CHAPTER 9

# Household Welfare in Iran Under Banking Sanctions: From Open Economy Toward Autarchy

*Mohammad Mohammadi Khabbazan*
*and Mohammad Reza Farzanegan*

## Introduction

Over the last three decades, the role of economic sanctions in foreign policy has rapidly expanded. Economic sanctions are non-military measures that aim to change a target state's behavior (Kaempfer and Lowenberg 2007). Some analysts argue that economic sanctions are incapable of achieving their goals, because they have no real influence on the target economy's rulers (Drezner 1999; Elliott 1998; Hufbauer et al. 1990; Pape 1997). Others suggest that whereas sanctions may have a relatively high chance of success in the immediate period after their implementation (Dizaji and van Bergeijk 2013), over time, the target economy is likely to adjust to the

M.M. Khabbazan
Cluster of Excellence "Integrated Climate System Analysis and Prediction" (CliSAP) & Center for Earth System Research and Sustainability (CEN), University of Hamburg, Hamburg, Germany

M.R. Farzanegan (✉)
Center for Near and Middle Eastern Studies, School of Business & Economics, Philipps-Universität Marburg, Marbug, Germany



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imposed constraints by reallocating its resources (see Chap. 8; Dizaji and van Bergeijk 2013; Siddig 2011).

Post-revolutionary Iran has been a main target of international sanctions. A major reason for the imposition of sanctions on Iran has been to reduce the country's strategic power (Katzman 2013), while the stated goal has been to stop Iran from pursuing its nuclear program. The most important sanctions imposed on Iran include those affecting the country's oil exports and international banking.

In 2015, Iran and the P5+1 (the five Permanent Members of the UN Security Council plus Germany) reached a final agreement after much negotiation and signed the Joint Comprehensive Plan of Action that requires the lifting of nuclear-weapons-related[1] economic sanctions imposed on Iran. Many observers naturally attribute this agreement, at least partly, to economic pressures placed on Iran through the sanctions. Yet, it has also been shown (e.g., in Chap. 8) that although oil sanctions impose significant economic pressure on Iran, the economy may be able to partially alleviate their harmful effects through such adjustments as increasing non-oil exports.

There is little doubt about the welfare costs of embargoes on the target economies (Kaempfer and Lowenberg 2007). However, the question remains how and to what extent the sanctions have imposed welfare losses on Iran. Quantitative answers to this key question are of great interest as they shed light on the mechanisms of and differences among sanctions. To provide a reliable answer for one of the sanction types, namely, *banking sanctions*, we use in this chapter the SAM-based standard computable general equilibrium (SCGE) model by Lofgren et al. (2002) to pursue the following goals: (1) investigating the effects of banking sanctions on household welfare and macro-indicators in Iran, (2) detailing the effects of banking sanctions by decomposing them into three sub-banking sanctions (export-only, import-only, and financial-only sanctions), and (3) highlighting the differences between oil sanctions and banking sanctions in terms of welfare losses.

Through our simulations, we show that banking sanctions significantly reduce household welfare in Iran for all income groups in both urban and rural areas—with richer households generally losing more welfare than poorer households. Our decomposition of the effects of banking sanctions further indicates that bans on exports can be more harmful to Iranian households than embargos on imports and foreign investments. In addition, banking sanctions affect Iran's macro-indicators—such as GDP and private

consumption—negatively and significantly, while they raise the exchange rate and consumer price index (CPI). We also show that banking sanctions disrupt some adjustment processes—for example, increase in non-oil exports—that can take place under oil sanctions.

In the next section, we review the sanctions imposed against Iran as well as the reactions of the Iran's economy to them. In the third section, we introduce our stylized model and data used to simulate banking sanctions for various scenarios. In the fourth section, we explain our analyses and discuss our results. The final section concludes the chapter by discussing the implication of our results as well as outlooks.

## Sanctions and Iran's Economy

In 2012, Iran became the target of more international financial sanctions that made the international financial system inaccessible to Iran's Central Bank. These sanctions meant that Iranian individuals, enterprises, and the government could no longer engage in any international transaction in which the Central Bank of Iran was involved. Iranian businesses were thus forced to find alternative means to conduct business, such as working with black market dealers or paying and receiving funds in gold or the national currency of the other party (Katzman 2012). This resulted in higher transaction costs. Furthermore, some countries have been able to buy Iranian oil at major discounts (Van de Graaf 2013: 152), thus reducing Iran's take. Corruption was yet another consequence, instances of which have been featured prominently by the Iranian media. For example, Babak Zanjani, blacklisted by both the USA and the EU for helping the Iranian government circumvent sanctions, was arrested for withholding nearly two billion dollars in oil revenues.

