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Title	Redefining the picture of Myanmar's economic growth : trade, production, and jade
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Abstract	The economic potential of Myanmar is attracting significant attention. However, some questions have been raised about the reliability of Myanmar's official system of national accounts (MMSNA). First, it is suspected that under the military regime, economic growths might have been significantly overstated since the latter half of the 1990s, by the Economist Intelligence Unit (EIU 2010) and the ADB (2016). The second problem is that until the shift to the managed floating exchange rate system in April 2012, the official exchange rate had been used in the MMSNA in converting international trade into the national currency. Under the official exchange rate, which set the value of the Myanmar kyat at a level far above the market exchange rate, the amounts of exports and imports were significantly undervalued, resulting in a significant underestimation of GDP. The third problem is extensive illegal trade. In recent years, Global Witness (2015a and 2015b) and Dapice et al. (2014) pointed out that illegal exports of jade, whose prices began to surge in the latter half of the 2000s, have not been properly reflected in the MMSNA. According to those recent research findings, the total transaction value of jade is estimated to equate to 48% of Myanmar's GDP in 2014. In a bid to respond to those problems, this paper tries to develop new estimates of GDP. Our results show that Myanmar's real GDP growth turned negative twice, first in 2003–2004 and second in 2007–2008. In terms of the average growth rate for the period 1998–2010, our estimate of 4.9% represents a downward revision of 7.0 percentage points compared with the MMSNA estimate of 11.9%. The downward revision to economic growth in 1998–2010 based on our estimates bring Myanmar's GDP growth and labor productivity growth closer to those of Thailand and Bangladesh. Meanwhile, the impact of revaluing jade transactions on macroeconomic growth is observed from the mid-2000s, for instance, turning negative growth estimated for 2004 before reflecting the reassessed values of jade transactions to positive growth. The impact of revaluation of jade is even more conspicuous in 2008 and thereafter with jade production accounting for more than 10% of Myanmar's GDP. Notably, the revaluation of jade results in a significant upward revision in 2009–2010, from 3.2% to 17.9%. On the other hand, real GDP dropped 21.5% in 2012 as jade production decreased by half following the transfer of power to the civilian government. Based on our estimates reflecting the revaluation of jade, Myanmar was comparable to India and Vietnam—both in real GDP growth and labor productivity growth—in the period 1998–2010. However, Myanmar was alone to fall into negative growth in the period 2010–2014.
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KEO Discussion Paper No. 141

Redefining the Picture of Myanmar's Economic Growth: Trade, Production, and Jade

Koji Nomura and Hiroshi Shirane†

December 2016

Abstract

The economic potential of Myanmar is attracting significant attention. However, some questions have been raised about the reliability of Myanmar's official system of national accounts (MMSNA). First, it is suspected that under the military regime, economic growths might have been significantly overstated since the latter half of the 1990s, by the Economist Intelligence Unit (EIU 2010) and the ADB (2016). The second problem is that until the shift to the managed floating exchange rate system in April 2012, the official exchange rate had been used in the MMSNA in converting international trade into the national currency. Under the official exchange rate, which set the value of the Myanmar kyat at a level far above the market exchange rate, the amounts of exports and imports were significantly undervalued, resulting in a significant underestimation of GDP. The third problem is extensive illegal trade. In recent years, Global Witness (2015a and 2015b) and Dapice et al. (2014) pointed out that illegal exports of jade, whose prices began to surge in the latter half of the 2000s, have not been properly reflected in the MMSNA. According to those recent research findings, the total transaction value of jade is estimated to equate to 48% of Myanmar's GDP in 2014.

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Meanwhile, the impact of revaluing jade transactions on macroeconomic growth is observed from the mid-2000s, for instance, turning negative growth estimated for 2004 before reflecting the reassessed values of jade transactions to positive growth. The impact of revaluation of jade is even more conspicuous in 2008 and thereafter with jade production accounting for more than 10% of Myanmar's GDP. Notably, the revaluation of jade results in a significant upward revision in 2009–2010, from 3.2% to 17.9%. On the other hand, real GDP dropped 21.5% in 2012 as jade production decreased by half following the transfer of power to the civilian government. Based on our estimates reflecting the revaluation of jade, Myanmar was comparable to India and Vietnam—both in real GDP growth and labor productivity growth—in the period 1998–2010. However, Myanmar was alone to fall into negative growth in the period 2010–2014.

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1 Introduction

In March 2011, the civilian government of President Thein Sein took over power from the State Peace and Development Council (SPDC), the military government, in Myanmar. Since then, various economic reform measures have been implemented in the country. In April 2012, the government introduced a managed floating exchange rate system, under which the value of the Myanmar kyat is basically determined by the interbank market (although the central bank maintains a degree of influence), in a bid to unify several greatly different exchange rates (Figure 3 in Subsection 3.1), followed by the establishment of a new Foreign Investment Law. Although significant restrictions remain in businesses that have an impact on subterranean resources and the natural environment as well as those that can be undertaken by Myanmar citizens such as agriculture, livestock breeding, and fisheries, the government is now heading in the direction of easing restrictions over foreign direct investment. In response to such political and economic reform steps, the U.S. lifted its ban on the importation of goods from Myanmar (excluding gems such as jade) in November 2012, and the European Union (EU) lifted is economic sanction (excluding arms embargo) in April 2013.

In the general elections of November 2015, the National League for Democracy (NLD) led by Aung San Suu Kyi won a landslide victory by taking 80% of the contested seats. Then, in the transition from the Thein Sein government to the NLD-led government, leading to the transfer of power on March 30, 2016 from the Thein Sein government to the NLD-led government in a further step toward democracy. Following the formation of the new government, the Myanmar Investment Commission (MIC), a government-appointed body that scrutinize proposed inward investment projects from overseas, was temporarily paralyzed with no meeting held for about three months due to a delay in selecting new commission members, but resumed in June 2016. In response to further progress in democratization, the U.S. lifted all economic sanctions against Myanmar, including the embargo on jade and rubies, in October 2016. Furthermore, the U.S. reinstated Myanmar's eligibility for benefits under the Generalized System of Preferences (GSP) program to reduce or exempt tariffs on some imports from Myanmar effective from November 13, 2016. Up until now, foreign direct investment projects in Myanmar have been mostly confined to those from Singapore, China, and other countries within Asia. However, the complete lifting of the U.S. economic sanctions and the restatement of Myanmar's GSP status in its trade with the U.S. will likely boost inward foreign direct investment in Myanmar, not only from the U.S. but also from other countries with an eye to exporting to the U.S. market.

As democratization makes progress, the economic potential of Myanmar, which has a large number of quality young workers with its population totaling more than 50 million, is attracting significant attention. However, some questions have been raised about the reliability of Myanmar's official statistics on macroeconomic performance. First, it is suspected that under the military regime

of the SPDC, official economic growth rates might have been significantly overstated since the latter half of the 1990s. In forecasting Myanmar's future economic growth, the Economist Intelligence Unit (EIU) of The Economist Group of the United Kingdom has been releasing its own estimates of the real GDP growth by taking into account various other factors, i.e., electricity use, trade balance, and the impact of sanctions by the U.S. and the EU in 2003 and onward (EIU 2010). In Myanmar, the Central Statistical Organization (CSO) has compiled the Myanmar System of National Accounts (MMSNA). Figure 1 compares the CSO's official GDP growth estimates (MMSNA) and alternative estimates by the EIU. While the official GDP growth estimates peaked from 2002 through 2004, estimates by the EIU show that Myanmar suffered negative growth during the same period due to the impact of economic sanctions imposed by the U.S. and Europe. Likewise, considerable deviations are observed both before and after the period, the EIU notes that the pace of economic growth as shown in Myanmar's official statistics has been overestimated by two-fold. The Asian Development Bank (ADB) has also been publishing its own real GDP growth estimates (ADB 2016). As shown in Figure 1, growth estimates by the ADB slightly exceed those by the EIU but show that official growth figures based on the MMSNA have been grossly overestimated.[1]

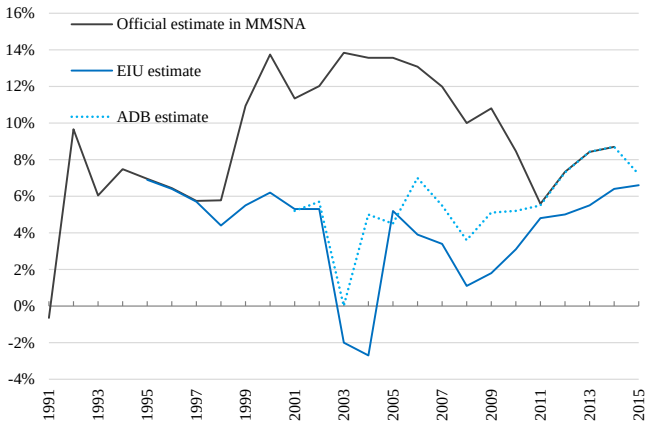


Figure 1: Real GDP Growth, Official vs Alternative Estimates

The second problem with the official statistics is that until the shift to the managed floating exchange rate system in April 2012, the official exchange rate had been used in the MMSNA in converting international trade (mainly denominated in the US dollar) into the national currency. Under the official exchange rate, which set the value of the Myanmar kyat at a level far above the market exchange rate, the amounts of exports and imports were significantly undervalued, resulting in a significant underestimation of GDP.

The third problem with Myanmar's economic statistics is extensive illegal trade. In recent years,

[1] Currently, the official estimates provided in the MMSNA are used as GDP figures for Myanmar in the United Nations Statistics Division (UNSD)'s National Accounts Estimates, the International Monetary fund (IMF)'s World Economic Outlook Database, and APO (2016).

Global Witness (2015a and 2015b) and a research team at Harvard University's ASH Center for Democratic Governance and Innovation (Dapice et al. 2014) pointed out that illegal exports of jade, whose prices began to surge in the latter half of the 2000s, have not been properly reflected in the MMSNA. According to those recent research findings, the total transaction value of jade is estimated to equate to 48% of Myanmar's nominal GDP in 2014. While the EIU (2010) points to the possibility of a significant overestimation of Myanmar's nominal GDP, the fact that illegal jade transactions are not properly accounted (neither the MMSNA nor the EIU takes this fact into consideration) points to the possibility of an underestimation.

In a bid to respond to those problems, this paper tries to develop new estimates of GDP from both of the production and demand sides, by revising Myanmar's system of national accounts based on existing studies, various materials available, and international comparisons. Section 2 provides an overview of the MMSNA data that are currently available, some minor revisions in MMSNA, and our adjustment process used in this paper. Specifically, we correct the amounts of exports and imports in Section 3, examine and correct data on gross output by industry in Section 4, and reassess the transaction value of jade in Section 5. Section 6 summarizes our estimation results. Some tables on the revised estimates are provided in Appendix.

2 Framework for Revision

2.1 Industry Outputs

In the MMSNA, GDP is measured by the production approach based on value added by industry. The constraint in examining output by industry is that the MMSNA provides data on nominal and real value added by industry but not on the corresponding gross outputs. Therefore, in this paper, we use data on gross outputs by industry from the United Nations Statistics Division (UNSD)'s National Accounts Official Country Data. The MMSNA's value added by industry and the UNSD's gross output by industry are mostly consistent with each other but there are two points that require attention. First, 4. Energy and Mining and 8. Transportation and Communications are further broken down to subcategories in the MMSNA (shown in the right column of Table 1) but not in the UNSD classification. Therefore, this paper deals only with 12 broadly-classified industries.

Table 1: Industry Classification

This study	MMSNA
1. Agriculture	1. Agriculture
2. Livestock and Fishery	2. Livestock and Fishery
3. Forestry	3. Forestry
4. Energy and Mining	4. Energy and Mining
	4.1 Energy
	4.2 Mining
5. Manufacturing	5. Processing and Manufacturing
6. Electricity	6. Electric Power
7. Construction	7. Construction
8. Transportation and Communications	8. Transportation and Communications
	8.1 Transportation
	8.2 Communications
9. Financial Institutions	9. Financial Institutions
10. Social and Administrative Services	10. Social and Administrative Services
11. Rental and Other Services	11. Rental and Other Services
12. Wholesale and Retail	12. Trade

Second, there are certain discrepancies between the two systems that may be regarded as time-series inconsistencies. Figure 2 shows changes over periods in the ratio of nominal value added to nominal gross output (value-added rate) calculated by using data on value added by industry from the MMSNA and data on gross output by industry from the UNSD. The two sets of data generally correspond fairly well but some irregularities are observed in certain years. In agriculture, the value-added rate dropped in 1993. However, as discussed later, we found no plausible factors in physical output data (the value-added rate remained stable even in 1991 and 2008 when agriculture suffered substantial cyclone damage). In this paper, we will use the MMSNA-based data on value added by industry as a benchmark and make adjustments to the UNSD-based data on gross output by industry to remove the irregularity in the time series of the value-added rate (rev-0 in Table 2). In 6. Electricity, there were some periods in which the value-added rate fell sharply. However, as these are also the periods in which Myanmar increased its dependence on import-reliant coal power generation (Figure 25 in Subsection 4.5), we avoid making ad-hoc adjustments here.

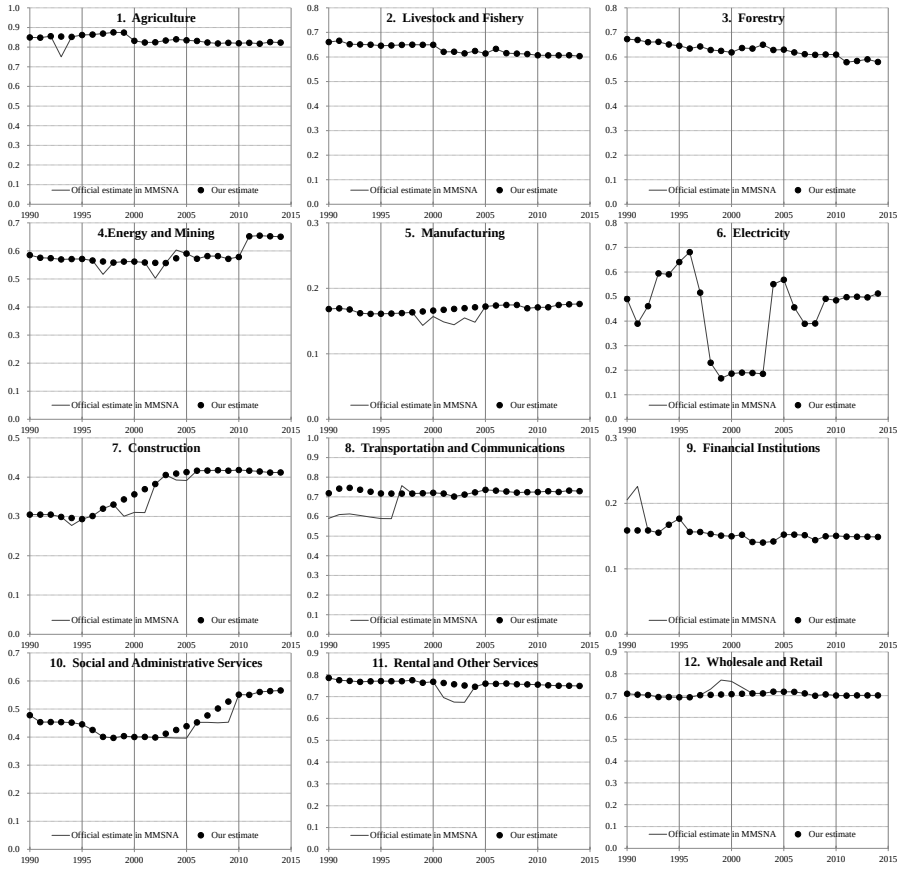


Figure 2: Adjustment in Value Added Ratios by Industry

2.2 Output Prices

The constraint on the side of price data is that neither the MMSNA nor the UNSD provides data on gross output prices by industry. Although we do not know how the MMSNA estimates the prices of value added by industry, we treat the value-added price index for each industry as being equal to the gross output price index for that industry.[2] In Section 4, we make adjustments to data on real gross output by industry based on those official estimates (rev-2 in Table 2). First, we compare official estimates for 1. Agriculture and 4. Energy and Mining with corresponding estimates in physical units by external organizations. Second, for 2. Livestock and Fishery, 5. Manufacturing, and 6. Electricity, we compare official estimates in the MMSNA with corresponding estimates in physical units separately released by the CSO. Although it is possible that the quantitative data released by the CSO have been overestimated, the comparison shows that the two sets of data also differ in their trajectories over periods. Third, for 8. Transportation and Communications and 12. Wholesale and Retail, whose demand is mainly derived demand and hence dependent on activities in other industries, we make

[2] Industry-level data on the values of gross output and value added (both in nominal and real terms) after these adjustments are hereinafter referred to as "official estimates" in the MMSNA.

adjustments associated with the aforementioned adjustments to data on real gross output by industry. In each case, relevant data from neighboring countries such as Cambodia, Thailand, and Vietnam are used as reference information for comparison.

