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Abstract

COVID-19 impacts have exacerbated socioeconomic inequalities and the threat of hunger and absolute poverty for vulnerable populations globally. China, as the most important Southern engine of growth, is a complex case. In taking countervailing measures for economic recovery and public health protection, the Chinese case is interesting for several reasons. First, from a public health perspective, what was distinctive about the Chinese policy and what have been the consequences so far? Second, what economic policy measures have led to a V-shaped recovery? Finally, what is the further prognosis for the Chinese Economy for the next few years? Our analysis highlights the salience of considering development and the economic and social shocks of pandemics from a Socially Embedded Intersectional Approach (SEICA) perspective. Using an economy-wide modeling methodology, we are able to draw conclusions that may be relevant for the case of other economies in various stages of development, particularly those with sharply uneven development patterns and large rural populations.

1. Introduction

The case of China in responding to the economic and public health crisis of COVID-19 stands out for a number of reasons. While the initial outbreak of COVID-19 was first identified in December 2019, the national health crisis had peaked and gradually stabilized after about mid-March of 2020. From January to February of 2020, the Chinese government imposed a series of strict containment measures including large-scale lockdowns and social distancing protocols across China. The timeliness and uniformity of these containment measures are identified to have successfully "flattened the curve" of infections across China's mainland (Peirlinck et al. 2020). However, acute economic shocks resulted from these containment measures.

China's national economic output is estimated to have declined by 6.8% on a year-to-year basis in the first quarter of 2020 with disproportionate impacts across sectors (Huang and Lardy 2020). The most affected industries were in the broad accommodations sector, which saw a total 35.3% reduction in sectoral output (Liu 2021b). There was a sharp reduction in this sector because of a drastic drop in travel and national tourism revenues due to national lockdowns and travel restrictions. As a result of significantly depressed consumption and investment spending, the wholesale and retail, construction and transportation sectors also experienced sharp declines. Because of the interdependence of various sectors through backward and forward linkages, most sectors also experienced decline in economic activity to various degrees. There were notable gains in the information technology and financial services sectors linked in particular to the rise of online services and the "digitalization" of entertainment, shopping, education, work, and medical consultations during the lockdown period (Liu 2021b).

Although the impacts of COVID-19 have weakened their economy, China had emerged in a stronger economic position relative to the rest of the world. The effectiveness of the government in containing the pandemic enabled the relatively quick recovery of the economy at a time when other major economies in Europe, and the Americas, and even Japan lagged far behind China in terms of pandemic containment and re-opening. A partial reopening of the economy coupled with the provision of industrial subsidies enabled the rapid recovery of fixed-asset investments in June 2020, leading to a V-shaped recovery in economic activity. In a global sense, the restoration of industrial production in China connects their own economic recovery with that of the Asian region as a whole and countries in Latin American and Africa with which trade links are strong.

In contrast to investment spending, domestic retail sales had recovered at a more stagnant pace throughout 2020, reflecting the weakened state of domestic and foreign demand (Sutter and Sutherland 2021). Retail expenditures have seen a substantial jump in early 2021 thanks to seasonable consumption patterns though this rebound has not been sustained through the year as growth rates for both retail sales and investment spending peaked in January and declined steadily after. These trends may point to a corrective process as China's speed of recovery stabilizes at a slower pace. However, the growth of retail sales expenditures by April 2021 have failed to meet expectations, leading to growing concerns among experts of the unbalanced nature of the present recovery and doubts as to its stability over the medium-run (Cheng 2021).

Although investments remain the most important component of aggregate demand in China, the domestic market has increased in importance in recent decades. This is particularly true after 2010 with the appreciation of the Renminbi, rising wage rates, and the saturation of export markets with Chinese goods (Lau 2020). Accordingly, policy measures aimed at stimulating recovery from the

impacts of COVID-19 have shifted attention from employment stabilization toward demand-side management. This shift in policy measures are core components of the newly-emphasized Dual Circulation policy, announced in the Central Committee's May 2020 Report on the Work of the Government.

The term "Dual Circulation" traces back to fundamental reforms in the late 1970s and 1980s which led to the liberalization of the economy and China's turn toward export markets. In leveraging a relatively low-cost labor force to develop export-intensive industries, China's internal economic development ("domestic circulation") would be driven by export-led growth and the expansion of "international circulation." The original usage of the term stressed the relative importance of "international circulation" in supporting the development of "domestic circulation." In practice, this involved large flows of foreign direct investment (FDI) in China, concentrated mainly along urban centers on the coast starting with the export-oriented special economic zones (SEZ). Comparatively, investment in Western interior provinces and rural areas had been geared for the development of primary industries to secure flows of raw materials for urbanization and the development of coastal industry (Fan 1997).

At the same time that exports as a share of GDP have increased since the 1980s, China has seen some of the fastest recorded growth rates in recent history. This rapid growth of output is behind the secular increases in standards of living and substantial declines in the level of absolute poverty observed in the process of China's development. However, this period has also seen substantial increases in income and wealth inequality. Today, China is a highly unequal country with the most deeply entrenched gap in rural-urban incomes in the world (Khan 2021). Structural inequalities between rural and urban residents are explicit in the "hukou" or "household registration system," which privileges urban residents in defining access to public benefits and high-quality education systems in cities. Despite large migrations of rural residents to urban areas for work, these migrant workers are left to live as second-class citizens in their respective cities.

China's guiding export-led vision of development was challenged with the onset of the 2008 global financial crisis. Collapsed export markets and their weak recovery called into question the long-run sustainability of export-led growth. Turning inward, the government initiated a program of subsidizing the expansion of domestic markets and promoting the development of interconnections between domestic markets and industry. This was done using tax breaks for the production of manufactured goods for domestic consumption, as well as direct subsidies to rural households for the purchase of domestically-produced goods (Wilde 2021). Thus, in a dialectical fashion the contemporary usage of "Dual Circulation" came to refer to the state-subsidized growth of domestic markets as a buffer of support for export-led sectors in times of global crisis.

Since 2015, Dual Circulation has increasingly taken the form of supply side reforms including import-substitution-industrialization (ISI) in high-tech manufacturing. The overall goal of these reforms is to pursue independence from foreign markets in critical "bottleneck" areas like energy, medical equipment, chemical products, and electronic components. The overall threat of supply chain shortages for import-intensive sectors has been realized with the onset of COVID-19 as a global pandemic.
With a combination of demand and supply-side shocks the pandemic has interrupted global recovery and generated lasting economic impacts across global markets and key trading partners.