Although Iran's rulers have tended to downplay the impact of sanctions publicly,[2] they have also called for precautionary measures, under the rubric of a "resilience economy," to reduce the economy's vulnerability to the sanctions and to prevent socio-economic and political crises. The principles of the resilience economy are: (1) to increase non-oil exports (such as gas, electricity, petrochemicals, and petroleum by-products) in place of crude oil and other raw materials; (2) to reform consumption patterns and address corruption; and (3) to reduce the reliance of public budget on oil revenues by among other things diverting more of the oil revenues into the National Development Fund of Iran (Khamenei.ir 2014). Yet, part of the vulnerability of Iran's economy is attributable to corruption and public-sector

mismanagement (Hufbauer and Schott 2006; Katzman 2013; Plaut 2013) which remain major problems.

As expected, sanctions created major trouble for Iran. Subsequent to their implementation, Iran's exports of crude oil dropped by around 40 % within a year, from approximately 2.5 million barrels per day (bbl/d) in 2011 to around 1.5 million bbl/d in 2012 (U.S. Energy Information Administration 2013). The country's GDP shrank as a result. The exchange value of the Iranian rial also dropped by more than 80 % (Monshipouri and Dorraj 2013) while Iran's inflation rate soared by 32 % in 2013 (Statistical Center of Iran 2016). According to Iran's Central Bank, the supply of money increased by more than 30 % between 2011 and 2012 (CBI 2015). However, non-oil exports from Iran increased by approximately 25 % from 2010 through 2012 (CBI 2015).[3] Hufbauer et al. (2012) note that Iran's average welfare loss caused by the sanctions was around $5.7 billion or approximately 1–3 % of Iranian GDP between 2006 and 2012. Yet, the agreement between Iran and P5+1 on July 14, 2015 dubbed Joint Comprehensive Plan of Action (JCPOA) calls for sanctions relief in return for the suspension of some of Iran's nuclear-related activities. Although prospects for significant sanctions relief are relatively bright at the moment, the implementation of JCPOA has faced some hurdles in practice. Probing the effects of the sanctions on Iran's economy thus continues to remain a relevant endeavor.

Using the SAM-based standard CGE (SCGE) model by Lofgren et al. (2002), Chap. 8 probed the effects of oil sanctions on Iran's macroeconomic indicators and household welfare, positing that banking sanctions exert no pressure on the economy. It modeled oil sanctions in a two-step *quantity* approach that works better when only one commodity is (or few commodities are) the target of sanctions. It indicated that although oil sanctions impose significant economic pressures on Iran (by among other things reducing its GDP, total exports, total imports, and household welfare), the country's economy may be able to partially alleviate these harmful effects through such adjustments as reallocating resources and increasing non-oil exports. However, these adjustment processes may be disrupted when banking sanctions are taken into account. For instance, even if the exchange rate soars, Iran may not be able to increase non-oil exports under banking sanctions; therefore, household welfare may further decrease.

## Research Design

### *Model and Data*

We follow Chap. 8's methodological approach by using the SCGE and employing the "Johansen closure" (Johansen 1960) rules for macro closures of the model. To "avoid the misleading welfare effects" (Lofgren et al. 2002), Johansen closure requires that: (1) the real government expenditure is fixed, whereas government saving is flexible; (2) the real exchange rate is flexible, whereas foreign saving is fixed in foreign currency; and (3) savings are investment-driven.[4] Based on a Walrasian general equilibrium theory, SCGE is a static non-linear model that is representative of a single open economy. SCGE is suitable for analyzing the effects of external shocks on heterogeneous households and follows the neo-classical approach. Labor and capital are fully employed in the model. Household welfare is measured by the equivalent variation (EV) indicator, which is the variation in income required to avert the simulated induced changes at base prices.[5]

To make it easier to report the results on activities, we use an aggregated version of the SAM used in Chap. 8. We aggregate the SAM according to the standard of Central Product Classification (CPC) Ver.2 (UNSD 2013) in its first level, where there are ten classes of commodities. For the aim of this chapter, there are three exceptions in our SAM. First, oil must have a distinct account in the SAM, so it is disaggregated from its mother class (ores and minerals, electricity, gas, and water). Second, we aggregate the last two classes (business and production services; community, social, and personal services) into a single class for activity (services). Third, we disaggregate the produced services into two groups including tradable and non-tradable services. The aggregated SAM has 52 accounts: 10 accounts for activities, 11 accounts for commodities, 20 accounts representing Iranian urban and rural households separated by income level, 4 accounts, each for enterprises, government, saving-investment, and rest of the world, 2 accounts for labor and capital, 3 accounts for tariff and direct and indirect tax, and 2 accounts showing domestic and export transaction costs. In this way, the size of the model (the number of single equations/variables) is reduced by almost a factor of eight, providing numerical solutions much faster. However, the accuracy of our results may be affected when the size of the model is reduced. To test the reliability of our results, we replicate the results of Chap. 8 using the aggregated SAM. Although the sizes of the models differ, the results are largely similar, thus justifying the use of the

aggregated SAM.[6] In addition, we employ the same amounts of elasticities and exogenous variables as in Chap. 8 to calibrate the model. By conducting a thorough sensitivity analysis, the previous chapter showed that the simulated results are insensitive to reasonable variations in the elasticities and the exogenous variables.

