Total	24.0	73.3	2.7	100.0

Each cell is informed by the ratio between the payments in the SAM from the sector in the row to the factor in the column and those from the sector in the row to all the production factors present in the SAM (labor, capital, and land)

mining in domestic value added and a high share of capital in the distribution of mining income, where only half of a percentage point of value added is used for remunerating labor. The heterogeneity in the value-added share of labor among the Iraqi sectors is significant, going from 0.5 to 07 % (oil and other mining) to 64.3 % (agricultural crops).

Iraq has a relatively urbanized population, with 21.5 out of 30.3 million inhabitants, or 71 %, located in urban areas (Table 7), and 7.1 million inhabitants (23.5 %) residing in Baghdad. Households in Iraq have 6.9 inhabitants on average. This size is even larger in poor and rural areas: The household size in the bottom quintile of the rural area reaches 9.5 inhabitants on average. Households in Baghdad and Kurdistan are relatively small (6.4 and 6.1 inhabitants, on average). Per capita income is significantly higher in the urban areas: Urban inhabitants earn on average 50 % more than their rural counterparts. Inequality within urban and rural areas is also high. The top per capita income quintile of the urban (rural) population gets 3.9 (3.7) times the figure for their bottom quintile counterparts.

Public transfers account for a measurable fraction of the income of the households, especially in the female-headed ones, where they explain nearly 18 % of total household income. More than three-fourth of household income (78.2 %) is earned by urban households (last column of Table 8). Compared to rural households, urban households get significantly higher per capita income (as shown above), have a higher share of capital and skilled labor income (especially in the case of the wealthier households), and a lower share of land and unskilled labor income. Households in Kurdistan have a relatively high share of capital and a low share of public transfers in their income in comparison with their non-Kurdistan counterparts.

Table 7 Income and population by representative household group. *Source*: author's elaboration based on social accounting matrix for Iraq 2011 and population data in IHSES 2007

	Income (trillion ID per year)	Population (millions)	Average household size	Per capita income (thousand ID per year)
Rural female headed	1.4	0.6	5.7	2496
Rural quintile 1	6.1	3.9	9.5	1576
Rural quintile 2	4.3	1.9	7.6	2235
Rural quintile 3	3.5	1.3	6.9	2808
Rural quintile 4	3.0	0.8	6.1	3816
Rural quintile 5	2.5	0.4	5.2	5821
Urban female headed	8.6	2.3	5.9	3693
Urban quintile 1	6.5	3.6	9.0	1827
Urban quintile 2	9.5	4.2	7.7	2286
Urban quintile 3	12.2	4.3	7.0	2875
Urban quintile 4	14.8	3.9	6.0	3778
Urban quintile 5	23.2	3.3	5.0	7097
Urban	74.8	21.5	6.6	3485
Rural	20.8	8.8	7.7	2362
Baghdad	22.4	7.1	6.4	3162
Kurdistan	21.0	3.9	6.1	5403
Other governorates	52.2	19.3	7.3	2703
Total	95.6	30.3	6.9	3158

The income column was generated by the sum of the incomes received by each of the household groups and their aggregates (e.g., urban households). The population for each group of households is provided by multiplying the row vector of number of individuals in the households by the column vector of expansion factors for each household. Average household size obtained dividing population by number of households in each household group, accounting for expansion factors. Per capita income (thousand ID per year) obtained dividing income (trillion ID per year) by population (millions) and multiplying by 10^{-3}

Controlling for the income level, the share of food (crops, livestock and processed food) in the total consumption value of the households tends to be higher in rural areas (for the same income quintile), and the share of services is systematically higher in urban areas (Table 9). Our SAM suggests that the Engel law is valid for Iraq: As we move into household groups with higher per capita expenditure, the share of food in total expenditure tends to go down, both in rural and urban areas.

Finally, even when the number of production factors in the SAM is significantly below the number of sectors and households, the SAM does capture factor income and expenditure patterns that are quite different among the ten production factors present in the SAM. As Fig. 5 shows, there are particularly high differences in the composition by source of factor earnings in the oil and the public services sector: The oil-specific capital stock derives all its income from the oil sector, while other factors (e.g., agricultural capital) have no income in that sector; most of the income (81.5 %) of the (few) skilled women comes from work in the public sector, while other factors earn no income in this sector (e.g., oil-specific capital). As Fig. 6 suggests, the allocation of factor expenditures among institutions is also quite different among factors. Given that the income earned by oil capital is captured by the government, any shock affecting this sector will tend to change significantly the income distribution among factors and among institutions. The mentioned differences in factor income and expenditure patterns suggest that the present SAM is not particularly affected by distribution invariance (Pyatt and Round 2012).