Aside from the immediate concerns of hunger prevention and targeted poverty reduction, responding to the pandemic with a view toward sustainable recovery will necessitate the expansion of domestic markets and indigenous innovation in high-tech manufacturing, biopharmaceuticals, and energy. Of critical importance for the treatment and containment of disease in China is the role played by indigenous knowledge systems (IKS) in healthcare including the development of vaccines and innovation in the use of traditional Chinese medicine (TCM) for the treatment of COVID-19 (Xu and Zhang 2020; Zheng et al. 2021). As we demonstrate in a related paper (Khan and Szymanski-Burgos 2021) further investment in IKS will be an important component for improving economic and social resilience to future pandemics.

The goal of this article is to provide a strategic framework for sustainable demand-led recovery. Our framework is framed at the outset by a socially-embedded intersectional capabilities approach (SEICA) (Khan 1998*).* This approach views development as a democratic process where important feedback loops link macro-level outcomes with the material well-being of disadvantaged and minority groups. We aim to assess and help direct the strategic allocation of resources for counter-COVID-19 fiscal expenditures in light of China's Dual Circulation policy. This is done on the basis of socioeconomic modeling using input-output (IO) multipliers. As a complement to Khan and Szymanski-Burgos (forthcoming), we focus on both immediate and medium-run impacts of direct economic stimulus by exploring a range of economic multipliers and modeling the employment effects of direct fiscal injections as part counter-COVID-19 expenditures. The following section focuses on a break-down of the Chinese response to the public health and economic challenges of COVID-19. Next, we provide a detailed description of multiplier analysis using a national 153x153 input-output (IO) table for 2018 and discuss the possible integration of indigenous knowledge into our schema. Then, we turn to an outline of findings regarding the structure of the Chinese economy and on this basis, identify *counterfactually* key strategic areas where targeted spending could generate the widest benefit, particularly for the disadvantaged and vulnerable groups.

2. Time Horizon for Optimal Planning

To inform optimal decision-making we highlight three distinct time frames specific to the case of China's exposure to the public health crisis and the economic impacts represented by the COVID-19 shock:

1. Addressing the immediate crisis from the initial outbreak through to the first quarter of 2020 (December 2019 - February 2020),
2. The restorative phase during the gradual reopening and restoration of economic activity throughout the year (March 2020 – March 2021),
3. Planning for going beyond 2021 consistent with China's long-run economic goals specified in the Chinese Communist Party's (CPC) 14th Five-Year Plan (2021-2025).

Of the three time periods, the first two were the most critical in terms of overcoming the challenges of containing the spread of infection, preventing shortages, and implementing incentives to ensure an optimal restorative path.

2.1 The immediate crisis: December 2019 to February 2020

On January 25th 2020, the Central Committee issued a series of nationwide pandemic control protocols requiring all public spaces, businesses, and schools to close down and implementing

strict stay-at-home orders and travel restrictions. These measures coincided with the ongoing Lunar New Year festivities, a time when millions of migrant workers had traveled home to rural areas or were caught in the process of returning when lockdowns were introduced. Travel restrictions and pandemic controls lasted through late February and early March, with regional quarantines easing at variable rates depending on local severity.

The strict January and February nation-wide lockdowns and containment measures were successful in preventing the spread of infection to critical levels in both urban and rural areas. The public health response in China is distinguished for its effectiveness in preventing the spread of infection and the Chinese case is increasingly used in the epidemiological literature as a benchmark for rapid containment.[1] Yang et al. (2020) highlight the critical importance of the timing and uniformity of lockdown implementation. They estimate a five-day delay in implementation would have tripled the number of infected, while lifting the province-wide Hubei quarantine prematurely would have resulted in a dramatic second peak and extended the pandemic into late April. Another point of distinction in the public health response relates to the fact that the Chinese government has traditionally not ignored the role of traditional knowledge systems in employing locally-viable solutions for indigenous communities. TCM is widely encouraged and sanctioned by the government for use in preventative healthcare and for use in public health crises as during the 2003 SARS epidemic and COVID-19.

2.2 Economic Impacts and Countervailing Policies from March 2020 to March 2021

By the end of March, the majority of Chinese provinces (with the exception of Hubei and Beijing) had significantly eased restrictions and begun the process of overall recovery. However, the COVID-19 shock led to acute economic impacts with the potential to present lasting effects on recovery. In total, national output declined by 6.8% on a year-to-year basis with disproportionate impacts across sectors in the first quarter of 2020 (Huang and Lardy 2020). The most affected industries were in the accommodations sector, followed by the wholesale and retail, construction and transportation sectors (Liu 2021b). National lockdowns and travel restrictions led to sharp drops in travel flows and national tourism revenues, which severely impacted the most affected industries. Because of the interdependence of various sectors through backward and forward linkages, most sectors in the economy experienced declines in economic activity to various degrees. In addition, the overall public health crisis significantly depressed consumption across much of China. Though many migrant workers were able to return to urban areas to find, unemployment rates in rural areas are estimated to have remained quite high for several months even after travel restrictions were lifted on account of lingering fears of infection and decreased propensity to travel (Wang et al. 2020).

Thanks to early success in pandemic containment, China exhibited a remarkable turn in economic trends, reporting positive economic growth by the end of June 2020. Declines in fixed-asset investments hit their lowest point in February of 2020 before bouncing-back fairly rapidly by the end of the second quarter and into the rest of the year. This recovery was orchestrated in part by fiscal and monetary policy measures targeting the corporate sector much more so than households. Measures including tax and interest rate cuts, state subsidies, and waived social security contributions were aimed at supporting production through medium, small, and micro enterprises (MSMEs) and state-owned enterprises (SOEs), which altogether provide the majority of China's

[1] See Yang et al. (2020), Peirlinck et al. (2020), and Wangping et al. (2020).

employment base (Zhang 2019; Liu 2021b). The growth of fixed-asset investment experienced a further jump in early 2021 above pre-pandemic levels thanks to lagged positive effects from 2020 investments and the partial recovery of global markets (Han and Huang 2020). Retail expenditures have also seen a substantial jump in early 2021 during the shopping season. However, this rebound in both investment and retail sales has not been sustained in more recent months as growth rates for both indicators peaked in January and declined steadily after.

Beyond the acute impacts of COVID-19, there are a number of factors behind the weakness in retail sales. These include uneven growth of output and employment across regions, an increase in household and corporate debt, and the onset of trade frictions that threaten to undermine China's export-led growth strategy (World Bank 2020). Aside from these, one persistent barrier to the recovery of consumption expenditures are the structural inequalities between urban and rural populations and across regions. The impacts of the pandemic are known to make economic and social inequalities worse (Pires et al. 2020). On one hand, low-income communities find themselves more exposed to infection due to public-facing employment and housing circumstances that make social distancing prohibitively difficult. On the other hand, the loss of incomes during the pandemic-driven recession disproportionately affect workers in the informal sector, low-skilled workers, service-sector and construction workers, and the self-employed.