### *Set up of Simulations and Scenarios for Banking Sanctions*

Adopting scenarios, we simulate the effects of the increasingly strict application of banking sanctions against Iran. To do so, we employ the *sanction parameter S*, which simultaneously decreases the relative received price for exports, increases the relative price paid for imports, and reduces the percentage of foreign savings in total saving. By introducing *S*, we implicitly suppose Iran, a small-open economy, can potentially circumvent sanctions at the expense of receiving less per quantity of export and paying more per quantity of import than before. That is, circumvention of sanctions compels Iranian trade activity to pay dealers a certain proportion of world price of the commodity being traded. In this sense, *S* can serve as a transaction cost which is imposed due to banking sanctions. Compared to Chap. 8, our current approach can be called a *price approach*.

In detail, an *increase* in *S decreases* the relative received price for exports through Eq. 1, *increases* the relative price paid for imports through Eq. 2, and *reduces* the percentage of foreign savings in total saving through Eq. 3:

$$\mathrm{PE_c} = \mathrm{pwe}.(1 - \mathrm{te_c} - \mathrm{S}).\mathrm{EXR} + \sum\nolimits_{c'} \mathrm{PQ_{c'}}.\mathrm{ice_{c'c}} \qquad \text{(Eq.1)}$$

$$\mathrm{PM_c} = \mathrm{pwm}.(1 + \mathrm{tm_c} + \mathrm{S}).\mathrm{EXR} + \sum\nolimits_{c'} \mathrm{PQ_{c'}}.\mathrm{icm_{c'c}} \qquad \text{(Eq.2)}$$

$$\mathrm{FSav}^{*} = \overline{\mathrm{Fsav}}.(1 - \mathrm{S}) \qquad \text{(Eq.3)}$$

where

$\mathrm{PE_c}$ = export price for commodity c in local currency;

pwe = f.o.b. (free on board) export price for commodity c in foreign currency;

$\mathrm{te_c}$ = export tax rate;

EXR = exchange rate;

$\mathrm{PQ_{c'}}$ = price of commodity $c'$ used as trade input;

$\mathrm{ice_{c'c}}$ = quantity of commodity $c'$ used as trade input per unit of traded commodity c.

$PM_c$ = import price for commodity c in local currency;

pwm = f.o.b. (free on board) import price for commodity c in foreign currency;

$tm_c$ = import tax rate;

$Fsav^*$ = (equilibrium) foreign saving after sanctions are implemented; and

$\overline{Fsav}$ = (equilibrium) foreign saving before sanctions; The optimal mix between domestic sales and exports for the commodity *c* in SCGE is expressed in the following equation:

$$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c}.\frac{1-\delta_c^t}{\delta_c^t}\right)^{\frac{1}{\rho_c^t-1}} \qquad \text{(Eq.4)}$$

where

$QE_c$ = quantity of export for commodity c;

$QD_c$ = quantity of domestic sale for commodity c;

$PDS_c$ = supply price for commodity c produced and sold domestically;

$\delta_c^t$ = a CET function share parameter for commodity c; and

$\rho_c^t$ = a CET function exponent for commodity c. This equation assures that a decrease in the export-domestic price ratio generates a decrease in the export-domestic supply ratio. In addition, in SCGE the optimal mix between domestic sales and imports for the commodity *c* is expressed in the following equation:

$$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c}.\frac{\delta_c^q}{1-\delta_c^q}\right)^{\frac{1}{1+\rho_c^q}} \qquad \text{(Eq.5)}$$

where

$QM_c$ = quantity of import for commodity c;

$PDD_c$ = demand price for commodity c produced and sold domestically;

$\delta_c^q$ = an Armington function share parameter for commodity c; and

$\rho_c^q$ = an Armington function exponent for commodity c. This equation assures that a decrease in the domestic-import price ratio generates a decrease in the import-domestic demand ratio.

We develop three scenarios in order to capture banking sanctions. We set *S* to *0.25*, *0.50*, and *0.75* as representative of *low*, *moderate*, and *strict* banking sanctions, respectively. It is worthwhile to note that here, our intention is not to reduce exports, imports, and foreign investments exactly

as those events have occurred but to develop three scenarios of increasingly strict application of banking sanctions. First, in reality, not all reductions can be attributed to sanctions. For example, part of the reductions in exports and imports after imposition of sanctions can be due to energy reforms which Iran experienced simultaneously with sanctions. Second, using *S*, we are able to simulate various magnitudes of sanctions that are more informative in terms of showing the effects under various intensities of sanctions. In fact, we emphasize *the way and the pressure* through which banking sanctions force Iran's economy to move toward an autarchy.