Table 8 Composition of household income (percentages). *Source: author's elaboration based on social accounting matrix for Iraq 2011*
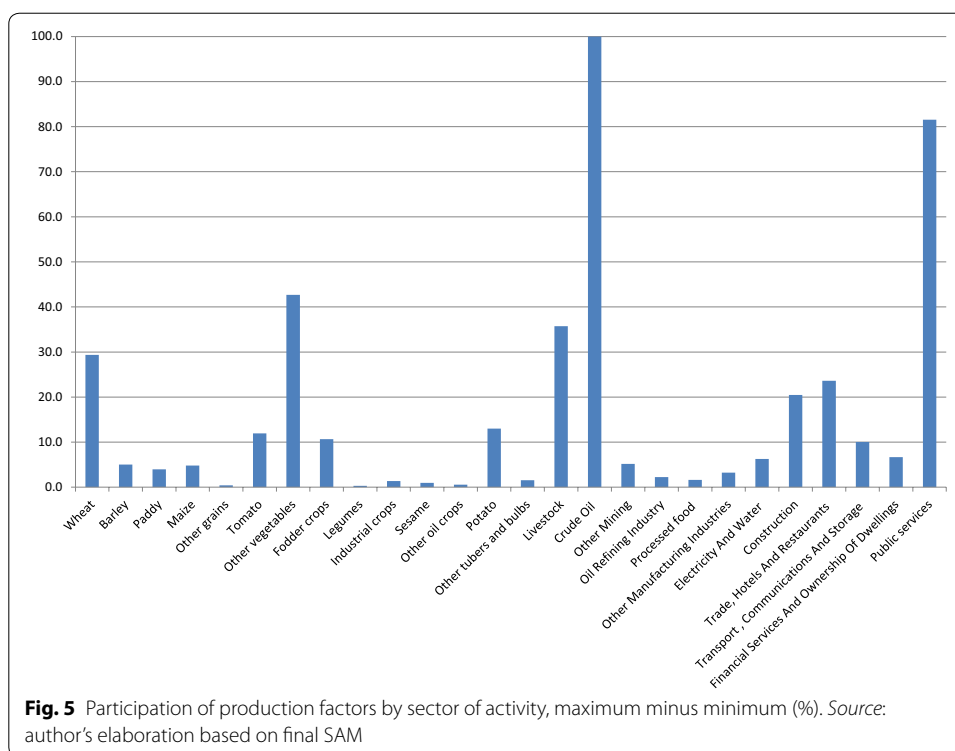
	Labor unskilled male	Labor unskilled female	Labor semi-skilled male	Labor semi-skilled female	Labor skilled male	Labor skilled female	Capital agricultural	Capital rest	Land	Gov.	Remittances	Total
Rural female headed	13.0	5.6	20.0	0.8	3.7	2.4	4.8	16.2	14.8	18.4	0.3	100
Rural quintile 1	14.6	1.1	24.9	0.1	7.6	0.6	7.6	12.2	21.5	9.7	0.1	100
Rural quintile 2	12.6	0.5	19.9	0.2	11.5	1.4	7.3	14.8	21.1	10.6	0.1	100
Rural quintile 3	15.4	0.4	15.6	0.1	13.4	1.5	6.4	15.2	19.7	12.2	0.1	100
Rural quintile 4	8.6	0.0	15.3	0.2	10.0	1.5	8.5	17.4	26.6	11.7	0.1	100
Rural quintile 5	21.6	0.8	15.8	0.1	8.5	1.6	5.0	21.9	15.7	9.0	0.1	100
Urban female headed	11.3	4.2	17.2	2.5	10.9	9.3	0.2	24.7	1.0	18.5	0.2	100
Urban quintile 1	20.0	0.7	29.2	0.5	14.7	0.8	0.4	20.5	1.3	11.8	0.1	100
Urban quintile 2	13.7	0.6	29.6	0.5	14.3	2.2	0.2	24.0	0.9	13.9	0.1	100
Urban quintile 3	10.4	0.3	23.3	0.5	16.5	3.6	0.6	28.9	2.0	13.8	0.1	100
Urban quintile 4	8.2	0.5	18.9	0.6	20.3	6.2	0.2	30.7	1.0	13.2	0.1	100
Urban quintile 5	11.5	0.4	12.1	0.7	18.4	6.8	1.1	34.8	3.6	10.2	0.2	100
Urban	11.7	0.9	19.6	0.8	16.8	5.3	0.6	29.2	2.0	13.0	0.1	100
Rural	14.2	1.0	19.5	0.2	9.6	1.3	6.9	15.5	20.7	11.1	0.1	100
Baghdad	8.5	0.4	24.1	0.8	18.7	6.1	0.4	25.4	1.4	14.2	0.1	100
Kurdistan	22.0	2.4	13.6	1.2	10.7	3.7	1.6	30.4	4.8	9.4	0.2	100
Other governorates	9.9	0.6	20.0	0.4	15.5	4.1	2.8	24.9	8.6	13.1	0.1	100
Total	12.2	0.9	19.5	0.7	15.2	4.5	2.0	26.2	6.1	12.6	0.1	100