These downward revisions to real gross output by industry result in upward revisions to the prices of production implicitly computed from data on nominal gross output by industry based on the MMSNA. However, the resulting prices of production for most industries (i.e., except for 4. Energy and Mining) appear to be significantly overestimated when compared to the consumer price index (CPI) and international prices. Therefore, data on nominal value of gross output are also adjusted for many industries. The adjustments to nominal gross output data revise nominal and real value added via the value-added rate for each industry as revised in Figure 2 (i.e., after rev-0 in Table 2).

Table 2: Our Revisions in MMSNA

		Gross output (GO)			Value added (VA)	
		value (v)	quantity (q)	price (p)	value (vv)	quantity (vq)
1. Agriculture	if rev-2	p*q	rev-2	rev-1	rev-0,1,2	vv/p
	otherwise	rev-0,1	v/p	rev-1	rev-1	–
2. Livestock and Fishery		p*q	rev-2	rev-1	rev-1,2	vv/p
3. Forestry		p*q	–	rev-1	rev-1	–
4. Energy and Mining	if rev-2, 3	rev-0,1,3	rev-2,3	v/q	rev-1,3	vv/p
	otherwise	rev-0,1	v/p	rev-1	rev-1	vv/p
5. Manufacturing	if rev-2	p*q	rev-2	rev-1	rev-0,1,2	vv/p
	otherwise	rev-0,1	v/p	rev-1	rev-1	–
6. Electricity		–	–	–	–	–
7. Construction		rev-0	v/p	–	–	–
8. Transportation and Communications		p*q	rev-2	–	rev-0,2	vv/p
9. Financial Institutions		rev-0	v/p	–	–	–
10. Social and Administrative Services		rev-0	v/p	–	–	–
11. Rental and Other Services		rev-0	v/p	–	–	–
12. Wholesale and Retail		p*q	rev-2	–	rev-0,2	vv/p

Note: In revision of gross output, 0=adjustment in irregular changes in value added rates by industry, 1=revision in trade (Section 3), 2=revision in output (Section 4), and 3=revision in jade value (Section 5)

2.3 Final Demand

In the MMSNA, final demand is composed of the following five components: gross fixed capital formation (GFCF), net increase in stock (INV), export (EX), import (IM), and total consumption.[3] Here, total consumption is defined as the difference between market price-based GDP for the country and the sum of the remaining four components of final demand, and no further breakdowns are provided in the MMSNA. As for government consumption (GC), relevant data from the UNSD's National Accounts Estimates of Main Aggregates (UN estimates) can be used. However, in recent years, the amount of government consumption based on the UN estimates has increased to a level equal to two- to three-times the nominal value of gross output for 10. Social and Administrative Services, which is supposed to be conceptually similar to government consumption. In our estimation, we assume that the nominal value of gross output for 10. Social and Administrative Services equals

[3] From 2005 onward, final demand in the MMSNA includes statistical discrepancy, in addition to the five components stated above.

the amount of government consumption to define household consumption (HC) as total consumption net of government consumption, thus decomposing final demand into six components.

As the first step for revising data on final demand, we make adjustments to the values of import and export (rev-1 in Table 2) in Section 3. This involves converting amounts based on the official exchange rate into those based on the market exchange rate, checking Myanmar's trade statistics against those of its major trade partners, and adding the amounts of trade in services and direct purchases that are no included in the MMSNA. Then, in Section 5, we reassess the values of jade exports and have them reflected in the GDP statistics (rev-3 in Table 2). Data used for revising the MMSNA are as shown in Table 3.

Table 3: List of Data Used for Revising MMSNA

No.	Variables	Periods	Unit	Sources
Official estimate in MMSNA				
1	final demands (C, GFCF, INV, EX, IM)	2010–2014	at current and 2010 prices	MMSNA (2015), CSO
2	final demands (C, GFCF, INV, EX, IM)	2005–2010	at current and 2005 prices	MMSNA (2011), CSO
3	final demands (C, GFCF, INV, EX, IM)	2000–2005	at current and 2000 prices	MMSNA (2006), CSO
4	final demands (C, GFCF, INV, EX, IM)	1987–2000	at current and 1985 prices	MMSNA (2003), CSO
5	gross value added (VA) by industry	2010–2014	at current and 2010 prices	MMSNA (2015), CSO
6	gross value added (VA) by industry	2005–2010	at current and 2005 prices	MMSNA (2011), CSO
7	gross value added (VA) by industry	2000–2005	at current and 2000 prices	MMSNA (2006), CSO
8	gross value added (VA) by industry	1987–2000	at current and 1985 prices	MMSNA (2003), CSO
9	gross output (GO) by industry	1998–2014	at current prices	National Accounts Official Country Data, UNSD
10	gross output (GO) by industry	1974–1998	at current prices	National Accounts Official Country Data, UNSD
Revision in trade				
11	official exchange rate	1960–2014	at current prices	World Development Indicators, WB
12	market exchange rate	1970–2014	at current prices	National Accounts Estimates of Main Aggregates, UNSD
13	trade in services	1980–2014	at current prices	WTO Statistics Database, WTO
14	trade by type of principal commodities	1990–2014	at current prices	Myanmar Statistical Yearbook, CSO
15	trade by commodity section (by B-SITC)*	1990–2014	at current prices	Myanmar Statistical Yearbook, CSO
16	trade by commodity section (by HS)*	2001–2014	at current prices	Myanmar Statistical Yearbook, CSO
17	trade by country*	1990–2014	at current prices	Myanmar Statistical Yearbook, CSO
18	trade by commodity section	1990–2014	at current prices	UN Comtrade, UNSD
19	trade by country	1990–2014	at current prices	UN Comtrade, UNSD
20	composition of imports	1990–2014	at current prices	Myanmar Statistical Yearbook, CSO
21	trade by country*	1990–2014	at current prices	Myanmar Statistical Yearbook, CSO
22	freight and insurance	2005	at current prices	Asian International Input-Output Table, JETRO
Revision in output				
23	sown area of selected crops*	1990–2014	at acres	Myanmar Statistical Yearbook, CSO
24	harvested area of selected crops*	1990–2014	at acres	Myanmar Statistical Yearbook, CSO
25	production of selected crops*	1990–2014	at physical uint	Myanmar Statistical Yearbook, CSO
26	prices of selected crops at harvest time*	1990–2014	at current prices	Myanmar Statistical Yearbook, CSO
27	agricultural production by country*	1961–2013	at constant prices	FAOSTAT, FAO
28	agricultural area by country*	1961–2013	at acres	FAOSTAT, FAO
29	production of grains	1960–2015	at physical uint	Production, Supply and Distribution, USDA
30	primary livestock production by country*	1961–2013	at physical uint	FAOSTAT, FAO
31	production of fish and prawns*	1990–2014	at number of uint	Myanmar Statistical Yearbook, CSO
32	livestock breeding	1990–2014	at number of uint	Myanmar Statistical Yearbook, CSO
33	volume of production of selected commodities	1990–2014	at physical uint	Myanmar Statistical Yearbook, CSO
34	electric power generation by type and location*	1990–2014	at physical uint	Myanmar Statistical Yearbook, CSO
35	production of electric power*	1990–2014	at physical uint	Myanmar Statistical Yearbook, CSO
36	sales of electric power by type*	1990–2014	at current prices	Myanmar Statistical Yearbook, CSO
37	retail prices of selected commodities in Yangon*	1990–2014	at current prices	Myanmar Statistical Yearbook, CSO
38	wholesale prices of selected commodities in Yangon	1990–2014	at current prices	Myanmar Statistical Yearbook, CSO
39	energy demand and production	1990–2014	at oil equivalent tonnes	Energy Balance Table, IEA
Revision in jade value				
40	jade production	1990–2014	at physical uint	Myanmar Statistical Yearbook, CSO
41	jade production*	1996–2013	at physical uint	U.S. Geological Survey, USGS
42	jade sales*	1995–2014	at current prices	Burma Gem Sales and Statistics, Pala International
43	jade sales	2005–2014	at current prices	Global Witness

Note: * indicates the data used for reference.

3 Revision in Trade

3.1 Revaluation of Exports

Until April 2012, multiple exchange rates were used in Myanmar. Basically, the US dollar is and has been the currency of settlement (although the euro is used in some transactions and the Chinese yuan in border trade). However, prior to the shift to the managed floating exchange rate system, the official exchange rate had been used to convert trade values in the currency of settlement into those in the domestic currency in the MMSNA and the balance of payment (BOP). Shown in Figure 3 is comparison of changes in the time series of the official exchange rate and those of the UNSD AMA rate, which can be regarded as the market exchange rate. Prior to the shift to the management floating exchange rate system, the two exchange rates were deviating significantly from each other. In 2007, the official exchange rate was 5.78 kyat per US dollar, overvalued by more than 220 times compared to the market exchange rate of 1,280 kyat per US dollar. Accordingly, trade values were grossly underestimated.

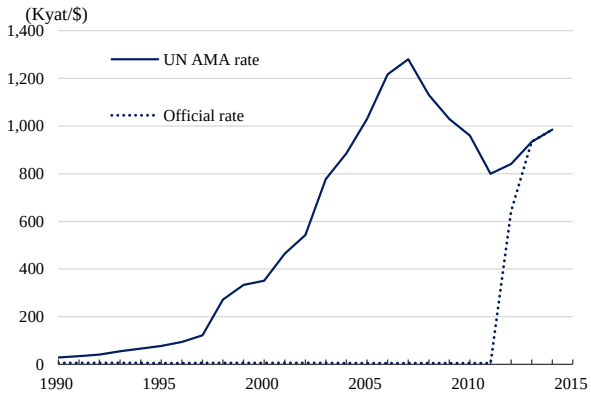


Figure 3: Market and Official Exchange Rates

The underestimation of export values result in an underestimation of the gross output and value added of industries producing goods for export. Figure 4 illustrates how the gross output of each industry is decomposed into the portion absorbed in domestic demand[4] and that in export demand (as converted into domestic currency value by the official exchange rate) before making any adjustments. In 4. Energy and Mining, an industry in which the share of export demand is particularly high, the underestimation of trade value due to the use of the official exchange rate is a major factor explaining the discontinuity in the time-series trend of nominal gross output between 2010 and 2011. The similar gap is also observed in nominal value added for the industry, indicating that the underestimation of

[4] Export values are based on the values of exports by commodity in the Myanmar Statistical Yearbook (MSY) published by the CSO. The value of exports of each commodity, denominated in the U.S. dollar, has been converted into kyat terms and applied to the relevant industry, assuming that each of the 20 commodities corresponds to an industry. The value of an industry's gross output accounted for by domestic demand is defined as the difference between the nominal value of gross output (Subsection 2.1) and the value of exports for the corresponding industry.

export values has been causing the underestimation of nominal GDP.

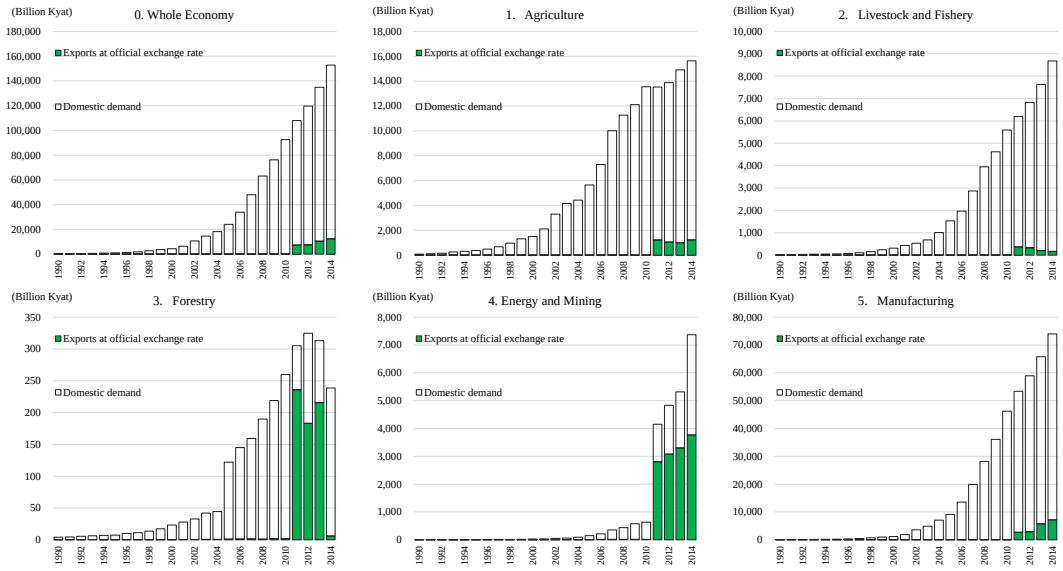


Figure 4: Nominal Gross Output by Industry (Before Revision)

Shown in Figure 5 are gross output values as recalculated by using the adjusted export values based on the market exchange rate. We can see that the discontinuity observed in 4. Energy and Mining has been resolved by revaluing the exchange rate. Meanwhile, although no particular discontinuity is observed in the graph for 3. Forestry in Figure 4, which is before making any adjustments, the trend of gross domestic values as seen in the shape of the graph in Figure 5 is quite different from that of Figure 4. The upward revision of gross output in the industry resulting from the revaluation of exports of the industry leads to an increase in nominal GDP for the country, given that the value-added rate of the industry is constant. Specifically, this necessitates an upward revision of nominal GDP every five years starting from 1990 through 2010 by 3.3%, 6.0%, 9.5%, 12.9%, and 8.6% respectively.