Furthermore, to thoroughly investigate how banking sanctions affect household welfare, we divide the banking sanctions into three scenarios: *export-only*, in which sanctions are only imposed against exports; *import-only*, in which sanctions are only imposed against imports; and *financial-only*, in which sanctions reduce foreign savings only. In addition, to make the differences between these scenarios more visible, we use the parameters *E*, *I*, and *FS*', respectively, for export-only, import-only, and financial-only scenarios.

## Results

### *The Macroeconomic and Welfare Effects of Banking Sanctions*

The effects of banking sanctions on Iran's macroeconomic indicators are shown in Table 9.1. Because of their obvious importance, oil exports and production values are also reported. The results capture the effects of the successive tightenings of banking sanctions from $S = 0.25$ to $S = 0.75$, which are representative of low banking sanctions to strict banking sanctions, respectively. As shown, the economy suffers significantly from banking sanctions; absorption, private consumption, total exports and imports, GDP, capital income, and household welfare fall, whereas net indirect tax, exchange rate, CPI, and labor income rise. Furthermore, the results indicate that Iran's economy becomes inflexible when banking sanctions are tougher.

We have simulated banking sanctions such that sanctions accompany decreases in total imports, exports, and foreign investment. Here, the results for the medium case ($S = 0.50$) are presented. The overall reduction in total exports is approximately 59 %, whereas the total reduction in total imports is approximately 82 %. Although declines in total imports negatively affect the exchange rate, the net effect of reductions in total exports and imports is an

**Table 9.1** Percentage changes in macro-indicators due to banking sanctions

| *Macro-indicators* | S = *25 %* | S = *50 %* | S = *75 %* |
|---|---|---|---|
| Absorption | −3.36 | −9.87 | −17.70 |
| Private consumption | −5.70 | −16.76 | −30.05 |
| Total export | −38.81 | −58.88 | −66.37 |
| Oil export | −47.42 | −67.52 | −73.46 |
| Total non-oil export | −22.30 | −42.32 | −52.79 |
| Total import | −52.49 | −82.32 | −96.92 |
| Oil production value | −44.9 | −62.2 | −67.3 |
| Net indirect tax | 12.99 | 14.75 | 26.54 |
| GDP | −2.25 | −7.54 | −14.09 |
| Exchange rate | 20.2 | 63.6 | 208.0 |
| CPI | 2.16 | 3.76 | 4.93 |
| Labor income | 3.57 | 4.35 | 4.47 |
| Capital income | −6.81 | −11.31 | −14.24 |
| Total households' welfare | −5.6 | −16.3 | −29.1 |

*Source*: Authors' calculations

increase of approximately 63 % in the exchange rate. Under banking sanctions, oil exports also fall by approximately 68 %, which leads to a reduction of around 62 % in oil production value. Because oil exports constitute the major source of Iran's government funding, their reduction results in an increase of approximately 15 % in net indirect taxes to preserve current government expenditures. The model's full employment assumption implies that when oil activity, which is indeed capital-intensive, decreases oil production, the activity uses less capital. As unused capital flows to other activities, capital income falls by more than 12 %. This is an opportunity for non-oil activities to increase.

Meanwhile, activities that need imported commodities for their manufacturing processes decrease their production because of the sanctions, which also implies more use of labor, leading to an increase in labor income of more than 4 %. The sanctions' overall effect is to decrease GDP by more than 7 %. In addition, the loss of foreign savings must be compensated with increases in private savings, which causes additional reduction in household consumption. Overall, absorption and private consumption fall by 9.87 % and 16.76 %, which result in approximately 16 % losses in household welfare. Although, as mentioned, some activities may gain from the reduced price of capital and increase their production, such increases cannot compensate for the vast, sanctions-induced loss of supply to domestic markets; the economy will experience a positive inflation rate of approximately 3.7 %.

Additionally, the simulation results indicate that Iran's economy becomes inflexible when banking sanctions are stronger. Most of the macro-indicators vary widely (nonlinearly) during successive tightening of sanctions. For example, when $S$ is 0.25, reductions in total exports and total imports are approximately 39 % and 52 %, respectively, which subsequently causes GDP to fall by 2.2 %. However, when $S$ rises to 0.50, reductions in total exports and total imports are approximately 59 % and 82 %, respectively, causing a 7.5 % decrease in GDP. For the extreme case, when $S = 0.75$, total imports decrease by more than 96 % while total exports decrease by approximately 66 %. In this case, GDP decreases by more than 14 %. In addition, the exchange rate increases under banking sanctions. For instance, the exchange rate soars by a factor of almost three for the extreme case. This increase in the exchange rate is an incentive for exporters and a hindrance for importers; this can explain the difference in the reduction of total exports and total imports. For the consecutive tightening of banking sanctions, total household welfare decreases by 5.6 %, 16.3 %, and 29.1 %. We interpret these nonlinear changes in macro-indicators as the inflexibility of Iran's economy in response to banking sanctions when banking sanctions become tougher. Indeed, such reductions also imply that banking sanctions may threaten Iranian households, which may lose more than 30 % of their consumption in the extreme case.

