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IMPACT EVALUATION OF POLICIES TO RESPOND TO COVID-19 ON VIETNAM'S ECONOMY

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ABSTRACT

This study aims to compare the economic trade-offs in the choice of wholly social isolation and partial social isolation policies by applying the TERM (The Enormous Regional Model) for Vietnam with the assumption of changes in Average Propensity Consumption (APCs) across the country (corresponding to the situation of wholly social isolation) and the change of APC across each region (corresponding to the situation of partial social isolation). After that, the study will compare the results of changes in basic economic indicators in each region according to each APC change scenario of (1) the whole country, (2) the North, (3) the Central, (4) the Southeast, (5) the Mekong Delta. Economic indicators include real GDP and expenditure components of GDP, labor and consumer price index. The study results show that the trade-off of a reduced APC shock across the country is greater than that of a decrease in APC in each region. We can see more clearly that social distancing across the country can have a significantly heavier impact on the economy than social distancing policies by region and locality. The TERM model also shows that APC declines across the country often affect regions where staples are traded domestically rather than those with export strengths.

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1. Introduction

The situation of the Covid-19 epidemic in Vietnam can be divided into 4 phases of the epidemic wave: (1) phase 1 from 23/01 to 24/7/2020; (2) phase 2 from July 25, 2020 to January 27, 2021; (3) phase 3 from January 27 to April 26, 2021; (4) Phase 4 from April 27 to December 30, 2021. In the process of responding to the Covid-19 epidemic, Vietnam has implemented many flexible policies, including social distancing policies under Directive 16. In general, the social distancing policy (under Directive 16) was only applied nationwide in Vietnam for 15 days from 31/03/2020 during the first wave of the epidemic. The social distancing policy (under Directive 16) was only applied nationwide in Vietnam for 15 days from 31/03/2020 during the first wave of the epidemic. The social distancing policy is then applied according to the locality where the case was detected.

Studying the impact of total social distancing and partial social distancing policies can help compare the impact of shocks occurring in a province, or region and the whole country on the economy. Especially with epidemic shocks such as Covid-19 with a high spread rate, this study can reflect the urgency of early detection and isolation of the affected area, avoiding other provinces and regions. Many studies were conducted to assess the impact of the Covid-19 epidemic on the economy. However, there has not been a study analyzing the impact of Covid-19 to approach the perspective of comparing the impact of social distancing policies and partial social distancing. This study aims to compare the economic trade-offs in choosing social distancing and social isolation policies only in affected areas by applying an overall equilibrium model for TERM regions. The results of the study may suggest some considerations to the government when choosing the right policy that enables it to respond to the epidemic disease while maintaining and developing the economy.

2. Literature review

2.1. TERM model overview

TERM (The Enormous Regional Model) is a computable general equilibrium (CGE) analysis model for multiple territories within a country. The General Equilibrium Model (CGE) was first coined in Johanson's research in 1960 and was the dominant economic model of the 1960s. The oil price shock of the 1970s attracted more research using the CGE model. Since the 1970s, the CGE model has dominated policy debates in Australia. Currently, it is a development tool in policy analysis in many countries and international organizations.

Policies to support the development of one region may harm the interests of another region or the whole country. Therefore, over time, there is more interest in the analysis of the overall equilibrium for regions within a country. There are two approaches to the overall regional balance. The first approach is top-down. In this approach, the model is analyzed for the whole economy and the results of the analysis for each region are based on the region's share of the overall economy in terms of industry, consumption, exports, and imports. This approach does not consider prices individually for each region nor does it consider the interaction between regions in the economy. Therefore, this approach cannot be used to analyze economic shocks that take place by region. In 1978, this approach was adopted from the ORANI national overall equilibrium model (see Dixon et al., 1982).

The second approach is the bottom-up approach. In this approach, each region is viewed as a separate economy and connectivity between regions is also included in the analysis. This approach allows analysis of the impact of the shock on the specific region. In 1995, this approach was applied in the Monash Multiregional Forecasting model (MMRF) with 8 states in Australia (Adams et al., 2003). By 2002, this model was developed to be applicable to more industries and regions of the Australian economy. TERM is designed to allow analysis

for many regions, even for large countries with the number of regions up to 30 to 50 provinces such as the US or China. Currently, TERM has been widely applied in several countries.

2.2. Different analytical frameworks of the CGE overall equilibrium model

Depending on the analysis timeframe, CGE models can be classified as static or dynamic. In addition, depending on the research objectives, the model can also be built for one or more areas. Applying both temporal and spatial criteria, CGE models can be classified into four categories: static single-region CGE, dynamic single-region CGE, static spatial CGE, and dynamic spatial CGE (Chen & Haynes, 2017).