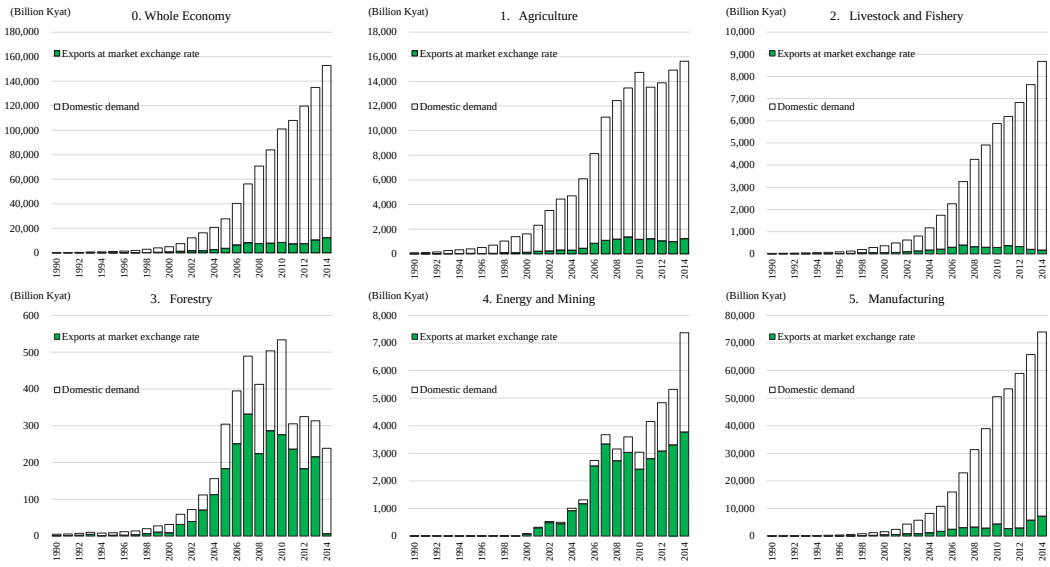


Figure 5: Nominal Gross Output by Industry (After Revision)

3.2 Revaluation of Imports

Meanwhile, in the case of the import of intermediate goods, the underestimation of the values of imports (denominated in the domestic currency) may lead to an underestimation in the value of GDP via an underestimation in the value of intermediate inputs. Figure 6 shows the composition of imports by type of commodities in value terms based on data provided in the Myanmar Statistical Yearbook (MSY). Commodities are classified into three broad categories—i.e., capital goods, intermediate goods, and consumer goods—which are further broken down into 12 subcategories. Among the imported goods, 20% to 30% are considered to intermediate goods. Revaluing those intermediate goods based on the market exchange rate would create a significant discontinuity in the time-series trend of the value-added rate at the aggregate level. Meanwhile, allocating the values of imports by commodity to the corresponding industries under certain assumptions would result in a negative value in the value-added rate in some industries. Based on those considerations, we refrain from making GDP adjustments for reflecting the revaluation of the imports of intermediate goods.

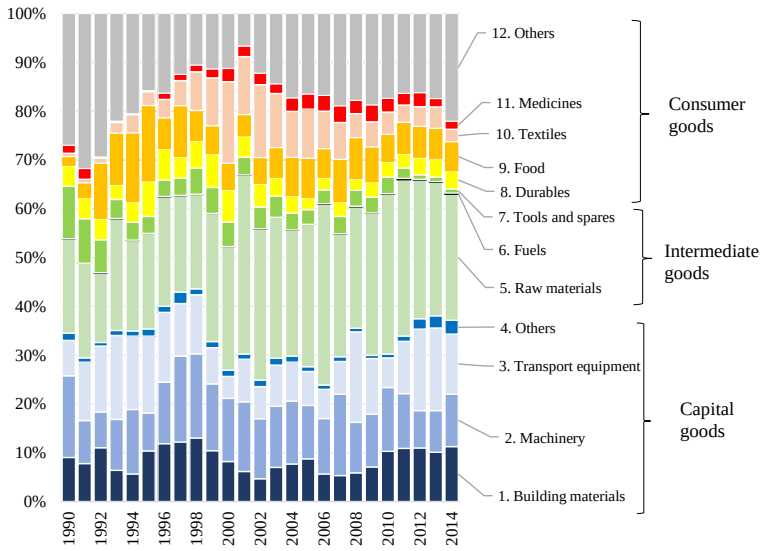
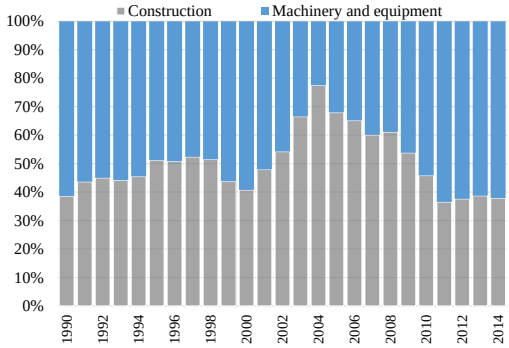


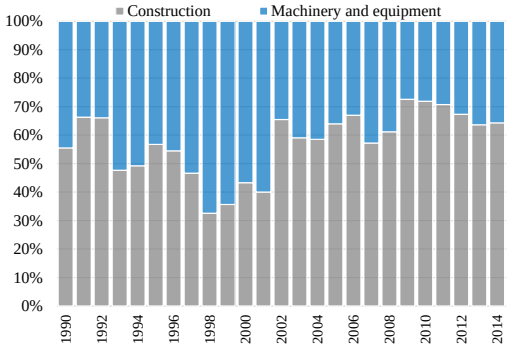
Figure 6: Composition of Import

Provided that Myanmar is dependent on imports for most of machinery and equipment as capital goods, and if such imports are measured in kyat terms converted from the US dollar at the official exchange rate, the construction industry's share in gross fixed capital formation (GFCF) can be presumed to be near 100%. Figure 7.1 plots the construction industry's share in GFCF, assuming that 95% of the nominal gross output of the industry is capital formation (with the remainder accounted for by maintenance and repair, hence treated as intermediate consumption). The construction industry's share generally falls within the range of 40% to 50%, showing no indication of an undervaluation of machinery and equipment imports. Meanwhile, an estimation based on data on imports (after adjustments as discussed in Subsection 3.3) shows that investment in machinery and equipment amounted to 4.8 trillion kyat in 2014,[5] which represents only one-third of 14.3 trillion kyat, the amount of such investment presented in the MMSNA. It is highly likely that nominal GFCF in the MMSNA has been overestimated along with the overestimation of nominal GDP. In our estimation, we use the estimates based on data on imports as the amount of investment in machinery and equipment. As a result of this revision, the construction industry's share in GFCF expands to around 50% to 70% as shown in Figure 7.2.

[5] The amount of investment is estimated at purchaser's prices, calculated as the sum of the gross outputs that are assumed to be accounted for by GFCF—i.e., 80% of 2. Machinery and 50% each of 3. Transport equipment and 4. Others in Figure 6—plus commercial margins and the estimated cost of transportation.



(Figure 7.1: Before Revision)



(Figure 7.2: After Revision)

Figure 7: Construction Share in GFCF

Based on what has been discussed above, we assume that the aggregate-level impact of revaluing import values based on the official exchange rate can be described as follows. Now, consider that the balance between output and final demand measured at the market exchange rate is described by the following equation:

(1) $GDP = HC + GC + GFCF + INV + EX - IM$,

and that the values of exports (*EX**) and imports (*IM**) measured at the official exchange rate are defined as:

(2) $EX = EX^* + R^{EX}$ and $IM = IM^* + R^{IM}$.

In the MMSNA, household consumption (*HC*) is defined as the difference between GDP and the total of the non-HC final demand. Therefore, the aggregate balance in the MMSNA for the periods in which export values were measured at the official exchange rate can be described as:

(3) $(GDP - R^{EX}) = (HC - R^{IM}) + GC + GFCF + INV + EX^* - IM^*$.

As such, in the current MMSNA, nominal GDP is measured as $(GDP - R^{EX})$ and underestimated by R^{EX}. Likewise, household consumption is measured as $(HC - R^{IM})$ and underestimated by R^{IM}. In this section, we use equation (3) as the basis and revise it into equation (1) by reassessing values measured at the official exchange rate to those at the market exchange rate.

Figure 8 compares the official estimates of export and import values in the MMSNA, which are measured at the official exchange rate, and our estimates measured at the market exchange rate. The discontinuity in the trend between 2010 and 2011 observed in the official estimate in the MMSNA (shown as dotted line in Figure 8) is resolved in our estimates measured at the market exchange rate. The revaluation of import values at the market exchange rate does not affect GDP as shown in equation

(3) (household consumption is affected by the revaluation of import values but the revision is made under the influence of various factors to be discussed later).

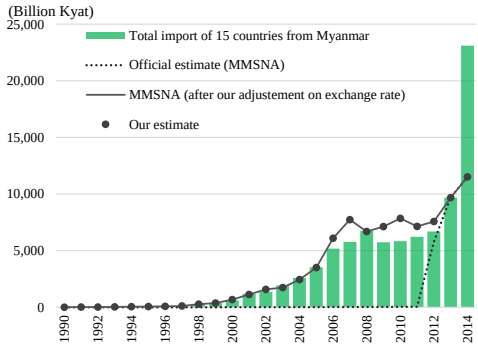
3.3 Other Revisions in Trade

In addition to the revaluation at the market exchange rate in the preceding subsection, we make revisions in two aspects, namely, the reexamination of import values in trade statistics and adjustments the SNA concept. By examining trade between pairs of countries based on customs data on exports reported one country and corresponding imports reported by its trade partners, Kellenberg et al. (2016) found the tendency that the lower the level of economic development and the greater the level of corruption, the country is more likely to underreport exports. Meanwhile, with regard to the case of Myanmar, Ebashi (2000) pointed to the possibility of underreporting the amounts of exports and imports in a bid to evade the export taxes and the import tariffs respectively. Figure 8 compares trade values reported in the MMSNA and the sums of corresponding trade figures reported by Myanmar's 15 major trade partners and published on the UN Comtrade.[6] As shown in Figure 8.1, the value of exports reported in the MMSNA has been generally consistent with the sum of corresponding imports reported by the trade partners and the former slightly exceeds the latter from 2006 onward. Thus, as far as export values are concerned, we do not find any underreporting tendency in the MMSNA.[7]

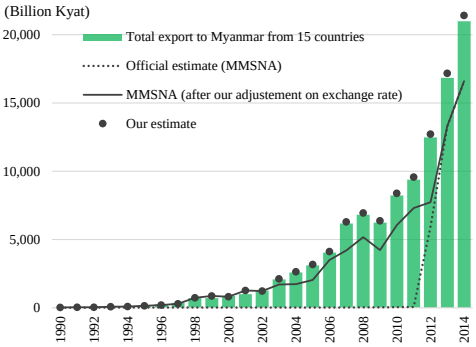
Meanwhile, imports reported in the MMSNA are based on CIF, meaning that the reported value includes cost, insurance, and freight, whereas exports reported by the trade partners are based on FOB, which do not include insurance and freight. Accordingly, the value of imports in the MMSNA is supposed to exceed the sum of corresponding exports reported by the trade partners. However, as shown in Figure 8.2, the sum of corresponding exports reported by the trading partners has been exceeding the value of imports reported in the MMSNA by 20% to 60%. Thus, in our estimation, we adjust Myanmar's import data for 2003 and onward based on the sum of corresponding exports reported by the trade partners. Since freight and insurance rates charged in Myanmar are not available, we apply the factor applicable to Thailand at the national aggregate level (2.0%) in IDE (2013) to convert FOB-based values into CIF-based values. As a result of this revision, Myanmar's trade deficit in 2014 expands from 5.1 trillion kyat to 9.9 trillion kyat.

[6] Myanmar's 15 major trade partners are: China, Hong Kong, India, Indonesia, Japan, Malaysia, South Korea, Singapore, Thailand, the U.S., France, Italy, the United Kingdom, Vietnam, and Germany.

[7] Although the sum of imports reported by the trading partners for 2014 was twice as the corresponding value of exports reported in the MMSNA, this is attributable to China's import of jade from Myanmar, as discussed in detail in Section 5.



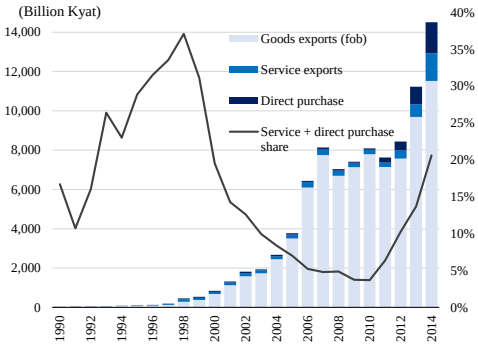
(Figure 8.1: Goods Export)



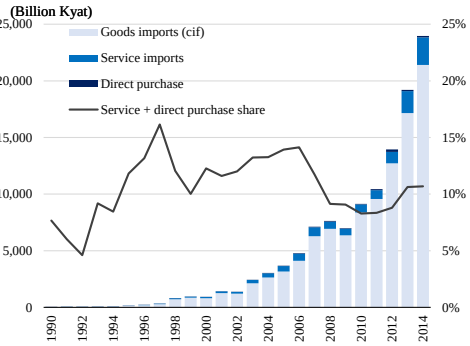
(Figure 8.2: Goods Import)

Figure 8: Goods Trade, Comparison with Values in Major Trading Nations

The values of exports and imports reported in the MMSNA are consistent with figures in customs clearance-based trade statistics. In the national accounts, however, it is desirable to include, not only trade in goods recorded in customs clearance-based trade statistics, but also trade in services and direct purchases. Here, we estimate the values of trade in services and direct purchases based on balance of payments (BOP) data provided in the WTO (2015) and added them to the value of trade in goods.[8] The results are shown in Figure 9. The combined share of trade in services and direct purchases in total exports varies significantly depending on the year. After peaking at 37% in 1998, the share dropped to 4% in 2009 and 2010, the final years of the military regime, but rebounded following the transfer of power to the civilian government in 2011, rising to 21% in 2014. In contrast, the combined share of trade in services and direct purchases in total imports has been relatively stable, falling within the rage of 5% to 15% over the past 25 years.



(Figure 9.1: Export)



(Figure 9.2: Import)

Figure 9: Service Trade and Direct Purchase

[8] Trade in services corresponds to "trade in commercial services" net of "construction," "royalties and license fees," and "travel" in the BOP, whereas direct purchases correspond to "travel" in BOP.

4 Revision in Production

4.1 Agriculture

According to data in the MMSNA, agriculture used to account for roughly half of Myanmar's GDP in the 1990s. Although its share in GDP has declined to around 20% in recent years, agriculture remains the country's mainstay industry. Shown in Figure 10 are changes in the growth rates of agriculture production, sown area, and harvested area based on data published in the CSO's Myanmar Statistical Yearbook (MSY), as compared to those in the growth rate of real gross output for agriculture.[9] Significant changes were observed in the 1990s but relatively high growth rates were maintained in all of the indicators in the 2000s.