The most important difference between banking sanctions and oil sanctions arises out of the pressure that banking sanctions—but not oil sanctions—put on non-oil exports. This is a crucial assumption that explains why under oil sanctions, CPI may decrease, whereas it increases with banking sanctions. Under oil sanctions, a soaring exchange rate and reduced capital wages are two strong motivations for non-oil exporters to increase their exports and production. Because it is assumed that exports are related to domestic supply through a constant elasticity of transformation (CET) function, increased exports of non-oil products must be accompanied by increased domestic supply. Therefore, assuming there is no pressure on non-oil exports, there is not only a possibility that CPI increases will be low but also a possibility that it will decrease. However, this adjustment process is disrupted by banking sanctions. As the simulation results show, although some activities may increase their level of production in the presence of banking sanctions (see Table 9.2 in Appendix A), the shocks to the supply side of the economy cannot be fully offset, logically leading to inflation.

Figure 9.1 shows the welfare effects of three scenarios simulating successive tightening of banking sanctions against Iran on urban households (UH) and rural households (RH) grouped in income levels. When $S$ rises from 0.25 to 0.75, Iranian households may lose welfare in a range between 4 % and 35 %. In general, the reason for this finding is that national production (and national income) decreases because of banking sanctions, resulting in reductions in welfare losses through the decrease in private consumption. In the low banking sanctions' scenario ($S = 0.25$), losses in urban and rural households' welfare are almost the same, with a slightly increasing effect for upper-income levels. This pattern is nearly the same for the stricter banking sanctions' scenario. However, the results indicate that the richest households in both urban and rural areas suffer significantly more from sanctions than do other households. The reason for this finding is that upper-income households are the major owners of capital; therefore, decreases in capital income directly influence them. In addition, it is assumed that upper-income households are major users of imported commodities. Given the assumption that upper-income households have a stronger effect on Iran's decision-making process, our findings hint at the impetus on Iran's part for the realization of JCPOA in 2015.

### *The Welfare Effects of Sub-banking Sanctions*

In this sub-section, we decompose the effects of banking sanctions on households' welfare into its sub-scenarios of export-only, import-only, and financial-only sanctions. In this way, we can investigate the working mechanisms of the banking sanctions in detail and study which scenario may have the most significant impact on households. Figures 9.2, 9.3, and 9.4 demonstrate the effects of export-only, import-only, and financial-only sanctions against Iran, respectively, on household welfare in both urban and rural areas. In the export-only scenario, it is assumed that the sanctions are only imposed on exports (both oil and non-oil products). Under the import-only scenario, only Iran's importation of products is the target of sanctions, and in the financial-only scenario, only foreign savings are affected by sanctions.

Simulations for the low sanctioning scenario ($E = I = FS = 0.25$) indicate that financial-only sanctions are stronger than export- and import-only sanctions in reducing Iranian household welfare. Under the low sanctioning scenario, the losses in household welfare range from 1.3 % to 2.1 %, from 0.7 % to 1.9 %, and from 0.4 % to 1.3 in financial-only, export-only, and

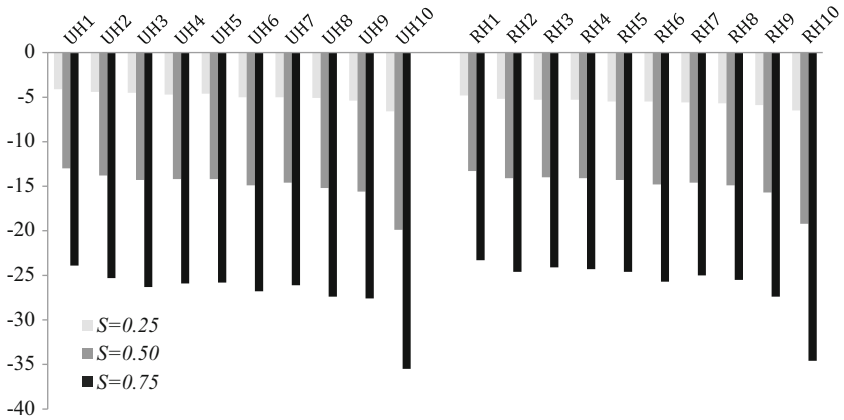


**Fig. 9.1** Percentage changes in household welfare due to banking sanctions. *Note*: UH = Urban household; RH = rural households