Static single-zone CGE

The CGE model, known as ORANI, was originally developed in Australia by Dixon et al. in 1982. It is considered to be one of the most prominent examples of early static single-zone CGE models. However, it wasn't until three decades later that ORANI was used for disaster analysis by Giesecke et al. in 2012. They applied ORANI to analyze the regional economic damage caused by a hypothetical radioactive dispersion device attack in downtown Los Angeles.

One of the most widely used CGE is the Computable General Equilibrium model (USCGE) in the United States. This model was developed by Rose and Oladosu (2002) models for disaster impact analysis and Rose is considered as a pioneer in the field. They evaluated a range of regional economic impacts of post-disaster arterial system losses, including water supply disruptions in Portland (Rose & Liao, 2005) and power outages in Los Angeles (Rose et al., 2007). Moreover, they also included the behavioral responses to estimate the overall economic impacts of terrorist events, such as the World Trade Center attack that occurred on September 11, 2001 (Rose et al., 2009) and hypothetical terrorist attacks on aviation systems (Rose et al., 2017). The USCGE model has also been applied to assess the economic consequences of other types of disasters. For instance, Chen and Rose (2018) evaluated the role of economic resilience due to transition infrastructure system failures, with a more specific nesting structure by using modified USCGE. In addition, a shortened form of the USCGE model has been developed to provide rapid estimates of the economic impact of aviation system disruptions caused by terrorist attacks (Chen et al., 2017). The USCGE model has also been applied to assess the economic losses of foot-and-mouth disease (Oladosu et al., 2013) and influenza pandemics (Prager et al., 2017). In addition, Prager et al. (2018) developed a multi-threat analysis, also based on the USCGE model.

Another static single-zone model for disaster impact analyses is The University of Pretoria Total Equilibrium Model (UPGEM). Specifically, it describes manufacturing operations in a "continuous elasticity of transformation" (CET) format with imperfect interchangeability between imported and domestic goods, under Armington's assumption of constant elasticity of substitution (CES). Ntombela et al. (2017) applied The UPGEM model in the economic impact assessment of drought in South Africa.

The static single-area CGE model has been widely applied for empirical evaluation in various countries such as Malawi (Pauw et al., 2011), Thailand (Thirawat et al., 2017), the United States. (Blake & Sinclair, 2003; Chen et al., 2018; Guha, 2011; Tirasirichai & Enke, 2007), China (Shi et al., 2015; Shi & Wang, 2013; Wang et al., 2015; Xiao et al., 2011), and Nga (Sharp, 2002). Albeit the static single-area CGE model is simple and straightforward, it could only provide the right impact results for a specific area at a specific time.

Dynamic Single Zone CGE

Dynamic models seem to be a better solution due to eliminating time lag problems. Therefore, this model is often used to assess long-term economic impacts since it can estimate changes in output over specific periods. There is growing interest in assessing the economic impact of

disasters using a dynamic CGE model. For instance, the applied master equity model (USAGE) has been developed by the Center for Policy Research (CoPS) as the dynamic CGE model in the United States. The model has three types of dynamic mechanisms including capital accumulation, liability accumulation, and a delayed adjustment process (Dixon et al., 2010). There are a representative group of households and a central government; international trade follows the assumption of Armington CES in this model. Dixon et al.(2010) estimated the impact of a hypothetical H1N1 outbreak in the US. In addition, they also assessed the economic damage caused by the closure of U.S. borders for twelve months in the form of trade, tourism, and immigration shutdowns by this model (Dixon et al., 2011). Recently, Nassios & Giesecke (2015, 2018) also applied this model to assess the potential macroeconomic impacts of various assumed terrorist events.

Another dynamic single-area CGE model is the Development Research Center's CGE Model (DRC-CGE). This model has been developed by the Development Research Center of the State Council of China. The DRC-CGE model has also been applied to reduce the traffic disruption effect caused by a severe ice storm in 2008 in Hunan province (Xie et al., 2014a). Xie et al. (2015) applied a further revision of the DRC-CGE model to assess post-disaster economic recovery with a focus on the mitigating investment factor. Furthermore, various dynamic single-sector CGE models have also been widely applied to disaster impact assessment in other countries, such as New Zealand (McDonald et al., 2017), Japan (Kunimitsu, 2018), Canada (Gertz et al., 2019), and the United States (Sue Wing et al., 2015). The disvantage of this model is to lack spatial interaction between regions, which may lead to some issues, especially in larger countries.