Although the spread of infection to rural communities in China was relatively minimal, these communities have experienced disproportionate economic impacts including high unemployment, loss of household income, price inflation, and disrupted student learning (Wang et al. 2021). Unemployment in the early months of the pandemic are estimated to have risen to virtually 100% for many rural villages in Central China where residents were entirely dependent on working in cities (Wang et al. 2020). Even after quarantine protocols were lifted, rural unemployment remained very high (upwards of 60%) through March and April, implying substantial and lasting effects on income loss for rural households. China's large proportion of rural residents are an important driver of economic activity and constitute an enormous source of drag under extraneous conditions. These estimates suggest that economic recovery in rural areas has been significantly slower than in urban areas in spite of the stabilization of urban employment opportunities for migrants.

While proportionately small, expenditures targeted toward households include unemployment and emergency relief (including food and shelter aid) oriented toward the most vulnerable households. Largely at their own initiative, local governments in China engaged in modest efforts to support regional spending through the distribution of prepaid consumption vouchers; however, the magnitude of household transfers remained small and locally-specific. Notably absent from the present stimulus were direct unconditional federal transfers to households that we have seen in the stimulus programs of advanced economies around the world. For some observers of China, the lack of demand-side stimulus during 2020 is a key factor behind the unbalanced recovery (Tang 2021).

We argue that a key component of any successful demand-led recovery requires addressing structural factors that constitute a source of drag in aggregate demand. One such structural source of drag is the large level of income and consumption inequality between rural and urban residents and within urban areas in China (Gradin and Wu 2020). Recently, the Chinese government has

made significant efforts to make labor market supports more inclusive for rural and migrant workers, in particular with the extension of emergency aid for rural residents and unemployment insurance for migrant workers. These efforts have been important for protecting incomes in particularly vulnerable communities. Additional priority is being given to the poorest workers to secure employment through state-provided "welfare jobs," presently responsible for employing a large percentage of impoverished rural and migrant workers (Xinhua 2021).

There is still much work to be done on this front. Greater efforts are necessary to generate high-value development and income growth in rural and interior areas. Such an effort would best involve significant public investments in developing an economic base in the tertiary sectors in rural areas, including tourism and accommodation as well as upgrading in the primary sector to higher value-added products in the agricultural and food processing sectors. Notably, high-level development plans are being implemented which include a focus on developing the manufacturing base of key interior regions, like machinery manufacturing in Guangxi Zhuang Autonomous Region (Xinhua 2021). As we will see, assuming necessary imports are drawn largely from within China, such a boost in rural manufacturing promises to generate growth in employment within rural provinces and across China.

2.3 Going Beyond: The 14th Five-Year Plan

The growing size of China's urban middle class is poised to provide a steady future consumption base (Barton et al. 2013), though the COVID-19 shock has imparted considerable drag on the consumption component of GDP. Despite the recent surge in urbanization and rising living standards, China's poorer rural households continue to make up a huge portion of China's population and are likely to require additional government support during the longer-run recovery phase to support the much slower recovery of rural households' consumption.

Rising labor costs in China are beginning to drive patterns of structural change observed in advanced economies. Although the share of service sector employment has not reached the level of Japan or the US, the manufacturing share of employment in China is estimated to have peaked in 2012 (Hou et al. 2017). As the service sector share of employment continues to grow in coming years, government economic policy must prioritize household consumption and industrial upgrading. In line with the longer-run goals of Dual Circulation, recovery policy over the end of the second period and into the third period appears to have shifted from employment stabilization toward demand-side management while simultaneously engaging in supply wide reforms through major public investment projects over the next five years. Key areas of focus for public investment are in technology-intensive infrastructure projects such as 5G telecommunications infrastructure, comprehensive national high-speed rail networks, electric car charging stations and other "green energy" infrastructure (Liu 2021b).

3. Methodology

The data used for this analysis come from the 2018 national IO table for China, which offers a set of interindustry flows for 153 production activities. This level of disaggregation provides a unique level of details regarding the identification of important sectors and linkages in the economy. Final demand is divided into rural and urban household consumption, government consumption, gross fixed capital formation (investment in fixed assets), changes in inventory, and exports. Total value-

added is then distributed among factors of production in the form of workers' compensation, gross operating surplus, production taxes, and capital depreciation.

Although the data does not presently allow, augmenting our IO for indigenous knowledge sectors would be useful for modeling indigenous innovation sectors and identifying the inflow and outflow of resources for this sector. Khan and Rahman (2021) propose a method for integrating indigenous knowledge-based innovations within a social accounting matrix (SAM) for South Africa. By delineating total knowledge production into two sectors, non-indigenous (NIK) and indigenous knowledge (IK), it would be possible to derive their respective production functions and identify the consequences and complementarities between NIK and IK production.

3.1 Multiplier Analysis

The basis for input-output multiplier analysis is the matrix of interindustry transactions. This matrix offers a model of interindustry flows of products and resources within an economy as well as resources flows to institutional accounts including households, taxes, capital incomes, and exports. The interindustry transactions matrix describes the total output of each production sector in the economy as it is distributed among purchasing sectors as intermediate goods and among households and other agents as final goods. Data for interindustry flows are necessary for multiplier analysis because it enables the derivation of the matrix of direct requirements for the economy, describing the direct sector requirements in terms of inputs of sector *i* for a unit of total output in sector *j*. Algebraically, this produces a system of equations with the general form (1) and matrix notation (2):

$$x_i = a_{ij}x_j + y_i \quad (1)$$

$$x = Ax + y \quad (2)$$

where a_{ij} is the technical coefficient representing the per-unit monetary value of input from sector *i* required to produce a monetary unit value of output in sector *j*. In the matrix notation, *x* is a column vector of total output produced by each production sector, *y* is a column vector of output generated by final demand, and *A* is a square matrix of technical coefficients a_{ij}. A fundamental assumption with the use of input-output tables is that, for a definite length of time, interindustry resource flows from sector *i* to sector *j* depend entirely on the total output of sector *j* for the same period of time. Conventionally in IO analysis, we assume this ratio is constant according to a fixed-proportions production function with constant returns to scale.

If the vector of final demand *y* is known, the total output of each sector needed to supply both intermediate and final demand requirements may be found as the solution to the following equation:

$$x = (I - A)^{-1}y \quad (3)$$

where *I* denotes the identity matrix, and the inverse matrix L=$(I - A)^{-1}$ gives the matrix of total requirements coefficients (Fjeldsted 1980). The product of the total requirements matrix and the vector of final demand *y* give the necessary output required from each of the sectors to satisfy total demand in the economy. The elements of the total requirements matrix describe the direct and indirect sector output effects for change in final demand. For a change in final demand $y' > y$, we

can use the total requirements matrix to perform an analysis of the multiplier effects across sectors after several rounds of spending are complete.