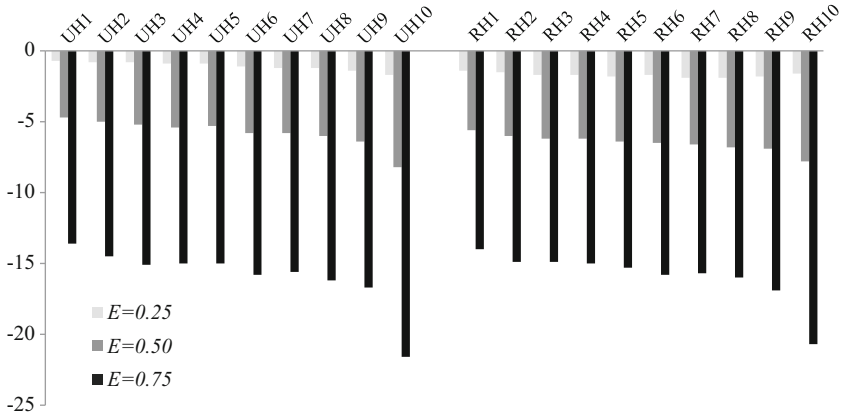


**Fig. 9.2** Percentage changes in household welfare due to export-only sanctions. *Note*: UH = Urban Household; RH = rural Households

import-only scenarios, respectively. However, as sanctions become harsher, the export-only scenario has more harmful effects on household welfare. In the strict scenarios ($E = I = FS = 0.75$), export-only sanctions reduce household welfare by more than 13 %, whereas financial-only and import-

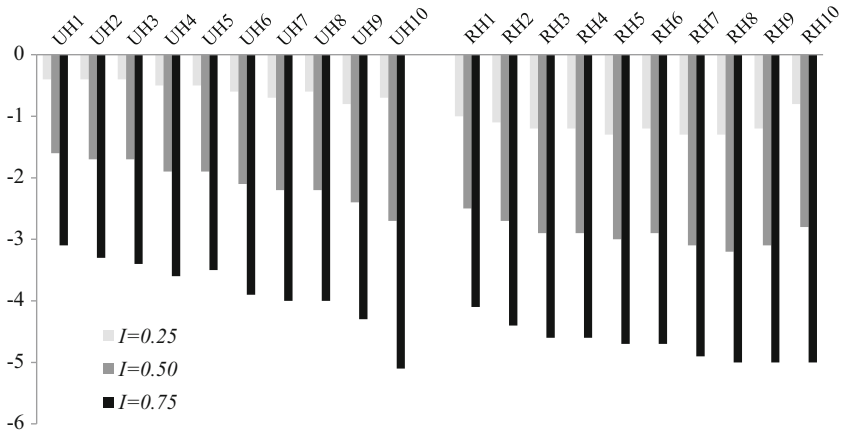


**Fig. 9.3** Percentage changes in household welfare due to import-only sanctions. *Note*: UH = Urban Household; RH = rural Households

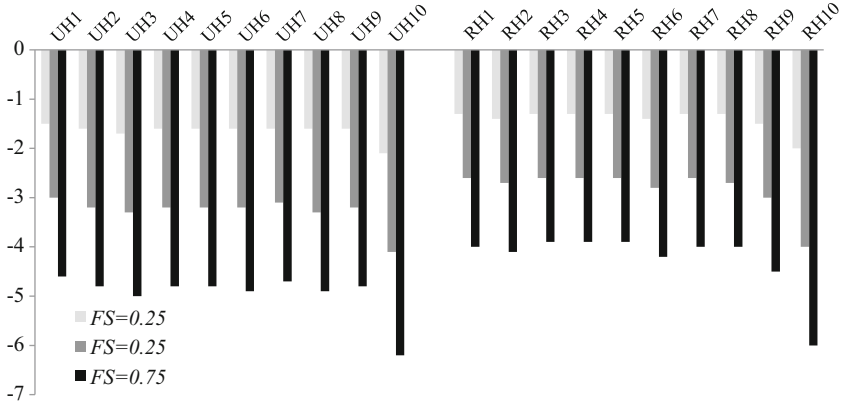


**Fig. 9.4** Percentage changes in household welfare due to financial-only sanctions. *Note*: UH = Urban Household; RH = rural Households

only scenarios decrease household welfare in a range of 3.9–6.2 % and 3.1 %–5.1 %, respectively. There is an interesting pattern of sanctions-induced welfare change among households. In general, welfare loss increases among richer households both in urban and rural areas. However,

this loss is more significant for the richest households. In addition, although rural households are more vulnerable than urban households to import-only sanctions, under low ($I = 0.25$) and moderate sanctions ($I = 0.50$), welfare loss is more significant for rural middle-income households.