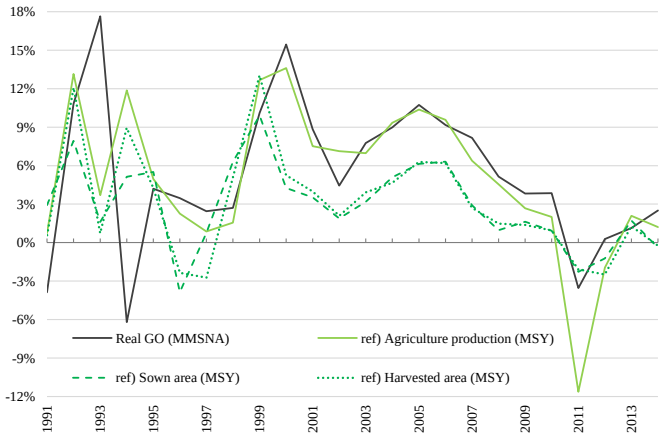


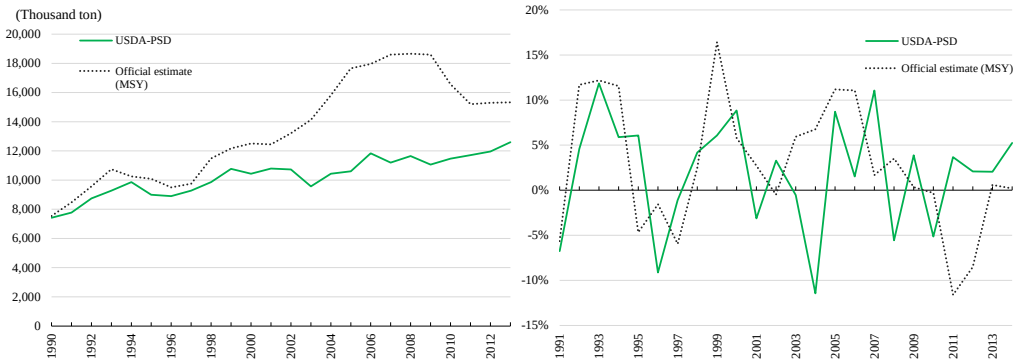
Figure 10: Comparison of Agriculture Indicators

However, those high growth rates are questionable. Okamoto (2008) points out that rice, which is the staple crop of Myanmar, has been subject to overstatement as it has been used as a measure for the performance of local governments. This tendency was accelerated from 2004 onward, following the abolition of a compulsory rice procurement system, under which farmers were required to deliver to the government a quota of rice set per unit sown area at a lower-than-market price. With no delivery required, nothing stopped local government officials from overstating the sown area under their control to inflate their administrative performance. Harvard University's ASH Center (Dapice et al. 2010) also points out that the production of milled rice in Myanmar has been significantly overstated. By comparing data from FAOSTAT that are based on the CSO's official estimates and data from the US Department of Agriculture (USDA)'s Production, Supply and Distribution (PSD) database, they have concluded that the latter are more in line with the reality. In the period 2001 through 2009, annual rice

[9] The MSY provides data on production, sown area, and harvested area for each of the 49 agricultural products. The growth rate of agricultural production is a weighted average of the growth rates of the 49 agricultural products, based on their two-period average shares in the total in value terms. The value of production for each product is calculated by multiplying the yield by the price at harvest. Harvested area is defined as follows: sown area + area under multiple cropping – non-harvested area.

yield per capita ranged from 200 kg to 300 kg based on FAOSTAT data, compared to 200 kg to 220 kg based on USDA-PSD data. The annual yield of 300kg per capita as shown by FAOSTAT data translated into a daily calorie intake of 3,000 kcal per capita, exceeding 2,800 kcal required by an adult male living in a rural area. Given the fact that Myanmar's population includes women, children, and urban dwellers, who need less calories, they maintain that the FAOSTAT-based average yield of rice, which is equivalent to 3,000 kcal per capita per day, cannot be considered realistic, noting that an annual consumption of 180 kg to 200 kg per capita would be a reasonable estimate. They say that the estimate is roughly in line with the USDA-PSD-based annual yield of 200 kg to 220 kg when netted with what they perceive to be unrecorded exports (amounting to 500,000 tons per year or 10 kg per capita per year).

Figure 11 show changes in the level and growth rate of rice production, comparing how they differ depending on whether they are based on data from USDA-PSD or those from the MSY.[10] In term of the growth rate, particularly large gaps are observed in 1998 and the mid-2000s. Meanwhile, in the level of production, the gap peaked in 2009, with the level of production based on MSY data exceeding that based on USDA-PSD data by roughly 70%. From 2010 onward, the former declined in a way to close the gap with the latter.



(Figure 11.1: Production) (Figure 11.2: Growth)

Figure 11: Rice Production, Official and USDA-PSD Estimates

An overestimation of quantitative data may be found in other agricultural products. Figure 12 shows agricultural output growth by type of products in three different periods (1990–1997, 1997–2010, and 2010–2014), classifying the 49 agricultural products in the MSY into seven groups (the number provided in the brackets following each type of products is the number of products classified into the type, and product-level data are aggregated for each group as measured in the translog index using the product prices at harvest). A comparison of the seven groups reveals that some types of agricultural products show greater growth than cereals, which include rice. They show particularly

[10] The MSY does not provide data on milled rice. As in Dapice et al. (2010), we estimate the production of milled rice by multiplying paddy output by 0.58.

high growth in the period 1997–2010, during which MSY-based rice production exceeded that based on USDA-PSD data by a significant margin, indicating the possibility of similar overestimation.

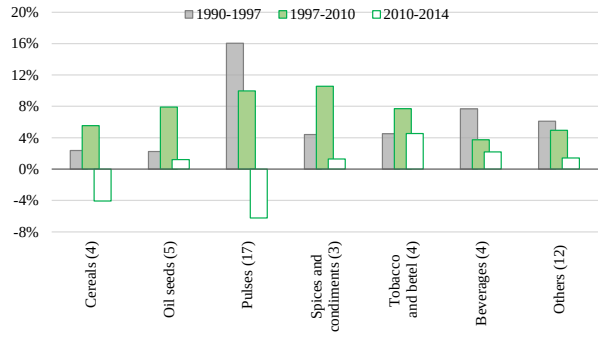


Figure 12: Agriculture Output Growth by Products

In our estimation, we first replace the growth rates calculated based on MSY data with those based on USDA-PSD data for three of the 49 agricultural products, namely, paddy, wheat, and millet. Second, for the remaining 46 products, for which no substitute estimates are available, we adjust MSY-based growth rates for the years in which the MSY-based growth rate for rice exceeds that based on USDA-PSD, reducing the growth rate for each of the 46 products by the percentage-point difference observed in the growth rate for rice. The years from 1998 through 2010 are subject to this adjustment. Revised real gross output is estimated by aggregating thus-adjusted output by product as measured in the translog index. Figure 13 shows the growth of revised real gross output for 1. Agriculture.

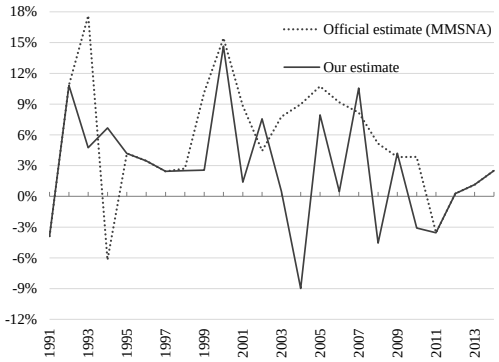
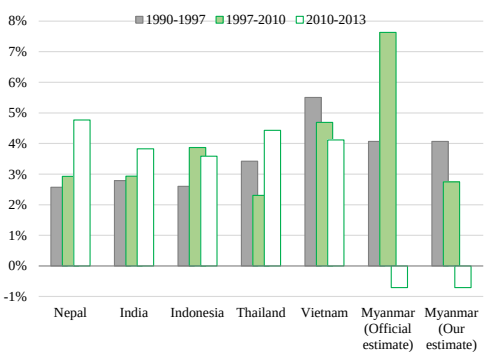


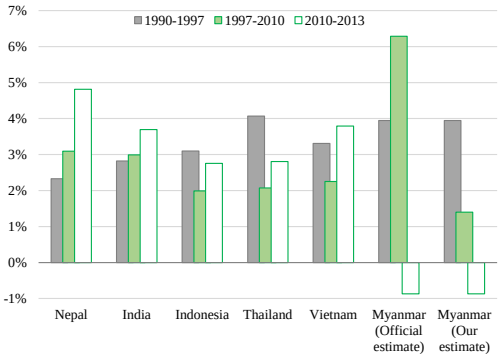
Figure 13: Revision in Agriculture Production, Official and Our Estimates

Based on the revised production data, we calculated average growth rates for agricultural production and land productivity in three different periods (1990–1997, 1997–2010, and 2010–2013), and plotted the results in Figure 14. Except for those for Myanmar, data are taken from FAOSTAT. Land productivity is defined as agricultural production per unit sown area. Based on official estimates, i.e., before adjustments, Myanmar's agricultural production and land productivity for the period 1997–

2010 were extremely high relative to those of its neighboring countries. Those after the adjustments were generally in line with those of the neighboring countries.



(Figure 14.1: Production Growth)

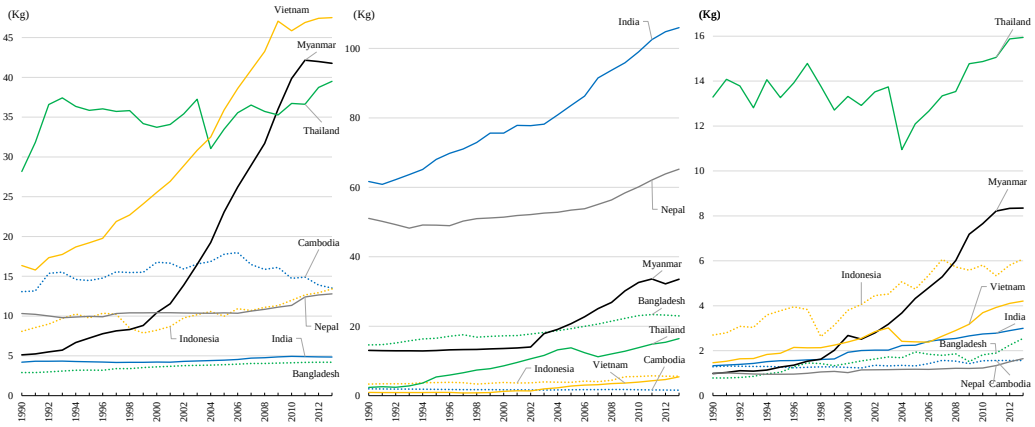


(Figure 14.2: Land Productivity Growth)

Figure 14: Comparison of Agriculture Production and Land Productivity

4.2 Livestock and Fishery

2. Livestock and Fishery accounts for approximately 6% to 9% of Myanmar's value added. According to data from the MMSNA, livestock and fishery production grew by an average of 11% per year over the past 25 years, with particularly high growth—an average of 15% per year—recorded from the latter half of the 1990s through the 2000s. Figure 15 compares Myanmar's annual livestock production per capita with those of its neighboring countries, all based on data from FAOSTAT. In 1990, Myanmar's meat production (Figure 15.1) stood at 5 kg per capita, slightly above that of India but only one-sixth the level of Thailand. However, from 1999 onward, Myanmar's meat production grew rapidly to exceed that of Thailand in 2009. The average growth rate for the period 1998–2010 was 13%, more than twice that of Vietnam, which achieved the second largest growth (6% per year) among the neighboring countries. Likewise, Myanmar's milk and egg production (Figure 15.2 and Figure 15.3) grew rapidly—at the pace of 7% and 13% respectively—during the same period, indicating the high likelihood of overestimation.



(Figure 15.1: Meat) (Figure 15.2: Milk) (Figure 15.3: Egg)

Figure 15: Livestock Production per Capita

Figure 16 compares the number of breeding animals for beef, pork, and fowl meat production (expressed in the number of heads) and the corresponding livestock production, as measured in indexes (1990 = 1.0) based on data from the MYS. The production of cultivated assets or cultivated biological resources, which include livestock, in the context of the system of national accounts (SNA) is measured in terms of the growth of breeding animals, not in terms of the shipment of meat. Thus, it is assumed that the number of breeding animals for meat production and the production of livestock are closely correlated with each other. However, the production of livestock grew far more rapidly than the number of breeding animals in all of the three products, particularly from 1999 onward.

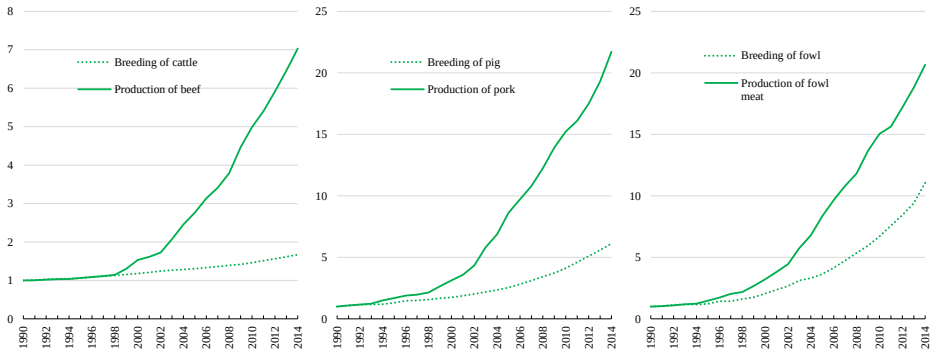


Figure 16: Production and Breeding of Livestock

Figure 17 shows the average production growth rates for nine types of livestock in three different periods (1990–1998, 1998–2010, and 2010–2014) based on data from the MSY. In the period 1998–2010, almost all products posted double-digit growth, sharply higher than the growth rates recorded in the preceding and subsequent period. Thus, in our estimation, we adjust production data for the period 1998–2010, for which particularly high growth was recorded, assuming that livestock

production for each of the nine products grew at the same pace as the number of breeding animals.[11] As a result of this adjustment, average production growth rates for all of the nine types of livestock are revised downwardly, for instance, from 16% to 8% for pork.

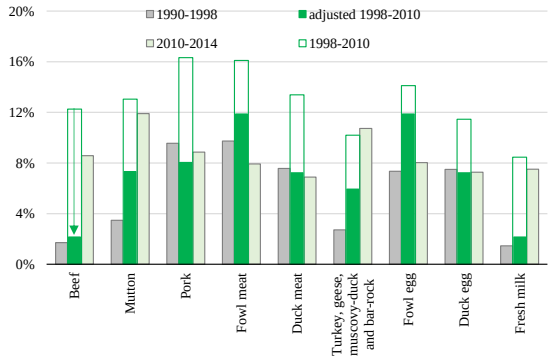


Figure 17: Production Growths by Types of Livestock

Although unrealistically high growth is observed in a certain period, no adjustments are made to data on fishery production as no substitute data are available. Figure 18 compares the rates of growth in real gross output for 2. Livestock and Fishery based on official estimates and those based on our estimates.[12] As a result of adjustments made above, the average annual growth rate for the period 1998–2010 is revised from 15% to 10%.

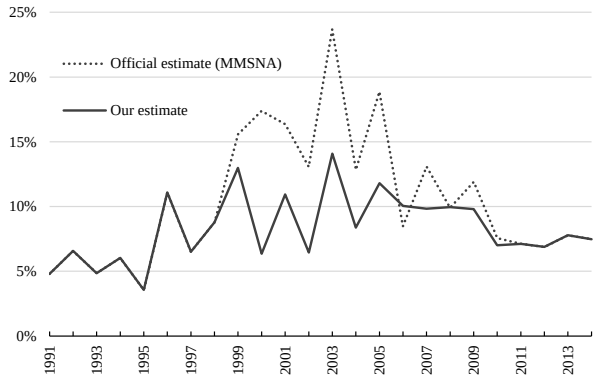


Figure 18: Revision of Output Growth in Livestock and Fishery

4.3 Energy and Mining

Since 2000, approximately 90% of output in 4. Energy and Mining has been for export, most of which is accounted for by natural gas (Figure 19). As Thailand is the largest destination for Myanmar's

[11] The productions of beef and fresh milk, mutton, pork, fowl egg, and duck egg are corresponded to the number of breeding of cattle, the total of sheep and goat, pig, fowl, and duck, respectively.
[12] The outputs in livestock and fishery are aggregated by the translog index using the wholesale price indices in Yangon city in MSY.

exports in energy and mining, Thailand's data on imports from Myanmar provide an effective benchmark against which to examine output in Myanmar in quantity terms.[13] Figure 20 shows real gross output based on data from the MMSNA, natural gas output reported in the MSY, Thailand's import of mineral products from Myanmar reported in the Thailand Trade Statistics (TTS), energy production in oil equivalent as shown on the International Energy Agency (IEA)'s Energy Balance Table, all in quantity terms and measured in indexes (2010 = 1.0). As the trend of real gross output deviates from those of the others in 1999 onward, we adjust the MMSNA-based data on real gross output based on IEA data.