Static Space CGE

Due to capturing the inter-regional effects of economic activities, the static spatial CGE model, also known as the static multi-zone CGE model, is more advanced than the single-zone model. Interregional connectivity plays an important role in the operation of spatial impacts and is driven by various key factors such as trade relations (commodity flows) and factor mobility (capital and labor migration) (Haddad & Hewings, 2005).

The Global Trade Analysis Project (GTAP) model is prominent in the static spatial CGE model. This was originally developed in 1990 with comprehensive trade-offs between international markets and widely applied to assess disasters. The latest version (GTAP 9) covers 140 regions, 57 sectors, eight production elements and three base years (2004, 2007 and 2011). GTAP was used to assess indirect economic damage caused by floods in Northern Italy by Carrera et al. (2015) and to assess the economic impact of severe acute respiratory syndrome (SARS) outbreaks in 16 regions of Taiwan by Chou et al. (2004).

The country has also developed this type of model for its purpose. For instance, the Brazilian multidisciplinary and regional/interregional analysis model (B-MARIA) was developed for Brazil, while the JENNIFER model was developed for New Zealand. Specifically, the B-MARIA model developed by Haddad (1999) is based on the pre-existing Monash Multi-Regional Forecasting (MMRF) model (Naqvi & Peter, 1996). Haddad (1999) used a bottom-up approach, from which he obtained national results through regional aggregation. This model includes 27 Brazilian states and eight economic sectors that use the CES (nested CES) characteristic. Haddad and Teixeira (2015) assessed the economic consequences of flooding in Sao Paulo using the B-MARIA model.

JENNIFER, developed by Robson (2013), covers 25 sectors and 5 regions in New Zealand. Like the B-MARIA model, this is a bottom-up approach model to simulate the short-term economic impacts of a natural disaster in Wellington's central business district. In addition, static space CGE models have been applied in the assessment of the economic

consequences of disasters in other countries, such as Japan (Okiyama & Tokunaga, 2017; Tatano & Tsuchiya, 2008; Tsuchiya et al., 2007), Turkey (Selcuk & Yeldan, 2001) and China (Haung & Hosoe, 2016). However, these models have not been able to track the effects of a shock over time.

Dynamic Space CGE

The dynamic spatial CGE models are often considered the most complex and advanced CGE models and adopted by different organizations since it could overcome the temporal and spatial shortcomings of other CGE models. A dynamic spatial CGE model called LINKAGE was built by the World Bank. Evans et al. (2014) applied LINKAGE to measure the economic impact of the Ebola epidemic in West Africa.

One of the popular dynamic spaces CGE models is TERM. TERM was used to examine the effects of drought in Australia in 2002-2003 (Horridge et al., 2005). A dynamic version of TERM (Wittwer, 2012) has been used to assess the economic impact of water scarcity in Australia, as well as to determine the United States' risk against hypothetical acts of terrorism (Dixon et al., 2017). These models have also been developed to assess economic impact in other countries, largely in Japan (Akune, 2017; Cutler et al., 2016; Kajitani & Tatano, 2018; Shibusawa & Miyata, 2011; Tokunaga & Okiyama, 2017; Yamazaki et al., 2018) and Canada (Withey et al., 2016).

3. Research methodology

This study applies the TERM model with the assumption of changes in average consumption trends (APCs) across the country (corresponding to social isolation situations) and changes in average consumption trends (APCs) across each region (corresponding to partial social isolation situations). To compare the impact of social distancing and partial social distancing policies on the economy, this study assumes different scenarios with a decline in APC average consumption trends of 10% occurring across (1) the whole country, (2) the North, respectively (3) the Central, (4) the Southeast, (5) the Mekong Delta. The study selects the Gragg 2-4-6 step method in the application of the TERM model to Vietnamese situations to calculate the situations of the model. From there, the study in turn analyzes and compares the results of changes in the basic indicators of the economy in each region according to each change scenario of APC.

3.1. Research assumptions and the analytical framework of the model

This study makes some assumptions about the change in average propensity to consumption (APC) before lockdowns. The lockdown will be assumed to affect the APC of everyone in the economy. Meanwhile, social distancing is assumed to affect the average consumption trend of people in that region. Based on economic theories, the study will analyze the impact of changes in average consumption on the expenditure components of each region's gross domestic product. The study then also looked at the change in employment in the economy for each situation (*see Appendix 1 online*).