Although all three sub-banking sanctions have decreasing effects on household welfare, it is worthwhile to restate that the mechanisms underlying such decreases are completely different (see Table 9.3, in Appendix A). Under export-only sanctions, the pressure on exports increases the exchange rate, leading to a reduction in imports. Such sanctions affect household welfare through income reductions, which leads to consumption losses. Moreover, under export-only sanctions, increased CPI exacerbates the situation by making domestic production even more expensive. In contrast, in the import-only scenario, the exchange rate falls. This appreciation in Iranian rial against international currency discourages exporters by reducing their received monetary value. The shortage in domestic supply caused by reduced imports, however, again results in increased CPI. As noted, foreign saving is the only decreased indicator in the financial-only simulation. Because the saving-investment closure implies that the amount of savings must be equivalent to the amount of investments, decreased foreign savings must be compensated by increased private savings.[7] Therefore, household consumption should be reduced, which consequently decreases household welfare.

## Conclusion

In this chapter, we investigated the economic effects of banking sanctions on Iranian household welfare and macroeconomic indicators. We also highlighted the differences between banking sanctions and oil sanctions in terms of their effects on household welfare and macroeconomic indicators. Moreover, by decomposing banking sanctions into three sub-banking sanctions (export-only, import-only, and financial-only sanctions), we shed light on its working mechanisms.

Our results show that banking sanctions significantly affect Iranian macroeconomic indicators and cause enormous economic hardship. Macroeconomic indicators that *decrease* include absorption, private consumption, total export and import, GDP, and capital income. Macroeconomic indicators that *increase* include net indirect tax, exchange rate, CPI, and labor income. Depending on the intensity of sanctions, the changes in macroeconomic indicators vary over different scenarios. For example, the decrease in

GDP varies from 2.25 % under low sanctions to 14.09 % under high sanctions economy, whereas the increase in exchange rates ranges from 20.2 % to 208 %. The simulation results suggest that Iran's economy becomes inflexible when sanctions are stricter.

Our results further indicate that all urban and rural households suffer from banking sanctions regardless of income group. Depending on the intensity of a given banking sanction, Iranian households may experience welfare loss in a range between 4 % and 35 %, with the higher losses pertaining to the richer households. With respect to sub-banking sanctioning scenarios, whereas the results indicate welfare reductions in all scenarios, the export-only scenario is more stringent than the others. The financial-only scenario is also more stringent than the import-only scenario. The greater loss of welfare by middle-income households in rural areas under low and moderate import-only scenarios is an important result of this chapter.

Oil sanctions and banking sanctions can influence Iranian household welfare and macro-indicators differently. In general, banking sanctions disrupt some adjustment processes (such as increasing non-oil exports) that may take place under oil sanctions to alleviate the harms. The stricter limitations under banking sanctions suggest that this type of sanctions is more effective than oil sanctions. This shows clearly in the consumer price index, which decreases under oil sanctions and increases under banking sanctions. Our results are in line with the political and economic reality in Iran since the beginning of banking sanctions and may provide an ambitious explanation for the Iranian government's recent political actions, such as entering negotiations and reaching a nuclear deal in 2015.

In this work, we assume both that sanctions do not reduce Iran's government expenditures and that upper-income households have more influence on Iran's government. Given these assumptions, we conclude that banking sanctions have been effective because they resulted in significant welfare loss for rich households. However, one may argue that government welfare must be separately considered. Although this can be the case, here two questions arise: (a) How can we measure government welfare? (b) What is the relationship between government income and household income?

We support our results by arguing that our assumptions are adequate because Iran's government can use its National Development Fund in the case of negative revenues shocks. Moreover, because household income can be derived from work for government, any reduction in government revenues should be reflected in reduced household income.

# Appendix A

**Table 9.2** Percentage changes in activities' quantity, price, and levels due to banking sanctions

| *Activities* | *Quantity (Q)* | | | *Price (P)* | | | *Level (P.Q)* | | |
|---|---|---|---|---|---|---|---|---|---|
| | S = *25 %* | S = *50 %* | S = *75 %* | S = *0.25* | S = *0.50* | S = *0.75* | S = *25 %* | S = *50 %* | S = *75 %* |
| Agricultural | 1.2 | −5.9 | −16.6 | −3.2 | −5.4 | −6.9 | −2.1 | −11 | −22.4 |
| Mining | 17.3 | 34 | 51.2 | −2.8 | −4.8 | −6.1 | 14 | 27.6 | 42 |
| Oil | −41.1 | −57.6 | −62.2 | −6.4 | −10.7 | −13.5 | −44.9 | −62.2 | −67.3 |
| Food | 7.7 | 5.6 | −2 | −0.5 | −1.3 | −2.1 | 7.1 | 4.2 | −4 |
| Transportation | 13.2 | 20.8 | 24.7 | 1.8 | 2.7 | 2.8 | 15.3 | 24.1 | 28.1 |
| Industrial | 33.3 | 70.9 | 111.8 | 5.9 | 11.5 | 16.7 | 41.1 | 90.5 | 147.2 |
| Construction | −1.2 | −2.5 | −3.7 | 4.5 | 8 | 11 | 3.2 | 5.3 | 6.9 |
| Distribution | 13 | 20.3 | 25 | −3.5 | −5.8 | −7.4 | 9.1 | 13.2 | 15.7 |
| Financial | −10 | −24.2 | −39.9 | −4.5 | −7.5 | −9.5 | −14 | −29.9 | −45.6 |
| Services | −0.9 | −3.8 | −7.4 | 0.1 | −0.4 | −0.7 | −0.9 | −4.2 | −8.1 |