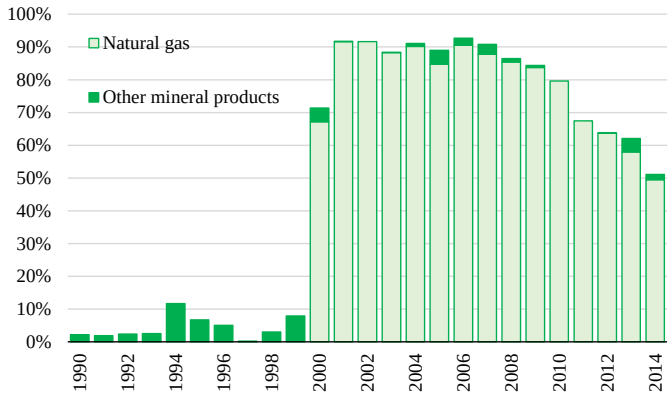


Figure 19: Export Share of Output in Energy and Mining

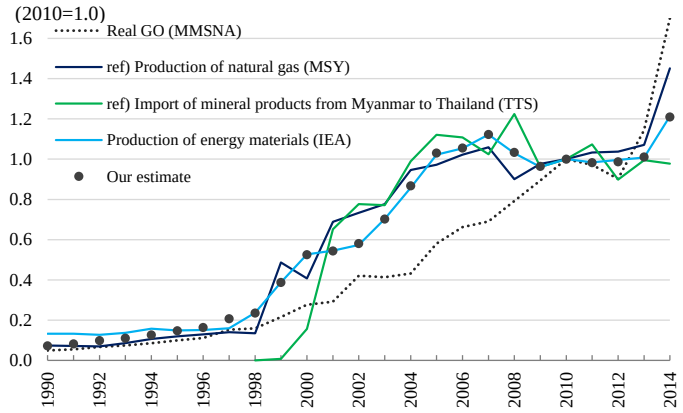


Figure 20: Output and Export in Energy and Mining

Figure 21 compares value added based on data from the MMSNA, natural gas exports reported in the MSY, Thailand's import of mineral products from Myanmar reported in the TTS, and revised

[13] Based on traded statistics of Myanmar's major trade partners (U.S., Thailand, Singapore, Malaysia, Japan, India, Hong Kong, and China), Thailand accounted for 90% or more of Myanmar's export of mineral products (including natural gas) through 2012. From 2013 onward, China's share increased to reach 35% in 2014 compared to Thailand's share of 64%.

gross output (calculated from the above adjusted real gross output and the adjusted nominal gross output in Subsection 3.1), all in value terms and measured in indexes (2010 = 1.0). We can see that the value of gross output based on our estimates, as compared to that based on official estimates, is more in line with the trends in the trade values reported in the MSY and the TTS.

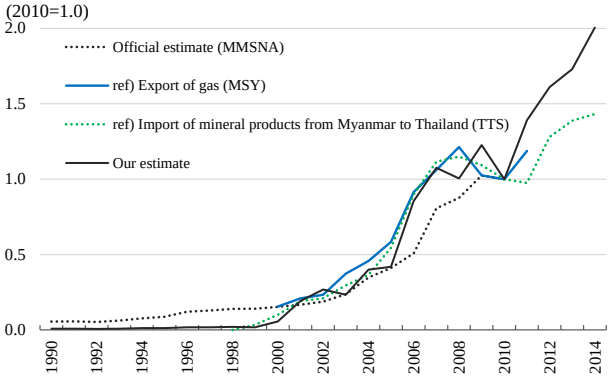


Figure 21: Output and Export Prices of Energy and Mining

4.4 Manufacturing

In order to examine the validity of the production index for 5. Manufacturing based on data from the MMSNA, we compare real gross output based on data from the MMSNA, industrial electricity demand reported in the MSY[14] as well as in the IEA's Energy Balance Table, and the production index[15] calculated from quantitative data on manufacturing production reported in the MSY, in their average growth rates for three different periods (1990–1998, 1998–2010, and 2010–2014), as shown in Figure 22. In the period 1998–2010, real gross output increased at the pace of 19% per year, more than twice the growth rates of other indexes. Manufacturing production and industrial electricity demand showed a strong correlation in the period 1990–1998 (correlation coefficient = 0.90) and the period 2010–2014 (0.86). However, in the period 1998–2010, the two variables deviated from each, showing a negative correlation coefficient (–0.22). The MMSNA-based real gross output in this particular period deviated greatly not only from industrial electricity demand but also from the production index based on quantitative data in the MSY. Since production in physical unit does not reflect quality improvement, the growth in the MSY-based production index is supposed to fall below that in the MMSNA-based real gross output index. Even so, however, the difference observed in the period 1998–2010 seems too huge, reaching 15.2 percentage points compared to 2.7 percentage points in the period 1990–1998. Thus, we revise real gross output data for the period 1998–2010 by applying

[14] The sales and consumption data of electricity are provided by type of purposes (general, industrial, bulk, and other) in MSY. In this comparison, electricity consumption only for industrial purpose is used.

[15] The numbers of production items published in MSY are different over periods. The total output of manufacturing is measured as the translog index based on the production data at the physical units of all available items (about 30–50 items) until 2010.

an average annual growth rate calculated by adding 2.7 percentage points to the growth rate of the production index based on the MSY-based quantitative data.

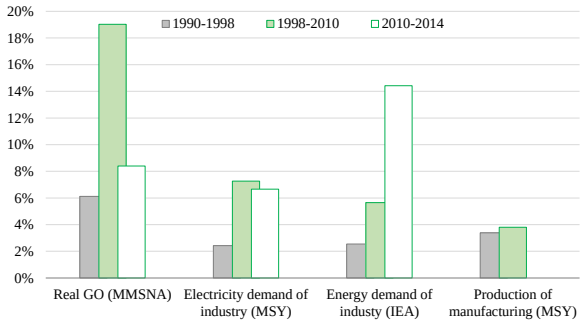


Figure 22: Growths of Output and Energy Demand in Manufacturing

Figure 23 compares the growth rates of the MMSNA-based real gross output, the MSY-based industrial electricity demand, and the adjusted real gross output based on our estimates. The adjusted real gross output recorded negative growth (–1.7%) in 2003–2004, which is probably attributable to economic sanctions imposed by the U.S. and the EU.[16] US trade statistics show that its import of manufacturing products from Myanmar, which stood at 329 million dollars in 2002, decreased to 251 million dollars in 2003 and to zero in 2004.

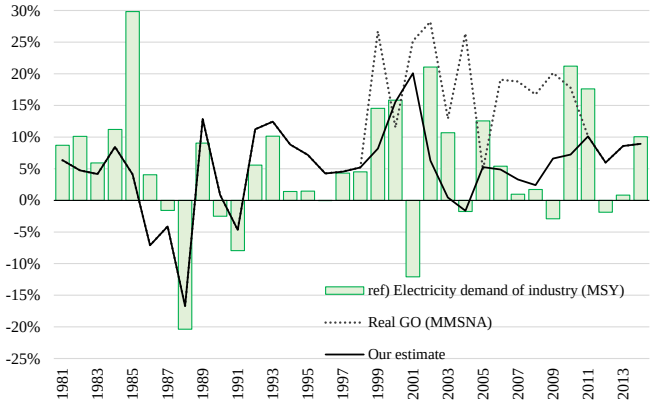


Figure 23: Growths of Output and Electricity Demand in Manufacturing

We revise nominal gross output downwardly by using the value calculated by multiplying the adjusted real gross output by the MMSNA-based price index. As a result, the export share of production is revised upwardly. Figure 24 compares changes in the export share in the nominal gross output of the manufacturing sector in Myanmar before making the above adjustment with those of

[16] Kudo (2005) indicates that the garment industry lost about 70–80 thousand jobs with the closure of about 150 firms/factories since its peak to mid-2005 in Myanmar, mainly caused by the U.S. sanctions of 2003.

other Asian countries based on data provided in APO (2016). The MMSNA-based export share before the above adjustment (after the exchange rate adjustments in Subsection 3.1) shows a sharp downward trend in the 2000s. In contrast, the export share after the above adjustment to production data shows an upward trend, following a trajectory similar to that of Bangladesh that has been expanding its exports, particularly in textiles.

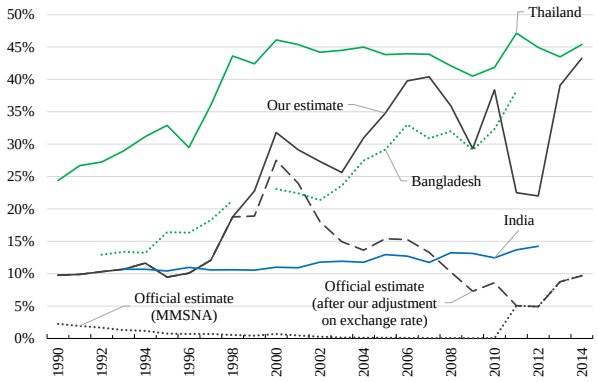


Figure 24: Country Comparison of Export Share in Manufacturing

4.5 Electricity

Hydro and natural gas-fired thermal power accounts for approximately 90% of total power generation in Myanmar. As shown in Figure 25, the share of natural gas in the energy mix for electricity generation peaked at 62% in 1999, subsequently overtaken by hydropower as the main source for generating electricity with its share rising from 22% in 1999 to 75% in 2009.

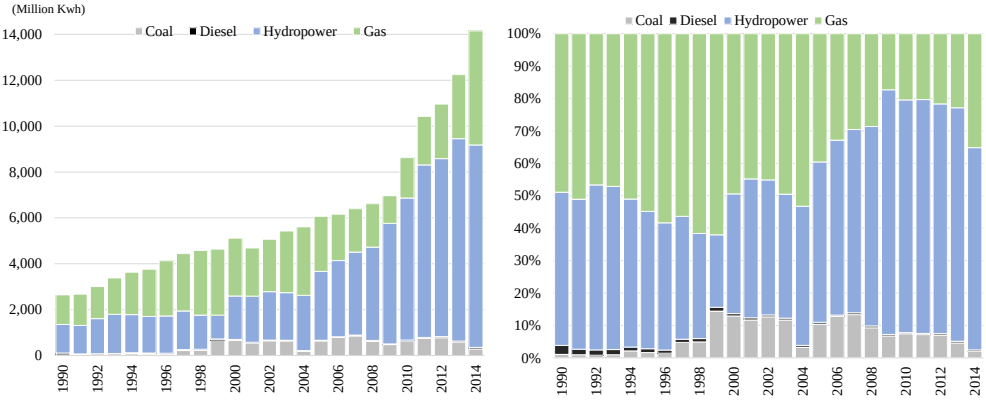


Figure 25: Electricity Generation by Type of Energy

Figure 26 compares the value of nominal gross output in the electricity industry based on data from the MMSNA and that of electricity sales reported in the MSY. The trajectories of the two

variables were almost identical from 1990 through 1998. After that, however, they began to deviate from each other and the gap expanded gradually in the period from 1999 through 2005. Both the value of the nominal output and that of electricity sales increased sharply—by four-fold and more than three-fold respectively—in 2005–2006. While the increase in electricity sales is attributable to higher electricity prices,[17] one contributing factor for the sharper increase in the nominal output was structural changes in the electricity sector. According to JICA (2014), the Ministry of Electric Power (MOEP) was divided into the Ministry of Electric Power No. 1 (MOEP-1) and the Ministry of Electric Power No. 2 (MOEP-2) in 2006, whereby the Myanmar Electric Power Enterprise (MEPE), which had been the sole power generator and distributor of the country, was split into four companies, i.e., Hydropower Generation Enterprise (HPGE), Electricity Supply Enterprise (ESE), Yangon City Electricity Supply Board (YESB), and what was left of MEPE.[18] The gross output after this restructuring reflects the sum of electricity sales of the four companies including sales between themselves, instead of the sales of MEPE as the sole power generator and distributor. Given that, it seems reasonable that the value of the nominal gross output after the restructuring has been three to four times that of electricity sales. Also, the long-term trend of the producer price index for electricity, which is calculated based on data from the MMSNA, has been generally consistent with the trends of electricity prices shown in the MSY. Thus, we do not make any adjustments to data on production values for 5. Electricity.

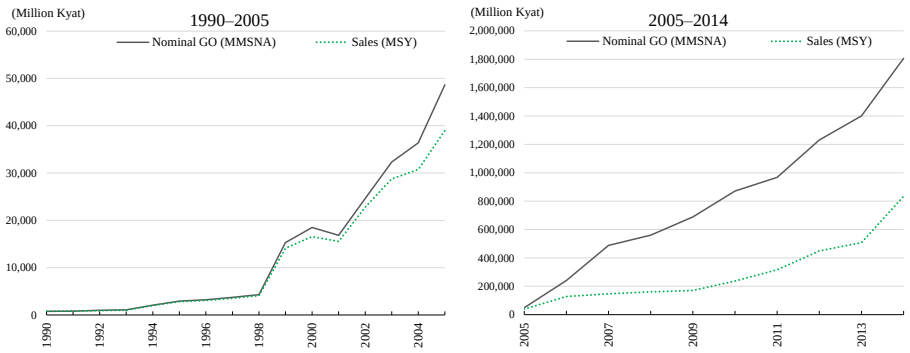


Figure 26: Nominal Outputs and Sales of Electricity

4.6 Transportation and Communications

For 8. Transportation and Communications, some quantitative data on services provided in the MSY are available but their coverage is very limited. Figure 27 compares five Asian countries including Myanmar in the cost of transportation and communications measured as a ratio (in percentage) to the

[17] The price of electricity increased 8.65 kyat/kWh to 27.69 kyat/kWh for general purpose users, from 10.62 kyat/kWh to 32.57 kyat/kWh for industrial users, from 6.35 kyat/kWh to 25.76 kyat/kWh for bulk users, and 2.64 kyat/kWh to 24.33 kyat/kWh for others. On average, the price of electricity increased threefold from 8.96 kyat/kWh to 29.35 kyat/kWh.

[18] The MOEP-1 and the MOEP-2 merged in 2012, but the four power companies remain separated.

total gross output of the first five industries in Table 1 (i.e., agriculture, livestock and fishery, forestry, energy and mining, and manufacturing). For each country, we first calculated the nominal ratio for 2010 and developed estimates for other years by applying the growth rate of the index of production in the five industries (translog aggregate production index calculated from production data for each of the five industries; the MMSNA-based data before adjustments are used for Myanmar) and that of the index of production in the transportation and communications industry. The ratio of the cost of transportation and communications has been on an upward trend in India and Thailand. However, in Myanmar, the ratio has been generally flat as has been the case of Bangladesh and Cambodia. Here, we adjust some of changes in the ratio of the cost. Then, we multiply the adjusted ratio by the adjusted gross output of the five industries (our estimate) to generate the value of the real gross output of the transportation and communications industry. As a result of this adjustment, the negative growth in 1997 based on data from the MMSNA is revised to positive growth and the average growth for the period 1998–2010 is revised from 15.4% per year to 5.6% per year (Figure 28).