Each cell (except those in the last column) represents the share of income of the household group in the row heading coming from each of the factor and non-factor sources in the column headings. The final column provides the participation of the household group in the row heading in the total household income of Iraq

Table 9 Composition of household expenditure (percentages). *Source:* author's elaboration based on social accounting matrix for Iraq 2011

Commodity	Rural								Urban								Region			Total
	Female headed	Quintile					Total		Female headed	Quintile					Total		Baghdad	Kurdistan	Other governorates	
		1	2	3	4	5				1	2	3	4	5						
Crops	15.7	18.3	14.7	13.1	11.2	8.5	14.4		9.9	15.5	13.1	11.5	9.9	6.9	10.2		10.5	8.6	12.4	11.1
Livestock	21.4	27.2	22.8	19.8	17.8	13.0	21.8		15.4	23.0	20.3	18.1	15.7	10.9	16.0		16.2	12.0	19.6	17.2
Processed food	11.0	12.8	12.2	12.6	10.8	8.9	11.8		10.8	11.9	12.0	12.0	11.3	7.8	10.5		13.0	9.0	10.5	10.8
Other manufacturing	10.8	10.1	11.5	12.7	13.0	12.2	11.5		10.9	9.6	10.8	11.5	12.4	12.0	11.5		10.0	12.7	11.7	11.5
Electricity and water	1.8	1.5	1.6	1.8	1.9	2.1	1.7		2.3	1.8	2.0	2.2	2.5	2.3	2.2		2.6	2.1	1.9	2.1
Trade	1.5	1.2	1.4	1.9	2.2	2.5	1.7		2.4	1.3	1.7	1.8	2.4	3.8	2.5		1.8	3.5	2.1	2.3
Transport	10.2	5.1	8.9	11.9	17.8	29.3	11.9		9.2	3.7	5.2	7.4	10.4	19.9	11.3		7.7	19.2	10.0	11.4
Financial services	1.4	0.2	0.4	0.6	0.8	1.2	0.6		1.3	0.4	0.3	0.4	0.7	1.7	0.9		0.4	1.9	0.7	0.9
Housing	23.9	21.2	23.9	22.7	21.3	19.7	22.0		34.8	30.7	32.2	32.5	32.0	31.5	32.2		35.1	27.7	28.6	29.9
Public services	2.3	2.3	2.6	2.8	3.2	2.7	2.6		2.9	2.3	2.5	2.5	2.8	3.2	2.8		2.7	3.3	2.6	2.8
Total	100	100	100	100	100	100	100		100	100	100	100	100	100	100		100	100	100	100

Each cell represents the share of expenditure of the household group in the row headings (and their aggregates) that is spent into each of the commodities in the row headings

Fig. 5 Participation of production factors by sector of activity, maximum minus minimum (%). *Source*: author's elaboration based on final SAM

To finalize the observations on the SAM, we provide its associated multipliers, jointly accounting for direct, indirect, and induced effects. For this, consistently with the following section, which focuses on the National Development Plan of Iraq, we split the economy into agriculture, crude oil, other industry, and services (Table 10). The income multiplier of oil is the highest one. Since this multiplier reflects the ratio of the change in total income earned by workers in all sectors of the economy to the change in earnings of workers directly engaged in the extraction of crude oil, what this is actually capturing is the relatively low share of labor earnings per unit of output in the extraction of crude oil, a stylized fact of the sector. More interestingly, the value-added multiplier of other industry is not only very high in absolute terms (11.3), but also more than double than the value-added multiplier of any other sector, making it an interesting avenue for the diversification of the economic structure that the present National Development Plan of Iraq has in its core.