*Source*: Authors' calculations

**Table 9.3** Percentage changes in macro-indicators due to sanctions

| *Macro-indicators* | *Export-only* | | | *Import-only* | | | *Financial-only* | | |
|---|---|---|---|---|---|---|---|---|---|
| | E = *0.25* | E = *0.50* | E = *0.75* | I = *0.25* | I = *0.50* | I = *0.75* | FS = *0.25* | FS = *0.50* | FS = *0.75* |
| Absorption | −0.8 | −4.0 | −10.7 | −0.4 | −1.5 | −2.7 | −1.0 | −2.0 | −3.0 |
| Private Consumption | −1.4 | −6.8 | −18.1 | −0.8 | −2.5 | −4.5 | −1.7 | −3.4 | −5.1 |
| Total export | −27.0 | −52.3 | −73.2 | −21.8 | −35.6 | −45.0 | 3.4 | 6.9 | 10.3 |
| Oil export | −34.3 | −62.2 | −80.7 | −28.0 | −44.4 | −54.7 | 5.1 | 10.2 | 15.4 |
| Total non-oil export | −13.1 | −33.3 | −58.8 | −10.0 | −18.9 | −26.4 | 0.3 | 0.5 | 0.7 |
| Total import | −32.7 | −63.3 | −88.6 | −26.4 | −43.1 | −54.5 | −1.4 | −2.8 | −4.1 |
| Oil production | −32.9 | −57.5 | −72.1 | −27.0 | −41.9 | −50.9 | 4.7 | 9.5 | 14.4 |
| Net indirect tax | 5.0 | 7.0 | 12.9 | 12.9 | 16.0 | 16.2 | 2.0 | 4.0 | 6.0 |
| GDP | −0.8 | −3.9 | −10.3 | −0.4 | −1.4 | −2.6 | 0.0 | 0.0 | 0.0 |
| Exchange rate | 25.2 | 71.4 | 197.0 | −4.8 | −8.5 | −11.5 | 0.4 | 0.7 | 1.1 |
| CPI | 1.2 | 2.5 | 3.9 | 1.0 | 1.7 | 2.2 | 0.1 | 0.2 | 0.4 |
| Labor income | 3.1 | 4.9 | 5.5 | 2.4 | 3.6 | 4.2 | −0.8 | −1.6 | −2.5 |
| Capital income | −4.4 | −8.9 | −13.2 | −3.5 | −5.8 | −7.4 | 0.2 | 0.4 | 0.7 |
| Total households' welfare | −1.4 | −6.6 | −17.5 | −0.7 | −2.4 | −4.4 | −1.7 | −3.4 | −5.1 |

*Source*: Authors' calculations

## Notes

1. According to JCPOA, only sanctions imposed against Iran because of its attempt to obtain nuclear weapons will be lifted, conditional upon a report by the International Atomic Energy Agency (IAEA) indicating that Iran has fulfilled the terms of the JCPOA. Other sanctions may remain.
2. "From right and from left, they adopt sanctions, but for us they are annoying flies, like a used tissue" (Mr. Ahmadinejad, on an official visit in Tajikistan, The Telegraph, 10 June 2010).
3. We have not found any reliable data on non-oil exports after 2013.
4. For a complete description of the SCGE and the treatment of closures, see Lofgren et al. (2002).
5. We believe that SCGE is sophisticated enough to investigate the effects of banking sanctions. Although we admit that there are more sophisticated models than SCGE, we argue that their complexity creates more uncertainty, which we wish to avoid here.
6. The test results are derived by employing the two-step approach introduced in Chap. 7 for the scenario in which oil exports are placed under sanctions by Japan and the EU. To preserve the brevity of this study, we do not show that test here.
7. Decreases in foreign savings can also be partly compensated by increases in the exchange rate. As we use the Johansen closure, the welfare effects of reductions in foreign savings are correctly measured. However, because we use a static model, the effects of reductions in foreign savings on macro-indicators may be misleading.

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