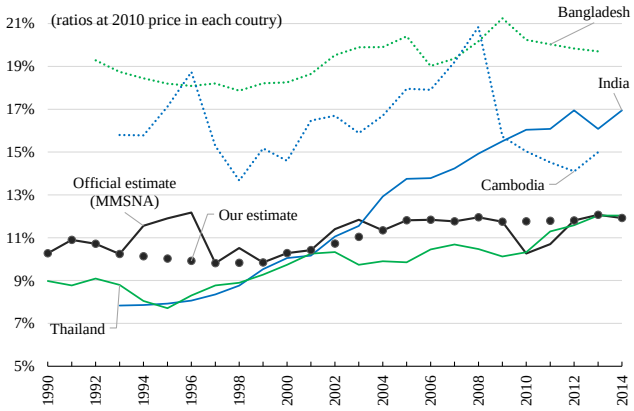


Figure 27: Ratio of Transportation and Communication Cost

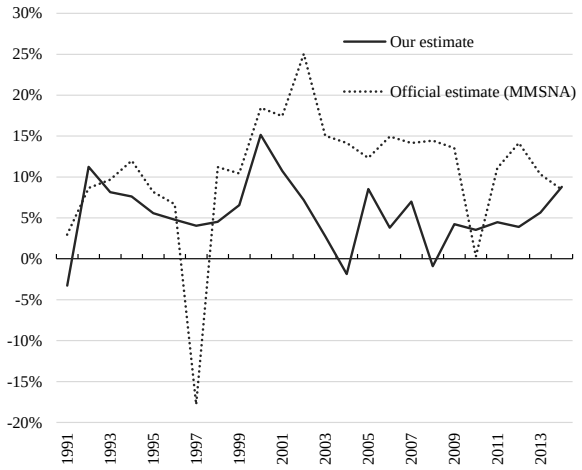


Figure 28: Revision of Output Growth in Transportation and Communication

Figure 29 compares Myanmar and four neighboring countries in the energy productivity of the transportation industry measured in an index, taking energy consumption in the transportation sector reported in the IEA's Energy Balance Table as input and real gross output for 8. Transportation and Communications as output. While the energy productivity has generally been flat in the neighboring countries except for India, the index for Myanmar based on the MMSNA-based data before adjustments jumped sixfold between 2000 and 2008, suggesting the possibility of an overestimation of the output. We can see that the abnormal tendency is reduced with the adjustment to quantitaive production data made in this subsection.

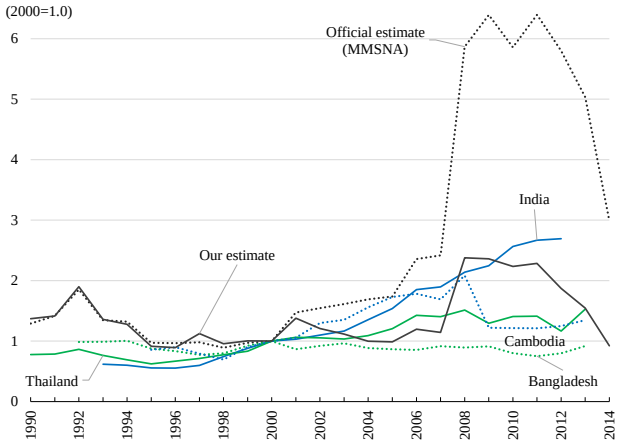


Figure 29: Energy Productivity in Transportation and Communication

4.7 Wholesale and Retail

In the same way as we have done for the transportation and communications industry, we calculate the ratio of wholesale and retail margin to the total output of the five industries (i.e., agriculture, livestock and fishery, forestry, energy and mining, and manufacturing) for 2010, and develop estimates for other years by applying the growth rate of the index of production in the five industries (translog aggregate production index calculated from production data for each of the five industries; the MMSNA-based data before adjustments are used for Myanmar) and that of the index of production in the wholesale and retail industry, as shown in Figure 30.[19] The ratio has been generally flat in India and Bangladesh, but on a similar downward trend in Myanmar, Thailand, and Cambodia—all of which belong to the Mekong Economic Zone.

[19] In countries except Myanmar, the outputs in repair of motor vehicles and hotels and restaurants are included in the output of wholesale and retail.

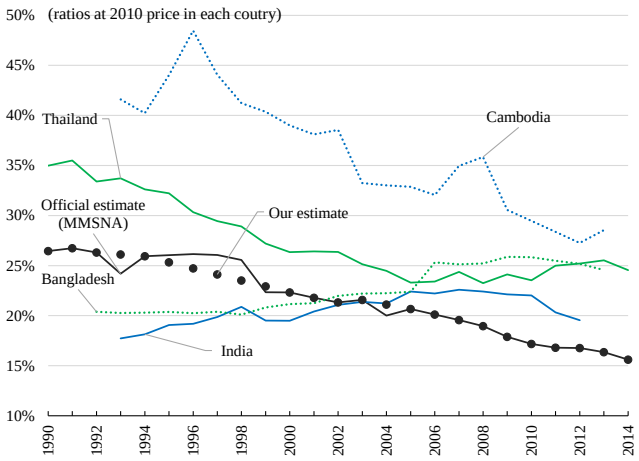


Figure 30: Ratio of Wholesale and Retail Margin

Just like we have done with the ratio of the cost of transportation and communications, we make some adjustments to the ratio of wholesale and retail margin to the gross output of the five industries. Then, by applying the adjusted ratio and replacing the MMSNA-based index of production in the five industries with the one based on our estimates as adjusted in this paper, we revise data on production values in the wholesale and retail industry. Figure 31 compares changes in the growth of real gross output of 12. Wholesale and Retail before and after adjustments. As a result of the downward revision of data on production values in the five industries, the average growth of the real gross output of the wholesale and retail industry for the period 1990–2010 is lowered significantly from 11.8% per year to 2.7% per year.

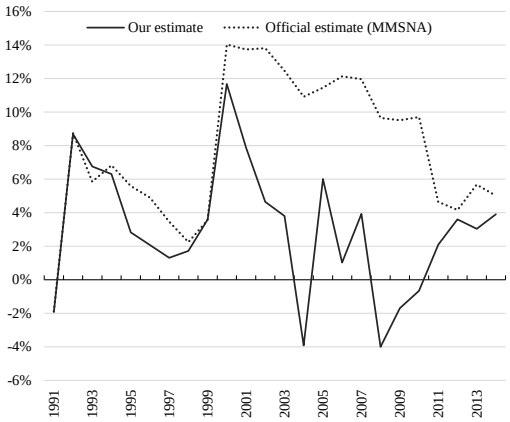


Figure 31: Revision of Output Growth in Wholesale and Retail

5 Revision in Jade Value

Several researchers have been investigating the production of jade in Myanmar, where it is possible that a large amount of its jade sales and production has been dropped because of, possibly, some

political or economic reasons, one of which would be smuggling.[20] An astonishing estimated production of jade is calculated by the Global Witness (2015a), which indicates that the value of "Jade production was worth up to $30.8 billion in 2014 alone: equivalent to almost half Myanmar's officially recorded GDP." The Government of Myanmar has not officially been issuing the precise details of any values in jade production and sales so far. This section tries to reconcile the time-series estimates of the jade production and export in Myanmar based on some sources including the reports of the Global Witness, Myanmar Statistical Yearbook, Mineral Yearbook issued by the U.S. Geological Survey, and the Harvard ASH Center's research (Dapice et al. 2014).

The MSY provides quantitative data on jade production, which are generally consistent with estimates in the U.S. Geological Survey (2016) (Figure 32). As for the value of jade production, Global Witness (2015b) provides its estimates for 2005–2014, employing the composition of jade production by grade estimated by Harvard University's ASH Center. In this paper, we calculate jade's average unit price based on these estimates and the quantitative data from the MSY. The average unit price of jade show significant fluctuations over the years but it has followed a trajectory similar to that of the average unit price at which jade is traded on the germs emporium (Figure 33).[21] For the years through 2004, no price data on jade are available. Thus, we applied the average growth rate for all of the mineral resources to develop our estimates. Our estimates for the years through 1995 are extrapolations based on the trends of prices on the gems emporium.

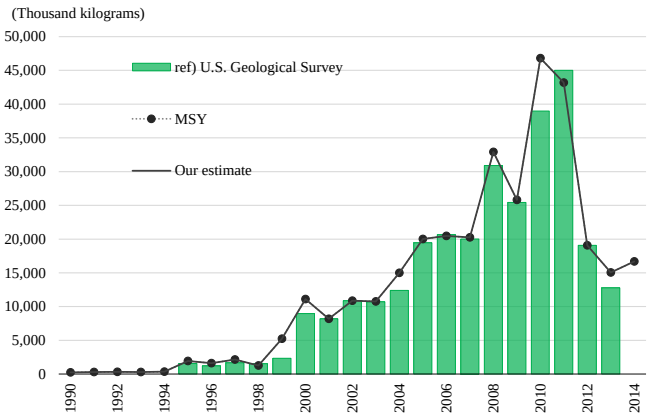
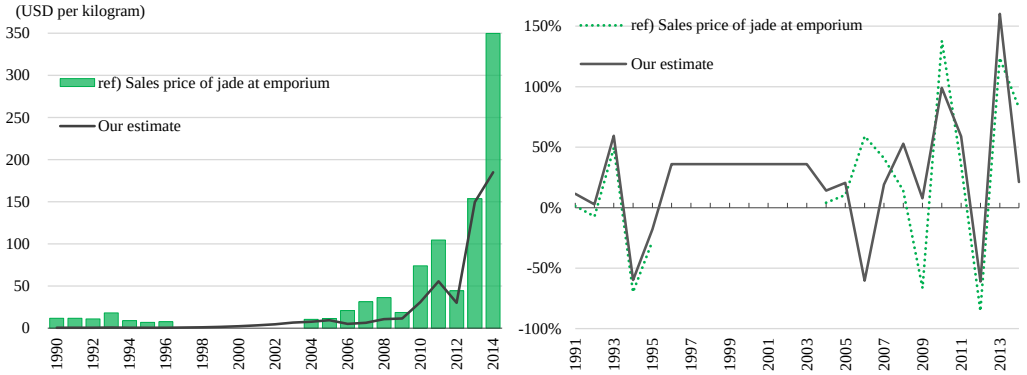


Figure 32: Production of Jade

[20] Shor (2013) indicates that "in China, the ultimate destination for most of Myanmar's jadeite, the price can jump as much as twentyfold. According to a September 2013 Reuters report, however, Myanmar's jadeite exports to China totaled only $34 million in 2011. Official Chinese figures list $293 million worth of precious stones and metals imported from Myanmar. So, out of a potential jadeite market of $7.8 billion, only a fraction was actually declared. Some, as noted above, is in limbo in customs warehouses, but the Harvard report found that the vast majority remains unaccounted for".

[21] The gems emporium is held every year in Yangon and Naypyidaw. Here, market prices for jade are estimated from data on the value of trade, the number of transactions (lots), and the volume of trade (kg) provided in NNA (http://www.nna.jp/).



(Figure 33.1 Unit Price) (Figure 33.2 Growth)

Figure 33: Price of Jade

6 Results

Figure 34 illustrates the impact of our adjustments on Myanmar's nominal GDP. Our adjustments, except for the revaluation of jade production, translated into a significant downward revision to nominal GDP, bringing it down to a level below the EIU's estimates. Meanwhile, the revaluation of jade leads to an upward revision, boosting the value of nominal GDP in 2014 by 90% to level close to the size of the economy shown in the latest data in the MMSNA. Myanmar's nominal GDP is greatly affected by fluctuations in jade prices. For instance, in 2012, when the average jade price fell sharply (Figure 33), nominal GDP dropped by 28%, falling below the estimate based on data from the MMSNA by 40%.

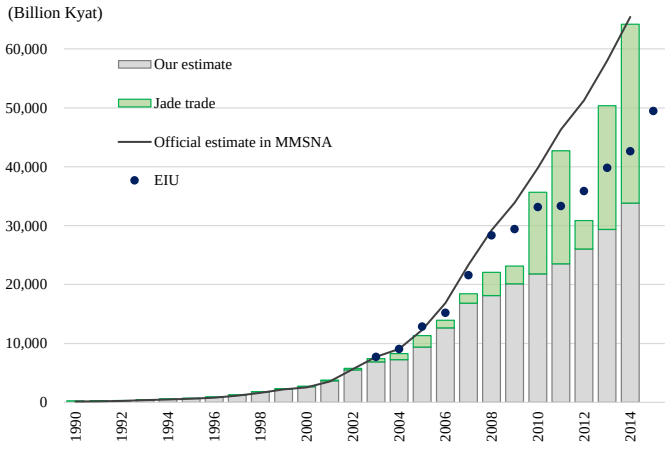


Figure 34: Revision in Nominal GDP

Figure 35 shows a comparison in real GDP growth. In this paper, we did not make any adjustments to real value added for the period 1990–1998, except for those for 8. Transportation and

Communications and 12. Wholesale and Retail.[22] However, as a result of the exchange rate adjustments (Subsection 3.1), industry shares in nominal value added are revised, and hence, the country's real GDP measured in the translog index is revised as well. As a result, the rate of real GDP growth for the period 1990–1998 based on our estimates falls below that based on official estimates in the MMSNA by 1.3 percentage points. In the period after 1998, our estimates show that Myanmar's real GDP growth turned negative twice, first in 2003–2004 and second in 2007–2008. Our estimates of real GDP growth in 2003–2004 are very much in line with the EIU's estimates, both reflecting the impact of the economic sanctions by the U.S. and Europe. For 2007 and 2008, however, while our estimates show negative growth, the EIU's estimates show slower but positive growth. The negative or slower real GDP growth in 2008 is attributable Cyclone Nargis that hit Myanmar in May 2008 (Table 4) and the fallouts of the global financial crisis.[23] In terms of the average growth rate for the period 1998–2010, our estimate of 4.9% represents a downward revision of 7.0 percentage points compared with the MMSNA-based estimate of 11.9%. Our estimate is higher than the EIU's estimate of 3.0% but close to the ADB's estimate of average 4.7% per year for the period 2001–2010.

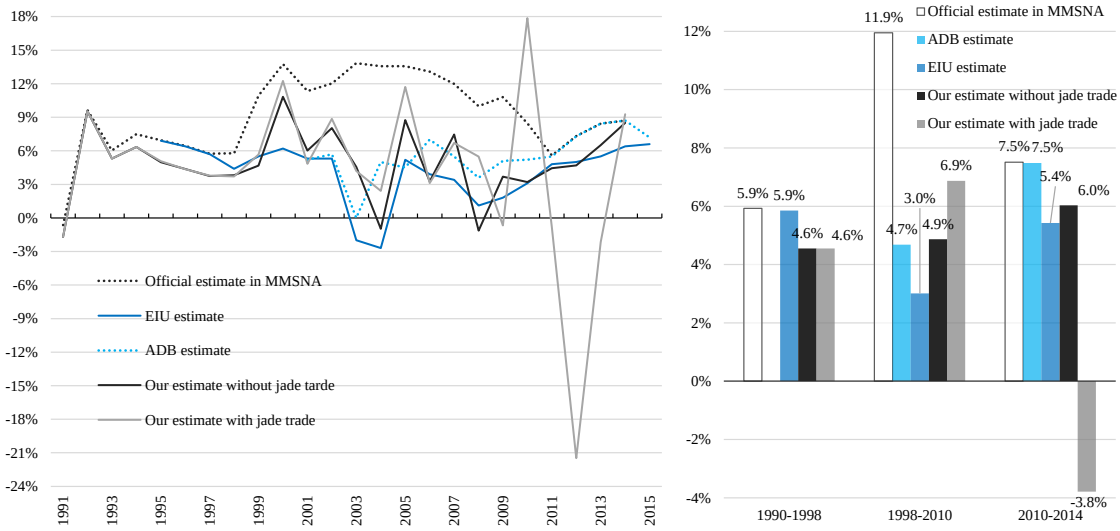


Figure 35: Revision in Real GDP Growths

Meanwhile, the impact of revaluing jade transactions on macroeconomic growth is observed from the mid-2000s, for instance, turning negative growth estimated for 2004 before reflecting the reassessed values of jade transactions to positive growth. The impact of revaluation of jade is even more conspicuous in 2008 and thereafter with jade production accounting for more than 10% of Myanmar's GDP. Notably, the revaluation of jade results in a significant upward revision in 2009–2010, from 3.2% (before revaluation) to 17.9% (after revaluation). On the other hand, real GDP

[22] Exceptionally, the value added in 1. Agriculture is revised from 1998.
[23] Thailand's economic growth slowed from 5.3% in 2007 to 1.7% in 2008 and turned negative in 2009, contracting by 0.7%.

dropped 21.5% in 2012 as jade production decreased by half following the transfer of power to the civilian government. The drop was sharper than the negative growth of 12% recorded in 1988–1989 following the coup led by General Saw Maung.