3.2. Data system of the TERM model

The data for analysis in the overall equilibrium model (CGE) generally consists of exchange value matrices in three directions: product, sector, and region. An overview of product flows is shown (*see Appendix 2 online*).

Commodity flows are specifically shown from the main Input/Output Balance Sheet data as shown in Table 1 below.

Table 1. Input/Output data source simulation

		Manufacturers			Consumer				
		Primary	Make	Service	Household	Invest	Government	Export	Aggregate demand
Domestic goods	Primary	5	10	2	1	0	0	15	33
	Make	5	15	10	15	15	10	10	80
	Service	5	13	20	30	5	20	5	98
Imports	Primary	1	2	0	0	0	0		3
	Make	1	3	2	3	3	2		14
	Service	1	3	4	6	1	4		19
Production factors	Labor	7	17	40					
	Capital	8	17	20					
Total Cost		33	80	98					

Source: Nhi Vo (2018)

According to the figure above, the lines represent the product supply, the columns represent the product demand. We find that the total cost of production is equal to the total revenue of the domestic product. This data is being simplified for a region and does not take taxes into account.

Table 2. The structure of TERM flows databases

		Manufacturers	Household	Invest	Government	Export
	Size	*I*	*1*	*1*	*1*	*1*
Merchandise	*CxS*	USE	USE	USE	USE	USE
Tax	*CxS*	TAX	TAX	TAX	TAX	TAX
Labour	*O*	LAB	C = 25; Number of products			
Capital	*1*	CAP	I= 25; Number of sectors			
sLand	*1*	LND	S=2; Domestic, Import			
Production tax	*1*	PRODTAX	O=6; Number of employment groups			
Total Cost	*1*	VTOT				

Source: Nhi Vo (2018)

In general, the flow of products of an economy is generalized as shown in Table 2. The area data applied to the TERM model is built on the separation of the data in each column in Table 2 for each region with some assumptions attached. Separate the production output of each sector of each region based on the share of regional output in that industry in the total national output of that industry. In addition, the technology is assumed to be applied the same in all regions.

Proportion (i, r) = proportion of region r in the total national output of industry i

The analysis of the column of household expenditure, investment expenditure and government expenditure will be based on local statistical data. For exports, the region's export value will be based on the location where the goods are exported. For imports, the region's import value will be based on the location where the goods are docked.

4. Research findings and discussions

This section will discuss research findings from the overall equilibrium model for regions of Vietnam with the scenario of reducing APC by an average of 10% across the country (1); then there is the scenario of reducing the APC by region including: the North (2); Central (3); the Southeast (4); Mekong Delta (5). The results analyze the impact of reducing consumption trends by an average of 10% according to 5 scenarios respectively on basic macroeconomic indicators including real GDP and expenditure factors of GDP, labor and consumer price index.

Table 3. Changes in real GDP and expenditure components of GDP, labor and consumer price index under the average consumption trend scenario decreased by 10% across the country and in the Northern, Central, Southeast, and Southwest, respectively

Domain	**Northern**					**Central**				
Scenario	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Real consumption expenditures	-4.68	-0.07	-4.56	-0.02	-0.03	-3.10	-2.91	-0.11	-0.05	-0.04
Real investment expenditure	-0.84	-0.06	-0.77	0.00	-0.01	-0.66	-0.51	-0.09	-0.04	-0.02
Real government spending	-4.62	-0.07	-4.51	-0.02	-0.03	-3.05	-2.87	-0.10	-0.05	-0.04
Export	1.74	0.32	0.98	0.23	0.21	1.01	0.36	0.32	0.18	0.15
Import	-1.13	-0.02	-1.12	0.01	-0.00	-0.89	-0.76	-0.07	-0.03	-0.03
Real GDP	-0.75	-0.04	-0.68	-0.01	-0.02	-0.55	-0.44	-0.06	-0.03	-0.02
Total labor	-0.84	-0.05	-0.76	-0.01	-0.02	-0.67	-0.49	-0.09	-0.05	-0.04
Average real wage	-0.00	-0.00	-0.00	0.00	-0.00	-0.00	-0.00	-0.00	0.00	-0.00
Consumer Price Index CPI	-1.12	-0.20	-0.64	-0.15	-0.13	-0.69	-0.25	-0.20	-0.13	-0.11
Domain	**Southeastern Vietnam**					**Mekong Delta**				
Scenario	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Real consumption expenditures	-2.44	0.01	0.03	-2.49	0.01	-2.66	-0.07	-0.11	-0.10	-2.37
Real investment expenditure	-0.12	0.04	0.07	-0.26	0.03	-0.79	-0.07	-0.10	-0.14	-0.48
Real government spending	-2.51	0.01	0.03	-2.56	0.02	-2.67	-0.08	-0.11	-0.10	-2.38
Export	2.82	0.61	0.75	0.84	0.62	0.31	0.06	0.07	0.07	0.12
Import	-0.38	0.04	0.05	-0.51	0.03	-0.77	-0.04	-0.06	-0.06	-0.62
Real GDP	-0.25	0.00	0.01	-0.28	0.01	-0.53	-0.04	-0.07	-0.06	-0.36
Total labor	-0.19	0.01	0.04	-0.24	0.01	-0.65	-0.07	-0.10	-0.09	-0.39
Average real wage	-0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.00	0.00	-0.00	-0.00
Consumer Price Index CPI	-0.69	-0.15	-0.17	-0.24	-0.14	-0.57	-0.11	-0.13	-0.13	-0.20