4 The 2013–2017 Iraq National Development Plan

With significant support from international organizations and bilateral donors, the Government of Iraq has recently designed a National Development Plan for 2013–2017. In its strategic document (IMoP 2013), the Government of Iraq diagnoses the country as "a revenue-generating economy dependent on a single resource, oil" (page v) and commits "to expanding its base to depend on other activities" (page v), "with industry, energy, agriculture and tourism as the main drivers and pillars of development" (page 58). The Plan is silent regarding the effects of relying on these drivers, either on the resulting production structure once the interrelations among the production sectors are taken into
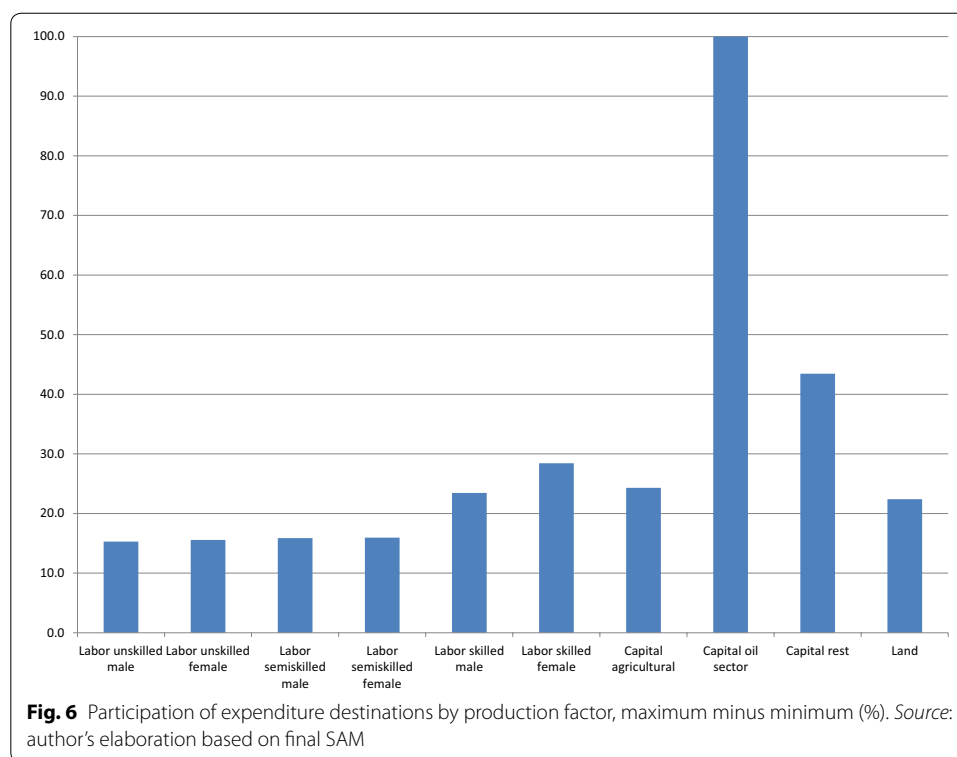
Fig. 6 Participation of expenditure destinations by production factor, maximum minus minimum (%). *Source*: author's elaboration based on final SAM

Table 10 Type 2 multipliers for the social accounting matrix for Iraq. *Source*: **author's calculation**

Sector	Multiplier		
	Output	Value added	Income
Agriculture	5.2	4.7	4.0
Crude oil	2.5	1.7	50.5
Other industry	5.7	11.3	15.9
Services	4.6	2.9	3.0

account, or on incomes of different household groups. Relying on a semi-input–output model, with constrained linear relationships among quantities in the model and fixed prices, and where the supply-constrained sectors are identified as the tradable goods,[3,4] we consider these effects in light of the estimated SAM, providing potentially valuable information on the economic effects of the Plan.

Considering the size of the economy of Iraq, we simulate a monetary injection of 20 trillion Iraq Dinars at constant prices of 2011—i.e., slightly less than 10 % of GDP—to the economy. Reflecting the driving sectors in the Plan, we run four simulations, with the injection: (1) focused on agriculture; (2) focused on oil extraction; (3) focused on

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[3] Namely: Wheat, barley, paddy, maize, other grains, other vegetables, fodder, industrial crops, oil crops, tubercles, livestock, crude oil, other mining, oil refining, food processing, other manufacturing, construction, and electricity.