The multiplier effect refers to the amplified effect of an economic stimulus considering all the indirect effects as money is spent and re-spent over several rounds within a system. For a given sector, the output multiplier measures the combined effect of a unit change in sector output on the output of all industries in which that sector purchases inputs. To produce an additional 10,000 yuan worth of machine parts requires the additional purchasing of local inputs (e.g. steel, electrical components, and transport services) as well as the purchasing of local labor services. These kinds of relationships are referred to as *backward linkages* (Hughes 2018). The extent of backward linkages are captured in our model and used to derive Type 1 output multipliers which together describe the total effects of both direct and indirect increases in sectoral output. An output multiplier of 1.5 indicates that an additional 10,000 yuan in demand for machine parts will generate 15,000 yuan in total output spread throughout sector linkages.

Summing the elements of the total requirements matrix L in column j gives the Type 1 output multiplier for sector j. This is defined in the following equation where l_{ij} are the elements of the total requirement matrix for a given column (Miller and Blair 2009).

$$m(o)_j = \sum_{i=1}^{n} l_{ij} \tag{4}$$

An increase in the purchases of local labor inputs following an increase in demand leads to higher household incomes and additional consumption expenditures. Consumption linkages present an additional multiplier effect on the basis of induced increases in output from increased household expenditures. By "closing" our model with respect to households we can derive Type 2 multipliers, which describe the total multiplier effect of direct, indirect, and induced increases in sector output. Closing our model with respect to households refers to the inclusion of consumption linkages as an endogenous sector by including an additional row for labor compensation and an additional column for household consumption in our intermediate matrix $\bar{l}_{ij}$. The Type 2 output multiplier is defined as:

$$\bar{m}(o)_j = \sum_{i=1}^{n} \bar{l}_{ij} \tag{5}$$

In order to assess the Chinese government's counter-COVID-19 expenditures we focus also on identifying counterfactually the *income and employment* effects of the current stimulus. In addition to our output multipliers, we derive also income and employment multipliers for each sector. Income multipliers represent the economic impacts of a change in final demand on household earnings and describe how the benefits to growth are distributed to households. By considering household expenditures as endogenous, these multipliers capture information regarding the magnitude of induced output effects which appear in our Type 2 output multipliers. The employment multiplier describes the sector-to-household linkages through the labor market, where the value of the multiplier denotes the direct and indirect increase in the total number of physical jobs across the economy for an increase of *one million yuan* in final demand for a given sector.

Simple income multipliers are derived using the technical coefficients for direct labor requirements when the IO model is closed with respect to households. The calculation involves weighting each

element in the direct labor requirements (households) row by the output multipliers of the corresponding sector and taking the sum. This relation is described formally in equation (6) where $a_{n+1,i}$ are the row elements of household income receipts from labor compensation by sector.

$$m(h)_j = \sum_{i=1}^{n} a_{n+1,i}(l_{ij}) \quad (6)$$

The simple income multiplier denotes the direct and indirect effect of an increase in final demand for sector *j* on the total value of required labor services. There is another kind of income multiplier, referred to as the Type 1 income multiplier, which describe how the initial sector-household income payments $a_{n+1,i}$ are "blown up" over several rounds of direct and indirect spending effects over the economy (Miller and Blair 2009). The formula for the Type 1 income multiplier is simply the ratio of the simple income multiplier (6) and the labor input requirement coefficient $a_{n+1,i}$.

$$m(h)_j^I = \frac{\sum_{i=1}^{n} a_{n+1,i}(l_{ij})}{a_{n+1,i}} \quad (7)$$

While the simple income multiplier describes the increase of household incomes as a result of additional labor input requirements for sector *j*, the Type 1 income multiplier captures the relative contribution of income gains in sector *j* in stimulating additional income gains across sectors. Thus, viewing the results of these income multipliers from a socioeconomic lens enables the identification of critical sectors which can be leveraged to pursue strategic commitments for sustained income growth and support of domestic markets. The major limitation of IO data in this respect is the lack of delineation between various income or skill groups, accounts which prominently feature in SAMs, to allow for identifying targeted income effects for low-income households or low-skilled workers.

Given that the household sector's main "output" are labor inputs, our income multipliers are closely related to a sector's physical employment multipliers for a change in final demand. Following (Kecek et al. 2021), we calculate $\hat{e}_j = {e_j}/{x_i^0}$ as the number of full-time employees in sector *j* where e_j is the total value of compensation paid to workers and x_i^0 denotes the monetary value of sector output in the base year. The physical employment multiplier is then calculated as

$$m(e)_j = \frac{\sum_{i=1}^{n} \hat{e}_i(l_{ij})}{\hat{e}_j} \quad (8)$$

which describes the number of additional direct and indirect gains in employment due to the autonomous increase of one direct unit of employment in sector j.

Finally, in order to estimate domestic employment effects, we construct a diagonal matrix of employment coefficients ε denoting the base-year value of employment in each sector divided by the level of sectoral gross output, shown below for a two-sector example.

$$\varepsilon = \begin{bmatrix} e_1/x_1^0 & 0 \\ 0 & e_2/x_2^0 \end{bmatrix}$$

Using our employment coefficients matrix in place of our A matrix, we take the inverse $(I - \varepsilon)^{-1}$ to account for indirect effects. For an increase in final demand $y' > y$, we multiply our employment requirements matrix ε by y' and then integrate average wage data by sector to produce estimates of employment effects in terms of physical units of employment.

4. Results and Interpretation

The identified panel of input-output multipliers describe the production structure of the economy and its relation to household income and consumption expenditures. The average output multipliers in our model are 2.83 (Type 1) and 3.6 (Type 2). These relatively high values for average economy-wide multipliers are indicative of the level of development of backward and forward linkages in the Chinese economy. These average multipliers suggest that a 1 trillion yuan injection in the economy will return between 2.8 trillion and 3.6 trillion in total additional sectoral output. These estimates are meant to reflect the lower- and upper-bounds of our modeled stimulus where the actual outcome depends on which sectors receive an increase in government spending as well as households' propensity to consume.[2]

Table 1.1 Average Economy-Wide Multipliers

Type 1 Multiplier	2.827
Type 2 Multiplier	3.601
Physical Employment Multiplier	4.544
Type 1 Income Multiplier	4.284

Source: Authors' calculation for 2018 IO Table

Moving down the list we find an average employment multiplier of 4.54. This value of the average employment multiplier suggests that aggregate employment growth in China is relatively responsive to changes in final demand, where the increase of 1 job for the average sector may directly and indirectly support up to *4.5* additional jobs throughout the economy. This high average is not representative of the typical sector however. Due to particularly robust backward and forward linkages, high employment multipliers are typically concentrated in tradable sectors like manufacturing, information technology, and professional services, which bring revenue flows and capital from outside the system. Next, we find an average income multiplier of 4.28. Every additional dollar of final demand in the average sector may be expected to stimulate additional economy-wide gains in household income by $4.28 dollars accounting for direct and indirect effects of backward linkages. An average income multiplier much greater than 1 in our case indicates that household expenditures indeed provide a significant channel for augmenting the effects of economic multipliers. However, the magnitude of income multipliers by sector varies

[2] Households' propensity to consume is taken as constant and uniform across income or social groups in the standard analysis of input-output multipliers. Whereas Type 1 multipliers may underestimate the multiplier effect by regarding household expenditures as exogenous, Type 2 multipliers can be seen as overestimating the likely effects of an increase in sector output because of static consumption propensities.

substantially, indicating significant differences between the consumption linkages of different sectors.