Table 3 shows that a shock of APCs would reduce the spending component of GDP excluding exports and real GDP. The TERM model results show the difference of this shock impact on different regions for each different scenario. With the APC scenario declining across the country, the decline in the expenditure components of GDP and real GDP is more significant than in the scenario where the APC is reduced in each individual region. For the North, the expenditure component of GDP except exports and real GDP declined more when the APC slump shock occurred in the North and Central. The same goes for the Central region as the expenditure components of GDP except exports and real GDP decline more when the APC slump shock occurs in the Central and Northern regions. Particularly in the Southeast region, the results of the model are quite special when the expenditure components in GDP and real GDP are not reduced when there is a shock-reducing APC in other regions. The Southeast only suffers a decline in the share of GDP except for exports and real GDP when the APC slump shock occurs across the country or in the Southeast itself. The Mekong Delta region experienced a decline in all expenditure components of GDP except exports and real GDP when APC shocks decreased in all scenarios and the largest decline when APC declined nationally or in the Mekong Delta alone. Exports increased in the APC scenario in all cases. This reflects the degree of substitution of the export market with the domestic commodity market.

Table 3 also shows that the decline in labor in all regions is at the highest level corresponding to the APC decline scenario across the country. Corresponding to the scenario of APC decreasing by region, the North and Central regions have a greater decrease in labor when APC decreases in these 2 regions. Particularly in the Southeast, labor will only decline with the APC scenario of a decline across the country or in the Southeast itself. The Mekong Delta saw a labor decline in all scenarios and the largest decline when the APC slump shock took place across the country or across the Mekong Delta itself. Meanwhile, the CPI declined in all regions in all scenarios.

5. Conclusion

The study makes comparisons of the economic effects of consumer shocks across the country and across different regions. Practice shows that this comparison is necessary in the context of policy choices in response to the Covid-19 epidemic. The TERM model assumes an average propensity to consumption (APC) decline shock of 10% across each region and across the country. The model results show that the APC decline shock across the country will cause more declines in key macro variables such as real GDP, expenditure components in GDP excluding exports and labor compared to the APC decline scenario across each region. Through the comparative results from the model, we can see that the trade-off of the reduced APC shock across the country can affect the economy more severely than the situation where APC decreases in each region. Therefore, we can see more clearly that social distancing across the country can have a heavier impact on the economy than the social distancing policy of each region and each locality. Social distancing policies for each region and each locality usually only affect the economy of the isolated region itself and partly on the region with close economic relations.

The TERM model also shows that regions could be affected differently with the same APC slump shock. APC declines across the country often hit regions where staples are traded domestically rather than those with export strengths. The contribution to GDP of categories will also vary in APC decline scenarios. Sectors with export strengths tend to contribute to the increase in GDP while other sectors tend to contribute to a decrease when there is a downward shock on the APC. This can partly explain the impact of APC decline shock on different regions depending on the characteristics of production and consumption as well as the ability to trade and export of that locality.

After the Covid-19, Vietnam should continue to invest in healthcare infrastructure and capacity, ensuring that the healthcare system is well-prepared for future health crises. Moreover, it also should develop and implement disaster preparedness plans that address not only health crises but also natural disasters and economic shocks. For sustainable development, it is necessary to strengthen social safety nets to protect vulnerable populations during economic transitions and crises, ensuring that basic needs are met. In responding to health crisis or disaster, the government should have carefully impact evaluation under general equilibrium aspect before implementing the policies.

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