[4] The inclusion of relative price changes potentially generated by these simulations would require setting up a computable general equilibrium (CGE) model and is out of the scope of the present research.

industry (excluding crude oil extraction); and (4) combining the mentioned sectors.[5,6] In each sector of the SAM, the injection is directed either to domestic supply (for supply-constrained sectors) or to net exports demand (for supply-flexible sectors), with the latter affecting in turn the sectors' endogenous supply. We consider two policy-relevant questions in particular: (1) is one of these injections particularly good at broadening the production base, as measured by the size of the non-oil extraction sector? and (2) is one of these injections particularly good at improving the income of the more disfavored—in terms of their original per capita income—groups of households?

Table 11 shows the resulting value added for broad sectors, both in terms of value (trillions of Iraq Dinars) and in terms of share of total value added (percentage), and Table 12 shows the resulting income changes for aggregated household groups, as percentage of their pre-simulated income. We find that, while the injection in the oil extraction sector is the one that achieves the maximum increase in the economy's value added (19.7 trillion of Iraq Dinars), due to the weak backward linkage of this sector with unconstrained-supply sectors in the domestic economy, it ends up significantly reducing the share of the non-oil sector in the economy (by 4.1 % points, from 52.1 to 48.1 %), against the diversification goal of the Plan. In contrast, the agricultural and the industrial injections result in a significant increase in the production of services (particularly, domestic trade services increase by 19.1 % with the agricultural-focused injection and 25.8 % with the industry-focused injection, and domestic banking services increase by 8.6 and 10.8 %, respectively[7]) and hence result in a significant final increase in the share of the non-oil sector in the economy's value added (3.1 % points). The industry-focused simulation leads to a relatively larger service sector, reflecting relatively high direct requirements of non-tradable services by the industrial sector. The combined injection leads to a significant increase in the value added of the oil sector (14.5 %), which has relatively low input requirements from other sectors. The increase in the value added of the non-oil sector, which relies to a larger extent on imports to satisfy its production requirements, is significantly smaller (3.5 %). The results suggest then that a combined injection as the one suggested by the National Development Plan runs the risk of ending up generating a significant reduction in the participation of the non-oil sector in the economy, in the order of 2.5 % points.

The agricultural injection significantly increases average household income in Iraq (by 11.6 %), by a proportion that exceeds the ratio between the injection and the value added of the economy (below 10 %)—reflecting the relative detachment of household income from the generation of value added in the oil extraction sector commented in Sect. 2, a structural characteristic of the economy, and exceeding the effect on household incomes of the other simulated injections. Given the low participation of factors owned by households into the production of oil and the low domestic input requirements of the oil sector, the oil-focused injection and the combined injection lead to particularly small increases in average household income (0.6 and 2.9 %, respectively). In contrast, both

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[5] The distribution of the simulated injection among the sectors in the SAM follows that of value added on the sectors under focus. For example, in the agricultural-focused simulation, livestock receives 6.1 % of the injection, following the proportion of value added in Table 5 (0.6 out of 9.7).

[6] An injection in the tourism sector is not simulated due to the lack of feasibility of developing the tourism sectors in the present country's security context and also due to lack of associated disaggregated data.

[7] Not tabulated.

Table 11 Simulated value added by broad sectors (trillions of Iraq Dinars and share of total). *Source*: authors' semi-input–output analysis

	Base		Injection in agriculture		Injection in crude oil		Injection in other industry		Combined injection	
	Value	%	Value	%	Value	%	Value	%	Value	%
Agriculture	20.5	9.7	28.5	12.6	20.5	8.9	20.7	9.2	21.8	9.5
Crude oil	101.2	47.9	101.2	44.8	120.0	51.9	101.2	44.8	115.9	50.4
Other industry	7.5	3.5	7.5	3.3	7.5	3.2	14.2	6.3	7.9	3.4
Services	82.1	38.9	88.9	39.3	83.0	35.9	89.6	39.7	84.3	36.7
Non-oil subtotal	110.1	52.1	124.9	55.2	111.0	48.1	124.4	55.2	114.0	49.6
Total	211.3	100	226.1	100	231.0	100	225.6	100	229.9	100

Table 12 Per capita income by household groups, base levels (thousand of Iraq Dinars per year) and simulated changes (%). *Source*: authors' semi-input–output analysis