To study the variation of multiplier effects across sector types we've classified the 153 production sectors into five categories: primary, low-tech manufacturing, high-tech manufacturing, services, and quaternary industries. Thirteen sectors are classified as primary including agriculture, forestry, animal husbandry, and fishery service products in addition to mining and other extractive industries. There are fifty-five sectors classified as low-tech manufacturing (food processed products, textiles, furniture, metal products and other building materials etc.) and an additional thirty classified as high-tech manufacturing (chemical products, pharmaceuticals, electronic components, special equipment etc.). Service industries account for forty-seven sectors with quaternary industries (those intensive in information and computer technology) accounting for the final eight sectors. Observing Table 1.2 we find average multipliers by sector type. Immediately, we can see that overall multiplier values are significantly higher on average in the manufacturing sectors than in any other sector. The highest average income and employment multipliers are found in low-tech manufacturing while, the highest output multipliers are concentrated in high-tech manufacturing.

Table 1.2 Average Multipliers by Sector Type

Primary	Type 1 Multiplier	2.418
	Type 2 Multiplier	3.264
	Employ. Multiplier	2.773
	Income Multiplier	2.936
Low-tech Manufacturing	Type 1 Multiplier	2.943
	Type 2 Multiplier	3.722
	Employ. Multiplier	6.545
	Income Multiplier	5.710
High-tech Manufacturing	Type 1 Multiplier	3.435
	Type 2 Multiplier	4.107
	Employ. Multiplier	4.912
	Income Multiplier	5.155
Services	Type 1 Multiplier	2.459
	Type 2 Multiplier	3.293
	Employ. Multiplier	2.574
	Income Multiplier	2.668
Quaternary	Type 1 Multiplier	2.587
	Type 2 Multiplier	3.304
	Employ. Multiplier	3.867
	Income Multiplier	2.908

Source: Authors' calculation for 2018 IO Table

4.1 Multipliers for Critical Sectors

Table 2.1 presents a full table of output, employment, and income multipliers for the top 10 value-added sectors of the economy. Observing our table, we see that the real estate sector contributes the largest share of value-added (VA), followed by the wholesale trade sector, financial services, the public administration sector, and the broad agricultural products sector. The output multipliers for the top 10 VA sectors are generally strong, indicating that they are well-integrated in the economy through backward and consumption linkages. The highest output multipliers are found in the residential construction (3.84), business services (3.79), and agricultural products (3.29) sectors. Notably at this level of disaggregation, all top 10 VA sectors are non-manufacturing.

The top three sectors: real estate, wholesale, and financial services appear to have modest output multipliers relative to rest of the top 10 VA sectors while exhibiting a relatively strong income and employment multipliers. These results indicate that the economy-wide impact from a change in final demand for the real estate sector occurs mainly through the employment channel as output gains in this sector tends to support employment and income gains in other sectors. Moreover, the relative size of the real estate, financial services, and business services sectors indicate the increasingly central importance of the finance, insurance, and real estate (FIRE) sector in the modern Chinese economy. This fact reflects one of the drivers in income inequality in China: the rise of skill premia. Jobs in the FIRE sector typically require high levels of formal education and are concentrated mainly in financial centers like Beijing, Shanghai, and other highly urbanized areas. These urban skill premia are largely inaccessible for China's large population of rural and migrant workers with comparatively less access to higher education and urban social networks.

Table 2.1 Multipliers for Top 10 Sectors by VA (in ten thousand yuan)

	Real estate	**Wholesale**	**Financial services**	**Public administration and social organization**	**Agricultural products**
Sector VA	¥ 681,344,741.76	¥ 497,784,169.53	¥ 488,219,705.16	¥ 429,894,799.64	¥ 401,199,459.53
Rank	1	2	3	4	5
%GTVA	7.39%	5.40%	5.29%	4.66%	4.35%
Type 1 Output Multiplier	1.591	1.848	1.976	2.036	1.853
Type 2 Output Multiplier	1.994	2.503	2.688	3.160	3.291
Physical Employment Multiplier	1.488	2.220	3.253	0.554	1.210
Type 1 Income Multiplier	1.794	2.291	2.991	0.404	1.278

	Retail trade	**Residential housing construction**	**Education**	**Business Services**	**Road cargo transportation services**
Sector VA	¥ 379,287,792.70	¥ 326,818,539.27	¥ 315,788,793.37	¥ 245,740,789.85	¥ 208,613,515.71
Rank	6	7	8	9	10
%GTVA	4.11%	3.54%	3.42%	2.67%	2.26%
Type 1 Output Multiplier	1.815	3.079	1.724	2.829	2.313
Type 2 Output Multiplier	2.679	3.835	2.795	3.792	2.892
Physical Employment Multiplier	1.046	2.827	0.831	1.975	2.512
Type 1 Income Multiplier	1.115	3.174	0.891	2.267	2.623

Source: Authors' calculation for 2018 IO Table

The highest income multipliers for the top 10 VA sectors are in residential housing construction (3.17), financial services (2.99), and road cargo and transportation services (2.62). These values indicate that the induced effects on output of increased labor demand in these sectors are quite high, however this effect occurs for different reasons. In the financial services sector this effect arises due to the high average wages earned by the relatively skilled workforce, leading to high induced output effects from the spending of these workers. While the FIRE sectors altogether make up 14% of value-added, they account for less than 7% of total employment. Since actual employment gains in these sectors and their respective income effects may be limited by education requirements and geographic location, the realized economy-wide effects depend largely on the higher propensity to consume of higher-wage earners in these sectors.