Figure 36 and Figure 37 compare Asian countries in real GDP growth and the growth rate of labor productivity (defined as real GDP per worker). The downward revision to economic growth in 1998–2010 based on our estimates bring Myanmar's real GDP growth and labor productivity growth closer to those of Thailand and Bangladesh. Although Cambodia showed relatively high economic growth, it is attributable to an increase in labor force. In terms of labor productivity growth, it is not much different from other low-income countries in Asia. Based on our estimates reflecting the revaluation of jade, Myanmar was comparable to India and Vietnam—both in real GDP growth and labor productivity growth—in the period 1998–2010. However, Myanmar was alone to fall into negative growth in the period 2010–2014.

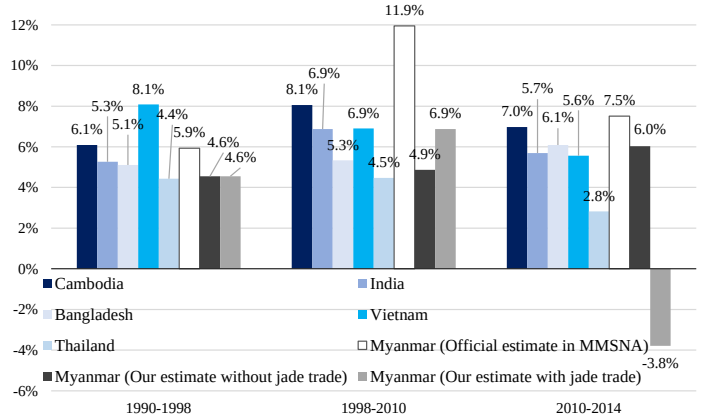


Figure 36: Country Comparison of GDP Growths

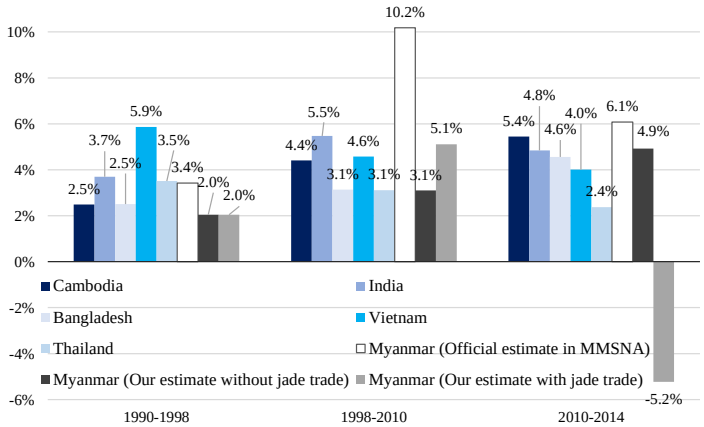


Figure 37: Country Comparison of Labor Productivity Growths

Shown in Figure 38 is a comparison of the five countries in GDP per capita on a purchasing power parity (PPP) basis. According to official estimates in the MMSNA, Myanmar, whose per capita GDP was lower than that of Cambodia in 1990, overtook Cambodia and Bangladesh in 2010. Myanmar's per capita GDP in 2014 stood at 5,100 dollars, significantly higher than those of Cambodia and Bangladesh. However, based on our estimates (before reflecting the revaluation of jade), Myanmar's per capita GDP in 2014 stood at 2,500 dollars, lower than Cambodia's 3,400 dollars and Bangladesh's 3,200 dollars. In the U.S. Central Intelligence Agency (CIA)'s World Factbook 2016 (CIA, 2015), Myanmar's per capita GDP in 2013 was estimated at 1,700 dollars, lower than Cambodia's 2,600 dollars and Bangladesh's 2,100 dollars. These figures are consistent with our estimates for 2014 before the revaluation of jade. In the latest Factbook, Myanmar's per capita GDP in 2015 has been revised to 5,500 dollars, exceeding Cambodia's 3,500 dollars and Bangladesh's 3,600. The revised figure for Myanmar exceeds our estimate after the revaluation of jade (4,700 dollars for 2014).

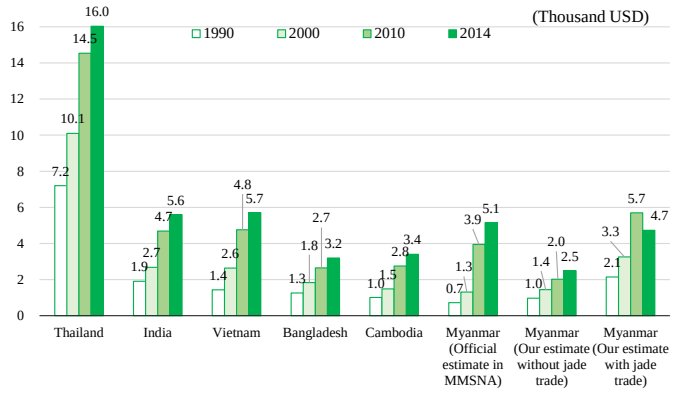
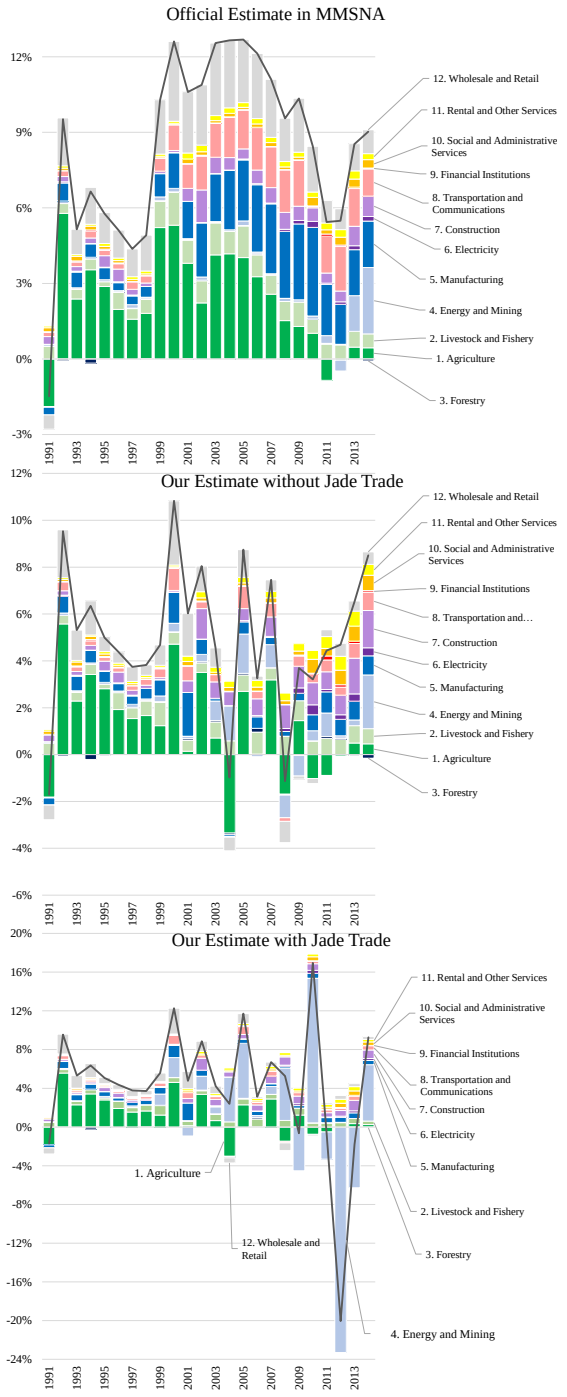


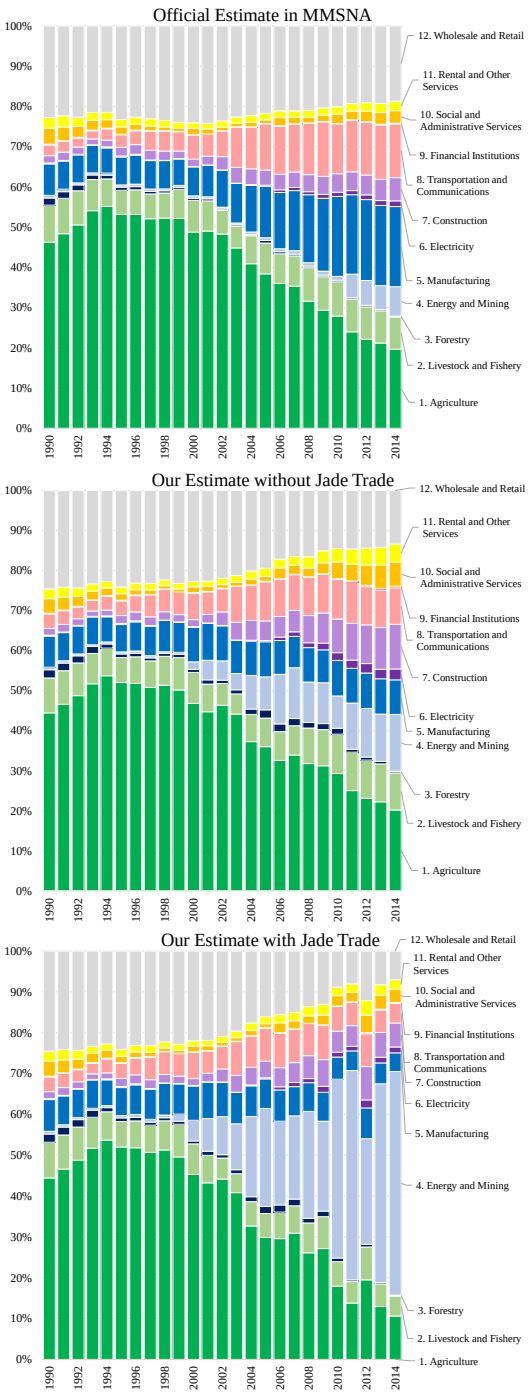
Figure 38: Country Comparison of Per Capita GDP

Note: GDP at constant market prices per person, using 2011 PPP, reference year 2014.

Figure 39 shows each industry's contribution and share of contribution to real GDP growth. According to official estimates in the MMSNA, agriculture and many other industries have achieved steady growth over the years. However, our revised estimates show that there have been significant ups and downs particularly in agriculture. Located in the tropical monsoon climate zone, Myanmar is subject to frequent natural disasters such as cyclones. Shown in Table 4 are major disasters since 1990 and the estimates of economic losses caused by them. According to the Centre for Research on the Epidemiology of Disasters (2016), the damage caused by Cyclone Nargis in 2008 totaled 4 billion dollars, an amount equal to 15.5% of the MMSNA-based nominal GDP. The 2004 Indian Ocean earthquake and tsunami also caused significant damage, which is equal to 4.9% of the MMSNA-based nominal GDP. Those significant economic losses cannot be found in the real GDP estimates in the MMSNA but are reflected in our estimates.



(Figure 39.1 contributions)



(Figure 39.2 contributions share)

Figure 39: Industry Contributions to GDP Growth

Table 4: Economic Damage of Disaster

Type	Date	Total damage ('000 US$)	Total damage ('Mil Kyat)	Damage/GDP(MMSNA) at market exchange rate
Storm	May-2008	4,000,000	4,521,000	15.5%
Earthquake	Dec-2004	500,000	442,708	4.9%
Flood	Jul-1991	79,840	2,800	1.5%
Storm	Oct-2010	57,000	54,706	0.1%
Flood	May-1992	55,115	2,301	0.9%
Storm	May-1994	10,000	664	0.1%
Earthquake	Mar-2011	3,600	2,880	0.0%
Flood	Oct-2011	1,700	1,360	0.0%
Earthquake	Nov-2012	1,170	983	0.0%
Storm	May-2004	688	609	0.0%

Source: Centre for Research on the Epidemiology of Disasters (2016).

Also, the impact of natural gas exports is underestimated in the MMSNA, which is dependent on the official exchange rate. According to our estimates, the energy and mining industry became a factor that explains approximately one-third of Myanmar's economic growth in the latter half of the 2000s and half of the economic growth in 2010 thereafter as a result of natural gas exports and the revaluation of jade. Contributions to economic growth by industry vary significantly depending on how data are revised. Based on our estimates, Myanmar's economic growth in recent years is reliant on natural resources.

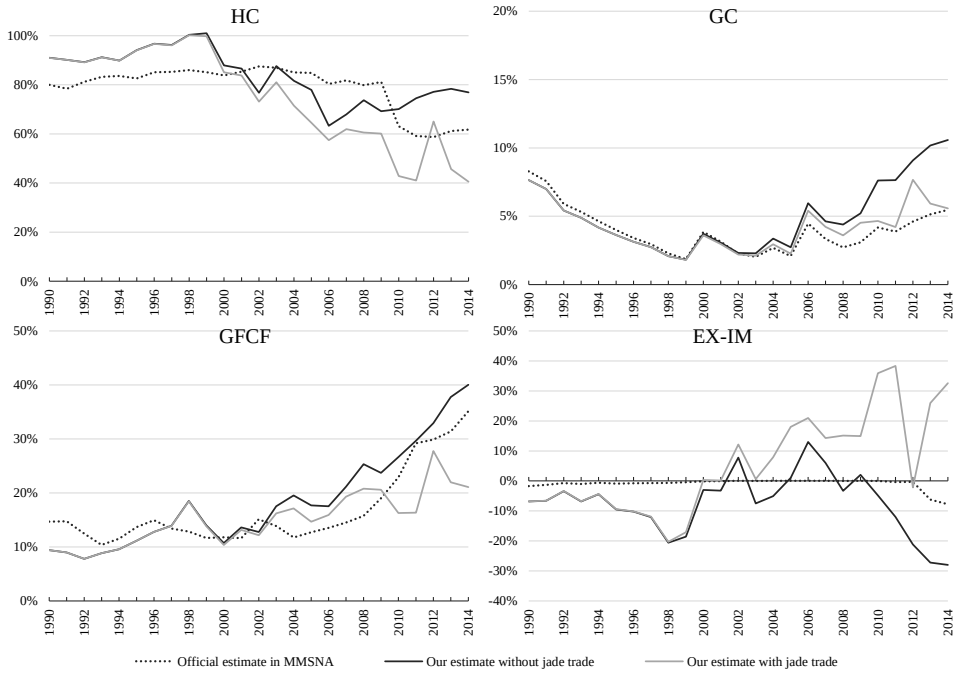


Figure 40: Final Demand Shares in GDP

Figure 40 shows the impact of our revisions on final demand. Our estimates before the revaluation of jade shows that household consumption (HC) accounted for about 77% of nominal GDP in 2014. However, the share of household is decreased to 41% when the revaluation of jade is reflected. An economy is reliant on natural resources for growth is greatly affected by international trade. Thus, we

compared Myanmar with its neighboring countries in household consumption (HC) and gross fixed capital formation (GFCF) as a share of domestic final demand, as shown in Figure 41. Myanmar's household consumption decreased from around 85% of final demand in the latter half of the 1990s to around 60% in 2014, falling below those of Bangladesh and Vietnam. This is due to an increase in the share of gross fixed capital formation, reaching 30% in recent years. While the MMSNA-based official estimates show that the share of household consumption dropped sharply and that of gross fixed capital formation rose rapidly in 2010 onward, no such drastic changes in the composition of domestic final demand are observed in our estimates.