Household group	Base	Injection in agriculture	Injection in crude oil	Injection in other industry	Combined injection
Rural female headed	2496	14.9	0.4	6.4	3.1
Rural quintile 1	1576	17.7	0.5	6.4	3.5
Rural quintile 2	2235	17.1	0.5	6.6	3.5
Rural quintile 3	2808	16.4	0.5	6.5	3.4
Rural quintile 4	3816	18.5	0.4	6.3	3.6
Rural quintile 5	5821	15.5	0.5	7.8	3.3
Urban female headed	3693	9.7	0.6	8.3	2.5
Urban quintile 1	1827	10.6	0.6	8.9	2.7
Urban quintile 2	2286	9.8	0.7	9.1	2.6
Urban quintile 3	2875	10.0	0.7	9.4	2.7
Urban quintile 4	3778	9.5	0.7	9.6	2.6
Urban quintile 5	7097	10.7	0.7	9.9	2.8
Urban	3485	10.1	0.7	9.4	2.7
Rural	2362	17.0	0.5	6.6	3.5
Baghdad	3162	9.6	0.7	9.0	2.6
Kurdistan	5402	12.1	0.7	9.4	3.0
Other governorates	2703	12.3	0.6	8.5	2.9
Total	3158	11.6	0.6	8.8	2.9

the agricultural injection and the industrial injection increase urban and rural incomes in a measurable way and significantly affect household incomes in Baghdad, Kurdistan, and other governorates. The agricultural injection, as opposed to the industrial injection, leads to increase the relative income of households groups whose original income is relatively low. The real income of rural households increases by 17 %, while the urban household income increases by 10.1 %. Household income in other governorates increases by 12.3 %, slightly above the national average household income increase (11.6 %). However, the female-headed households, a group whose welfare is targeted by social policy in Iraq, find their income increasing by less than average in the agricultural-focused simulation (as well as in other simulated injections), reflecting their relatively low share of factor income—and significant incidence of public transfers—in their income composition (as

listed in Tables 3, 4, 5), and suggesting the need for the Government of Iraq to continue implementing complementary policies to help this disadvantaged group.

5 Conclusions

The present study provides the first countrywide SAM for the analysis of economic counterfactuals in Iraq and a subsequent semi-input–output analysis of the potential effects of the National Development Plan of Iraq on its production structure and household incomes.

In dealing with the challenges associated with the generation of the SAM in a context where up-to-date measured data are scarce, the validity of the resulting matrix is assessed in light of stylized characteristics of the Iraqi economy, the analysis of the levels of shifts in the elements of the transactions matrix at the time of balancing the accounts of the SAM, and sensitivity analysis regarding the influence of the uncertainty in the underlying data on the resulting transactions matrix. Overall and under different assumptions regarding the uncertainty in the observed transaction matrix, the analysis suggests that the requirements to produce the different outputs in the Iraqi economy have not changed significantly from the last available input–output matrix, which is consistent with salient structural characteristics of the Iraqi economy having remaining unchanged. Having said this, looking to the future, it would be advisable for the Government of Iraq to update both the input–output matrix of the country and the present SAM in order to improve the empirical base for the analysis of the expected effects of economic policies and exogenous shocks to the economy.

The SAM-based semi-input–output analysis of the effects of the present National Development Plan of Iraq suggests that diversification efforts to expand the production base of Iraq into agriculture and non-oil industry are prone to increase significantly the relative size of the service sector, leading to a significant increase in the relative size of the non-oil sector in the economy. It also suggests that the diversification efforts will have widespread effects on households in different areas of the country and that diversifying the production base in the direction of agriculture leads to increase the relative income of the disfavored rural households. The analysis also suggests that the diversification strategy is unfortunately not prone to affect the income of the disfavored female-headed households in a significant way by itself and that complementary policies will continue to be needed to support this group, either in the form of direct transfers or boosting their participation in market activities.

These conclusions rely on the semi-input–output model assumption that the domestic commodity and factor markets can be equilibrated relying mainly on changes in quantities (production, consumption, and international trade) without relative price adjustments. While domestic relative prices in Iraq are linked to mostly exogenous world prices and are partly subject to state-driven price controls, future research could successfully exploit the constructed database in the implementation of a computable general equilibrium model with endogenous relative prices to assess the potential effects of economic diversification and other economic policies in Iraq. The analysis recently carried out by Al-Hahoby et al. (2016) based on this SAM provides an illustration focused on the expected effects of implementing the present National Development Plan of Iraq.

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