In construction and transportation services, where wages are much lower, this effect occurs because production in this sector remains quite labor-intensive and absolute employment numbers remain high. Overall, the construction sectors account for 8.76% of total employment and 7.05% of total value-added. The residential construction sector itself commands a large share in total employment at 4.5% with a share of total value-added around 3.5%. The aggregate transportation services sector accounts for 3.82% of total employment with a share of total value-added around 4.95%. The road cargo and transportation services sector alone accounts for 1.35% of total employment with a share of total value-added around 2.3%. Because residential construction and road cargo transportation services employ relatively large numbers of workers relative to value-added and exhibit particularly large employment multipliers, gains in output and employment in these sectors may be expected to be distributed somewhat more evenly across regions and support employment for both less-skilled urban and migrant workers since construction and transportation activities are not as concentrated as the FIRE sectors. The present stimulus explicitly targets spending in infrastructure construction across various provinces. As we will see, the multipliers for residential housing construction are similar to construction activities in infrastructure and other civil engineering projects. Therefore, we should expect significant direct and indirect gains from increased output in construction and related sectors.

Among the largest Type 2 output multipliers are found in the agricultural products sector. From the 153 production activities in our dataset, the agricultural products sector[3] commands the largest share of total employment at 13.2% despite a share of total value-added at 4.4%. As would be expected, the broad agricultural sector forms the bedrock for rural economies in China providing large numbers of rural households a source of primary or supplementary income.[4] Though wages are low relative to skilled workers in urban areas, any gains in the incomes for agricultural workers can have significant output impacts on rural communities given the outsized importance of consumption expenditures in rural economies. Moreover, since most employment in the primary sector typically require little formal education actual employment gains may very quickly be realized through increases in final or intermediate demand, meaning that investments in this sector can lead to positive economic effects in the short-run and contribute to addressing acute hunger and poverty. Finally, since rural areas provide markets for domestic goods in other regions, may

[3] This sector specifically references agricultural crops and excludes livestock, fisheries, forestry, and miscellaneous animal husbandry products. Altogether the agricultural sectors make up roughly 25% of total employment in China.
[4] As in the case of migrant workers who work seasonally in urban factories or construction sites and return for work in rural agricultural production for the rest of the year.

lead to significant economic impacts that are spread more evenly throughout the economy. However, these income effects do not generally lead to significant impacts in terms of sustained employment gains in other sectors because agricultural products have few backward linkages.

Using production-side accounts, Liu (2021) shows that the some of the largest sectors by share of value-added: wholesale trade, retail trade, and road cargo transportation services were among the most impacted by the COVID-19 shock. The collapse of wholesale and retail trade coincided with the sudden disruption of intercity and interregional commerce and transport flows on account of strict lockdowns. This particular impact of the pandemic has tended to concentrate in regions most affected by the pandemic (Chen et al. 2020). Accordingly, a significant portion of employment losses have been concentrated in broadly pandemic-sensitive service sectors like wholesale and retail trade, business services, and the transportation sector in addition to accommodations, meals and food services, and other related service sectors. Altogether, job losses in these sectors represent the loss of mainly middle and low-skill jobs.

Table 2.2 Multipliers for Pandemic-Sensitive Services (in 10 thousand yuan)

	Meals and Food Services	Accommodation and Hotels	Resident services
Sector VA	¥ 117,503,013.34	¥ 43,119,338.74	¥ 88,016,448.74
%GTVA	1.27%	0.47%	0.95%
Type 1 Output Multiplier	2.639	2.452	2.016
Type 2 Output Multiplier	3.592	3.321	2.993
Employment Multiplier	2.232	1.274	1.412
Income Multiplier	3.118	1.639	1.298

Source: Authors' calculation for 2018 IO Table

Table 2.2 reports multipliers for a set of three service industries that have experienced significant employment losses during the pandemic. We find that output and employment multipliers that are generally higher than would be expected for service sectors. Notably, we find higher than average employment multipliers in the meals and food services, and accommodation and hotels sectors. These results highlight the relative importance of these sectors in supporting overall economic activity across regions and as a major source of employment in both urban and rural areas. Declines in service sector output and employment left lasting impacts on the revenues and employment of various other sectors throughout the economy. Given this context, one of the principle challenges of the COVID-19 shock then is to restore domestic demand to pre-pandemic levels in order to boost employment in these and interconnected sectors.

Major employment losses also resulted from manufacturing plant shutdowns in early 2020. The wider impacts of these shutdowns can be traced in Table 2.3, which shows the estimated multipliers for the largest manufacturing sectors in China by VA. The largest manufacturing/utility sectors are electricity and heat production, steel rolled products, metal products, automobiles, and

refined petroleum and nuclear fuel processed products. All manufacturing sectors feature among the largest estimated employment and income multipliers in the economy. Given that manufacturing requires a wide-ranging list of inputs, stable manufacturing employment tends to support a large volume of additional output and employment in related sectors and local communities, leading to substantial spillover effects in terms of direct and indirect employment effects from changes in final demand. The sharp decline in manufacturing activity from the pandemic constituted a major drop in demand for intermediate goods throughout the wider economy.

Table 2.3 Multipliers for Top 10 Manufacturing/Utility Sectors by VA (in 10 thousand yuan)

	Electricity and heat production and supply	Steel rolled products	Metal products	Whole cars	Refined petroleum and nuclear fuel processed products
Sector VA	¥ 203,934,895.87	¥ 142,840,345.00	¥ 118,112,728.75	¥ 88,125,836.21	¥ 85,757,375.11
Sector Imports	¥ 167,346.58	¥ 10,748,552.80	¥ 8,933,652.91	¥ 11,054,482.11	¥ 90,126,121.46
Rank	1	2	3	4	5
%GTVA	2.21%	1.55%	1.28%	0.96%	0.93%
Type 1 Output Multiplier	2.813	2.808	3.127	3.428	2.560
Type 2 Output Multiplier	3.403	3.352	3.788	4.015	2.935
Physical Employment Multiplier	4.473	5.115	3.451	9.114	14.288
Type 1 Income Multiplier	4.246	5.493	3.645	9.630	15.247
Imports as % of VA	0.08%	7.5%	7.6%	40.2%	29.0%

	Medical products	Electronic Components	Waste resources and recycling products	Auto parts and accessories	Non-ferrous metals and alloys
Sector VA	¥ 80278968.1	¥ 72,060,214.58	¥ 72,006,612.70	¥ 70,833,823.84	¥ 58808883.2
Sector Imports	¥ 26,621,438.8	¥ 23,247,565.52	¥ 24,256,644.04	¥ 24,209,119.43	¥ 69,240,432.96
Rank	6	7	8	9	10
%GTVA		0.78%	0.78%	0.77%	%
Type 1 Output Multiplier	2.832	3.789	1.276	3.492	2.988
Type 2 Output Multiplier	3.638	4.450	1.669	4.142	3.523
Physical Employment Multiplier	5.399	6.102	1.246	5.636	5.305
Type 1 Income Multiplier	4.800	6.541	1.257	5.973	5.782

Imports as % of VA	33.2%	341.3%	17.3%	27.3%	%117.7

Source: Authors' calculation for 2018 IO Table

One key piece of context to note is that taking national employment multipliers for manufacturing at face value assumes that all value-added activities in manufacturing and ancillary sectors take place within-country (Lawrence 2017) and that value-added are distributed evenly across regions. When considering global value chains and uneven development, where manufacturing is largely concentrated in China's Eastern provinces and in cities, the total magnitude of large national employment multipliers may not always refer to employment created domestically within-country or evenly across regions. While distinguishing regional employment effects would require the use of a multi-regional input-output model, we can distinguish national employment effects of manufacturing by observing the final row entries for the sectors on Table 2.3 reporting the level of imports as a percentage of sector VA.