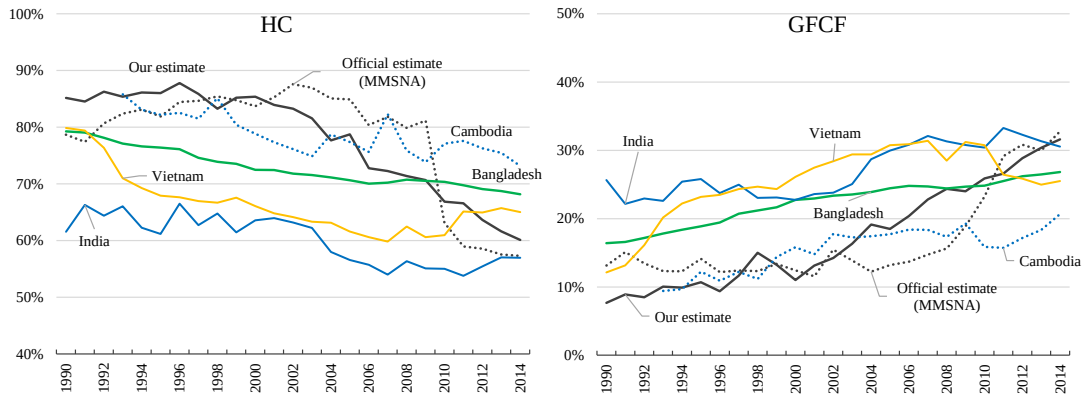


Figure 41: Country Comparison of HC and GFCF Shares in Domestic Final Demand

7 Conclusion

In this paper, we revised Myanmar's GDP statistics in the MMSNA by adjusting estimates from the production and expenditure sides. More specifically, we reviewed and revised data on trade, production, and jade transactions to recapture Myanmar's economic growth from the 1990s onward. Due to various problems with primary data such as the limited availability of production data, our estimates made in this paper are no more than pro forma estimates and the purpose of this attempt is to enable a more realistic interpretation of Myanmar's economic growth. The estimation of items on the income side, such as compensation of employees and consumption of fixed capital, along with the development of data on labor and capital input, remain future challenges toward developing a growth accounting framework for Myanmar.

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Appendix

Table 5: Value Added at Current Prices by Industry

	1. Agriculture	2. Livestock and Fishery	3. Forestry	4. Energy and Mining	5. Manufacturing	6. Electricity	7. Construction	8. Transportation and Communications	9. Financial Institutions	10. Social and Administrative Services	11. Rental and Other Services	12. Wholesale and Retail	GDP without Jade Trade	4.1 Jade	GDP with Jade Trade
1990	73,305	14,408	3,349	1,054	12,811	386	2,763	5,988	270	6,024	4,052	40,504	164,913	27	164,940
1991	94,272	16,947	3,865	1,177	14,215	318	3,863	6,908	318	6,413	5,178	48,812	202,285	44	202,329
1992	132,604	22,159	4,856	1,332	18,945	463	4,507	7,998	367	6,692	5,823	66,151	271,895	59	271,954
1993	203,172	29,811	6,835	1,743	27,204	653	5,211	10,423	521	8,702	6,943	91,658	392,876	137	393,013
1994	282,164	36,456	5,208	2,704	33,013	1,218	7,739	18,180	768	9,906	8,607	119,313	525,277	107	525,384
1995	347,210	41,572	5,973	3,382	45,603	1,872	13,057	24,605	1,041	10,782	11,335	160,596	667,029	565	667,594
1996	446,741	56,975	7,553	5,074	62,516	2,202	19,058	35,199	1,279	11,482	13,992	199,409	861,481	810	862,292
1997	615,078	80,594	9,039	6,466	89,282	1,933	26,494	66,368	1,475	13,293	19,911	280,787	1,210,719	2,029	1,212,747
1998	908,519	127,212	12,571	8,137	138,100	991	37,035	98,480	1,945	14,622	26,315	394,212	1,768,138	3,756	1,771,894
1999	1,125,133	181,671	17,294	11,755	167,940	2,558	40,425	125,106	2,215	16,505	32,174	519,262	2,242,037	27,549	2,269,586
2000	1,236,865	204,791	19,446	50,206	229,057	3,444	46,044	175,655	2,641	39,354	35,114	599,871	2,642,489	88,043	2,730,531
2001	1,626,353	252,189	37,593	178,442	336,186	3,202	77,115	205,446	3,299	44,685	50,064	822,171	3,636,746	123,172	3,759,918
2002	2,552,951	298,546	45,561	265,233	484,146	4,654	185,611	320,849	4,799	50,724	85,965	1,207,703	5,506,741	274,271	5,781,012
2003	3,029,534	346,163	72,696	277,988	567,472	5,992	303,497	615,363	5,297	64,742	119,782	1,455,581	6,864,106	557,019	7,421,125
2004	2,697,712	491,596	98,092	606,256	617,939	20,023	356,771	632,192	6,748	103,890	151,644	1,454,672	7,237,534	1,018,610	8,256,144
2005	3,379,863	668,559	191,629	775,661	821,449	27,652	461,656	917,550	10,237	112,599	196,534	1,818,008	9,381,398	1,941,927	11,323,325
2006	4,118,806	907,894	244,062	1,567,791	1,067,439	110,010	651,973	1,174,094	14,399	340,892	283,133	2,165,846	12,646,339	1,284,232	13,930,571
2007	5,697,632	1,235,032	299,215	2,137,639	1,316,423	189,790	893,654	1,505,154	16,948	371,290	378,504	2,766,518	16,807,799	1,620,163	18,427,962
2008	5,764,500	1,611,915	251,065	1,835,653	1,560,123	218,690	1,236,066	1,733,328	19,936	399,679	506,375	3,002,225	18,139,555	3,944,119	22,083,674
2009	6,284,683	1,812,867	307,268	2,056,187	1,644,346	337,675	1,518,309	1,939,887	27,392	551,654	609,840	3,022,929	20,113,037	3,038,258	23,151,295
2010	6,393,831	2,139,815	325,395	1,758,771	1,934,028	421,883	1,839,335	2,152,710	37,715	915,720	738,484	3,154,016	21,811,704	13,843,701	35,655,405
2011	5,887,547	2,255,544	176,617	2,710,693	2,044,690	481,449	2,165,836	2,418,269	65,318	989,006	883,291	3,440,004	23,518,264	19,191,191	42,709,455
2012	6,012,879	2,485,132	189,474	3,164,151	2,305,897	614,930	2,515,898	2,479,916	85,346	1,326,077	1,095,646	3,743,241	26,018,587	4,834,606	30,853,193
2013	6,524,901	2,779,615	184,930	3,467,620	2,586,735	695,855	3,056,830	2,761,187	114,385	1,683,301	1,323,898	4,163,097	29,342,354	21,039,400	50,381,753
2014	6,819,856	3,143,754	138,380	4,795,229	2,920,369	924,959	3,777,091	3,085,360	135,791	2,025,534	1,537,312	4,513,996	33,817,631	30,375,925	64,193,556

(Unit: Million Kyat)

Table 6: Growth Rate of Value Added at Constant Prices by Industry

	1. Agriculture	2. Livestock and Fishery	3. Forestry	4. Energy and Mining	5. Manufacturing	6. Electricity	7. Construction	8. Transportation and Communications	9. Financial Institutions	10. Social and Administrative Services	11. Rental and Other Services	12. Wholesale and Retail	GDP without Jade Trade	4.1 Jade	GDP with Jade Trade
1991	-4.0	5.6	-1.7	10.4	-4.1	6.5	15.8	-0.1	16.4	4.2	2.5	-2.5	-1.7	19.4	-1.7
1992	11.7	4.4	-3.3	18.3	10.3	27.1	10.6	11.8	14.0	2.9	3.5	8.4	9.5	8.4	9.5
1993	4.6	4.7	1.0	10.4	9.0	21.9	11.1	6.9	32.5	7.0	3.4	5.4	5.3	-3.4	5.3
1994	6.5	5.9	-15.4	13.9	8.2	4.7	14.5	6.2	38.7	6.6	3.9	6.3	6.3	16.9	6.4
1995	5.3	2.9	-4.6	15.4	7.3	6.3	24.0	4.4	29.9	6.0	6.1	2.7	5.0	168.4	5.1
1996	3.7	11.2	2.1	9.4	4.5	12.1	22.0	4.7	19.8	5.5	5.8	2.0	4.4	-18.9	4.4
1997	3.0	6.9	2.8	22.6	4.9	16.3	9.3	4.0	13.5	6.1	5.9	2.7	3.7	29.2	3.8
1998	3.3	8.9	3.2	12.1	6.0	-5.6	6.1	4.5	15.7	6.3	6.4	1.9	3.8	-53.9	3.7
1999	2.4	12.9	4.5	50.2	9.0	13.3	4.3	6.8	11.8	6.8	5.6	3.8	4.7	142.9	5.6
2000	9.7	6.3	3.2	30.2	16.3	14.2	3.9	15.4	15.1	4.3	5.7	11.9	10.8	75.0	12.3
2001	0.3	6.5	7.4	3.0	20.9	-8.1	25.8	10.2	22.2	12.7	17.1	8.1	6.0	-30.6	4.8
2002	7.7	6.5	6.0	6.4	7.0	20.0	47.3	5.0	37.5	12.7	18.2	4.9	8.0	28.6	8.9
2003	1.6	13.0	6.2	18.8	1.2	14.0	18.0	4.2	9.9	10.2	13.2	3.8	4.6	-1.2	4.2
2004	-8.2	9.9	-6.1	24.0	-0.9	7.1	12.6	-0.3	24.2	13.9	13.5	-2.8	-1.0	33.2	2.4
2005	7.4	10.1	3.9	20.2	6.0	17.6	10.4	10.3	41.7	8.0	11.3	6.0	8.7	28.9	11.7
2006	0.1	13.1	8.0	-0.8	5.8	9.7	14.2	3.3	16.3	8.6	13.3	1.0	3.3	2.2	3.1
2007	9.6	7.1	0.3	7.9	3.7	4.7	15.9	6.4	16.5	8.5	12.7	2.9	7.5	-0.9	6.7
2008	-5.2	9.7	-2.6	-8.4	2.5	10.9	16.6	-1.7	16.2	7.4	12.7	-5.5	-1.1	48.5	5.3
2009	4.6	9.5	-2.8	-8.6	3.7	16.0	12.9	4.5	31.8	7.0	10.9	-0.8	3.7	-24.4	-0.6
2010	-3.4	6.2	0.4	4.8	8.0	23.5	11.8	3.6	32.0	17.0	11.7	-1.4	3.2	59.6	17.0
2011	-3.3	7.1	7.1	10.3	10.3	5.1	8.6	5.0	72.6	7.7	14.3	2.0	4.4	-8.1	-0.8
2012	-0.2	6.9	6.4	0.8	8.0	8.6	8.9	3.4	34.6	13.3	14.9	3.8	4.7	-81.7	-20.0
2013	2.2	7.8	-6.9	2.0	9.1	13.1	15.2	6.6	29.3	11.8	14.7	3.0	6.5	-23.6	-1.8
2014	2.2	6.9	-29.2	17.6	9.3	13.7	14.7	8.4	17.2	11.2	10.3	3.9	8.5	10.2	9.3

(Unit: Percentage. Note: The GDP growths are measured in translog index.)

Table 7: Final Demand at Current Prices

	Household Consumption Expenditure	Government Consumption Expenditure	Gross Fixd Capital Formation	Change in Inventory	Export	Import	GDP without Jade Trade	Export of Jade	GDP with Jade Trade
1990	150,064	12,596	15,504	-1,995	16,378	-27,633	164,913	27	164,940
1991	182,354	14,138	18,157	1,032	18,295	-31,692	202,285	44	202,329
1992	242,532	14,742	21,240	2,601	29,241	-38,461	271,895	59	271,954
1993	358,439	19,198	34,762	7,360	51,846	-78,729	392,876	137	393,013
1994	472,211	21,915	50,392	3,875	78,055	-101,171	525,277	107	525,384
1995	628,114	24,200	74,466	3,540	97,280	-160,571	667,029	565	667,594
1996	833,683	26,969	110,305	-21,262	127,530	-215,745	861,481	810	862,292
1997	1,165,369	33,154	168,535	-10,276	190,733	-336,796	1,210,719	2,029	1,212,747
1998	1,775,090	36,804	327,265	-7,605	458,234	-821,650	1,768,138	3,756	1,771,894
1999	2,264,634	40,890	313,441	38,859	542,125	-957,912	2,242,037	27,549	2,269,586
2000	2,323,647	98,235	283,204	16,709	845,832	-925,138	2,642,489	88,043	2,730,531
2001	3,151,128	111,501	494,968	-2,610	1,313,804	-1,432,045	3,636,746	123,172	3,759,918
2002	4,227,764	127,141	703,566	19,095	1,813,125	-1,383,949	5,506,741	274,271	5,781,012
2003	6,016,285	157,010	1,203,388	418	1,930,630	-2,443,625	6,864,106	557,019	7,421,125
2004	5,904,911	244,031	1,414,393	39,689	2,670,237	-3,035,727	7,237,534	1,018,610	8,256,144
2005	7,311,648	256,425	1,660,677	57,041	3,769,336	-3,673,729	9,381,398	1,941,927	11,323,325
2006	8,009,222	753,361	2,219,096	23,996	6,436,582	-4,795,917	12,646,339	1,284,232	13,930,571
2007	11,417,901	777,974	3,557,885	43,470	8,135,708	-7,125,140	16,807,799	1,620,163	18,427,962
2008	13,381,565	796,160	4,592,304	-29,231	7,033,265	-7,634,508	18,139,555	3,944,119	22,083,674
2009	13,921,433	1,047,250	4,770,521	-41,587	7,414,254	-6,998,833	20,113,037	3,038,258	23,151,295
2010	15,286,689	1,660,353	5,808,122	106,059	8,090,512	-9,140,031	21,811,704	13,843,701	35,655,405
2011	17,532,096	1,795,898	6,976,959	27,084	7,625,839	-10,439,611	23,518,264	19,191,191	42,709,455
2012	20,063,058	2,364,544	8,563,841	532,457	8,437,201	-13,942,515	26,018,587	4,834,606	30,853,193
2013	23,002,853	2,984,616	11,078,712	253,895	11,225,753	-19,203,475	29,342,354	21,039,400	50,381,753
2014	26,015,266	3,576,016	13,540,088	138,565	14,509,821	-23,962,125	33,817,631	30,375,925	64,193,556

(Unit: Million Kyat)