We find that the largest manufacturing sectors with the greatest dependence on imports are electronic components, non-ferrous metals and alloys, and automobiles. The magnitude of import exposure in these and other sectors dependent on imports should raises doubt as to the full effect of the reported employment multipliers since an increase in demand for these sectors raises demand for imports and employment abroad.

An important set of non-tradable sectors for the Chinese economy are in construction and allied-industries. Table 2.4 reports multipliers for three construction sectors and the closely linked professional technical services sector. Among the four sectors we find output and employment multipliers that are high relative to the rest of the economy, particularly in construction related to infrastructure and other civil engineering projects. Because income multipliers here are relatively modest, it is clear that the bulk of output and employment effects are channeled through significant backward linkages. As we will see, construction sectors have significant linkages with local manufacturing and technical services, leading to indirect output and employment effects in these sectors for changes in final demand for construction. Accordingly, work stoppages on construction sites during the height of the pandemic in China resulted in acute ripple-out effects on intermediate demand. These ripple effects are compounded (e.g. construction declines lead to manufacturing declines which lead to further declines) to generate the steep jumps in unemployment characteristic of international experience with the pandemic.

Table 2.4 Multipliers for Construction and Allied-Industries (in 10 thousand yuan)

	Professional technical services	**Railway, road, tunnel and bridge construction**	**Building decoration, decoration and other construction services**	**Other civil engineering construction**
Sector VA	¥ 133,478,272.08	¥ 114,579,968.71	¥ 67,731,788.85	¥ 60,496,539.27
%GTVA	1.45%	1.24%	0.73%	0.66%
Type 1 Output Multiplier	2.724	3.100	2.990	3.102

Type 2 Output Multiplier	3.567	3.898	3.795	3.896
Physical Employment Multiplier	2.445	2.697	2.599	3.128
Type 1 Income Multiplier	2.011	3.103	2.982	2.716

Source: Authors' calculation for 2018 IO Table

A significant portion of the present stimulus is directed toward public health expenditures. The health services and related sectors constitute strategic sectors for managing the various public health challenges presented by the pandemic including the containment and treatment of disease in addition to vaccine development and disbursement. In Table 2.5 we show a set of multipliers for health services and related sectors. For the health services sector we find significant output multipliers of 2.61 and 3.61 coupled with a relatively modest but significant employment multiplier of 3.26. As will be shown in the next section, the health services sector has significant linkages with the medical products and medical equipment sectors, which in their turn exhibit high relative employment and income multipliers.

Table 2.5 Multipliers for Health Services and Allied Sectors (in 10 thousand yuan)

	Health services	**Medical products**	**Medical equipment**
Sector VA	¥ 163,270,017.00	¥ 80,278,968.07	¥ 9,857,574.89
%GTVA	1.80%	0.87%	0.11%
Type 1 Output Multiplier	2.612	2.832	3.166
Type 2 Output Multiplier	3.610	3.638	3.881
Physical Employment Multiplier	3.257	5.339	3.136
Type 1 Income Multiplier	2.967	4.800	3.300

Source: Authors' calculation for 2018 IO Table

The health services sector is well-integrated across regions (Xu and Yang 2009). Although the majority of hospitals are located in cities, up to 99% of health centers and a large portion of town and village clinics are concentrated in rural areas, providing the majority of total health services in China. Healthcare based on TCM or integrated with western medicine is in wide use by rural residents, who account for the largest portion of TCM clients. Household surveys suggest a growing trend among urban residents and college-educated individuals to seek health services in TCM hospitals and clinics (Xu and Yang 2009). Altogether, these facts indicate that the IK sector occupies a substantial portion of the health services sector. While the provision of healthcare services and products provide direct community benefits, which are often necessary to support overall economic activity, government spending here will also generate robust direct, indirect, and induced effects on economy-wide output and employment.

4.2 Modeling of Employment Effects After Fiscal Stimulus

This section presents details for an impact analysis of Chinese-counter COVID-19 expenditures. We model the employment effects of direct government injection totaling one trillion yuan. These expenditures are distributed as follows: 100 billion yuan are spent in *railway, road, tunnel, and bridge construction* and 500 billion yuan are spent in the *other civil engineering construction* sector as part of infrastructure projects, 300 billion are spent in the health services sector to fund public health and welfare programs, and 100 billion are spent in the public administration for broad support in the accelerated disbursement and extension of unemployment insurance for both urban and migrant workers. This distribution of government spending by sector is roughly representative of the total fiscal package spent in 2020, excluding tax and fees cuts and direct spending in the financial sector. Domestic employment effects are derived in terms of absolute monetary value of induced labor requirements and in terms of physical jobs using standard sector wages[5] and adjusted for import exposure.

The estimated value of additional sectoral output generated in our model totaled 3.05 trillion yuan.[6] The additional modeled employment corresponding to this increase in output amounts to over 7.7 million new domestic jobs. This figure is well within reach of the Central Committee's goal of 9-10 million jobs[7] and it is likely that the remaining gap in desired employment can be generated on the basis of substantial nation-wide tax cuts and subsidized expansion in credit availability targeting MSMEs. These employment effects are explored in further detail in this section, starting with Table 3.1 which shows the employment effects on the top 10 sectors by VA. We find that the sectors likely to see the most job growth are in public administration followed by agricultural products, business services, and wholesale and retail trade. The large increases in employment for the public administration sector are not surprising given the effect of a direct increase of government consumption in these sectors. However, the indirect effects of the overall stimulus turn out to be quite large, with significant spillover effects in the agricultural products, business and financial services, wholesale, and retail trade sectors. Employment gains of over 2.49 million jobs in the top 10 VA sectors amounts to 32.4% of the total increase in employment for the present stimulus.

Table 3.1 Employment Outcome for Top 10 Sectors by VA

	Real estate	Wholesale	Financial services	Public administration and social organization	Agricultural products
Rank	1	2	3	4	5
%GTVA	7.39%	5.40%	5.29%	4.66%	4.35%
Added Value of Labor Input Requirement (in 10 thousand yuan)	¥ 485,755.28	¥ 1,631,806.44	¥ 2,195,257.56	¥ 10,126,670.87	¥ 7,931,413.31

[5] Sector wages are calculated as the national average wage for urban units by sector in 2020, including both private and state-owned enterprises. Wage data are from the National Bureau of Statistics in China.

[6] Indicating an estimated output multiplier of around 3.05 for the modeled stimulus

[7] The goal of additional 9 million comes from the CPC's May 2020 Report on the Work of the Government. The 10 million figure refers to the amount of additional employment needed to have maintained the 2020 annual unemployment rate constant (Liang 2020).

No. of Additional Domestic Workers	69,585	217,546	201,391	965,198	469,969

	Retail trade	**Residential housing construction**	**Education**	**Business Services**	**Road cargo transportation services**
Rank	6	7	8	9	10
%GTVA	4.11%	3.54%	3.42%	2.67%	2.26%
Added Value of Labor Input Requirement (in 10 thousand yuan)	¥ 1,647,979.99	¥ 0	¥ 181,369.61	¥ 2,018,420.44	¥ 545,563.94
No. of Additional Domestic Workers	220,503	0	23,417	256,680	68,940

Source: Authors' calculation for 2018 IO Table

Among the main economic priorities in the first and second period of the crisis was the stabilization of employment. An important first step to stabilization is to prevent net employment losses at their source. As we saw, the most affected sectors in terms of output and employment were the consumer-facing industries in wholesale and retail trade, accommodation and other allied service industries. Table 3.2 reports the modeled employment outcomes for pandemic-sensitive service industries that were disproportionately impacted by the COVID-19 shock. We find significant employment gains in the reported service sectors. Including the wholesale, retail, transportation, and business services sectors, the overall modeled employment gains for pandemic-sensitive service sectors totaled 985,254 domestic jobs. These results suggest that the present stimulus is generally well-targeted to stem net employment losses, but an important question becomes the speed of the realization of these gains. The actual realization of these gains will come to depend on the speed of recovery of domestic consumption expenditures.

Table 3.2 Employment Outcomes for Services

	Meals and Food Services	**Accommodation and Hotels**	**Resident services**
%GTVA	1.27%	0.47%	0.95%
Added Value of Labor Input Requirement (in 10 thousand yuan)	¥ 361,287.31	¥ 448,233.90	¥ 142,144.81

No. of Additional Domestic Workers	74,207	71,959	26,524

Source: Authors' calculation for 2018 IO Table

An uneven recovery with the slow return of retail expenditures may translate into weak employment growth in the service sector. There is reason to be optimistic since domestic tourism and travel revenues are experiencing a relatively quick recovery in 2021, driving positive expectations for the growth retail expenditures throughout the year. However, structural factors are also at play. As a significant component of total consumption expenditures (verify this), the recovery of total consumption expenditures will depend in part on the restoration of disposable income on the part of China's large rural and migrant population. *Accordingly, it is important for China to focus stimulate domestic demand through rising labor incomes and reducing inequality.*

Table 3.3 Employment Outcome for Top 10 Manufacturing Sectors by VA

	Electricity and heat production and supply	**Steel rolled products**	**Metal products**	**Whole cars**	**Refined petroleum and nuclear fuel processed products**
Rank	1	2	3	4	5
%GTVA	2.21%	1.55%	1.28%	0.96%	0.93%
Added Value of Labor Input Requirement (in 10 thousand yuan)	¥ 700,615.44	¥ 626,251.31	¥ 618,990.22	¥ 2,807.28	¥ 92,421.06
No. of Additional Domestic Workers	81,927	88,379	88,112	361	13,138

	Medical products	**Electronic Components**	**Waste resources and recycling products**	**Auto parts and accessories**	**Non-ferrous metals and alloys**
Rank	6	7	8	9	10
%GTVA	0.87%	0.78%	0.78%	0.77%	0.64%
Added Value of Labor Input Requirement (in 10 thousand yuan)	¥ 1,485,372.11	¥ 206,063.77	¥ 261,676.97	¥ 130,505.87	¥ 141,874.76
No. of Additional Domestic Workers	211,151	12,068	32,077	17,559	20,168

Source: Authors' calculation for 2018 IO Table

Critical to employment stabilization in the early phases of the recovery was the restoration of production in the manufacturing sectors. Many of these jobs were restored once production restrictions were lifted and social distancing measures relaxed. However, maintaining a resilient front to stabilize employment will continue to lean on steady growth in manufacturing to support overall recovery. Table 3.3 shows that the greatest employment gains in manufacturing are found in the electricity and heat production, coal mining and processing, and steel rolled products, and metal products sectors. This result is due to the high number of linkages between these sectors and the construction sector. The various materials required for medium to long-term infrastructure projects are sourced from local manufacturing industries, generating a sustained employment effect, even after adjusting for import exposure. Thus, public investment and subsidies for infrastructure projects are likely to support well-paying domestic employment for many low-skilled and medium-skilled workers in manufacturing, providing up to 353,789[8] jobs or 4.5% of total employment gains. Much of this increase in employment will be disproportionately generated in manufacturing-intensive regions on the coast, in provinces like Guangdong, Zhejiang, and Shenzhen, as opposed to China's less developed interior provinces.

For a total 600 billion yuan increase in government spending in construction sectors we should expect both large direct effects and significant indirect effects as intermediate demand from construction activity ripples outward in connected or related sectors. Observing Table 3.4 we indeed find large direct gains of over 260,000 additional domestic workers in the railway, road, tunnel, and bridge construction sector and 1.3 million additional domestic workers in the other civil engineering construction sector. Additionally, we find significant gains in the professional technical services and building renovation and construction services sectors. Employment gains in construction and allied-industries account for a 26% of total employment gains and thus provide one of the main pillars of employment growth for the present stimulus.

Table 3.4 Employment Outcome for Construction and Allied-Industries

	Professional technical services	**Railway, road, tunnel and bridge engineering construction**	**Building decoration, decoration and other construction services**	**Other civil engineering construction**
%GTVA	1.45%	1.24%	0.73%	0.66%
Added Value of Labor Input Requirement (in 10 thousand yuan)	¥ 2,502,008.96	¥ 16.84	¥ 647,439.08	¥ 9,988,287.36
No. of Additional Workers	237,618	264,081	102,768	1,305,331

Source: Authors' calculation for 2018 IO Table

Another major source of employment growth in the present model comes from strategic spending in the health services and related sectors. Direct government expenditures in support of public

[8] Not including gains for the medical products sector since these are counter separately below.

health programs are targeted at improving basic capacity for pandemic control, treatment, and the distribution of essential goods and emergency aid. Improving capacity in this sector will require major labor inputs from both high-skilled and low-skilled workers including additional doctors and nurses, social workers, counselors, in addition to caretakers and medical aides. In addition, there are notable gains in the high-value added medical products sector (note that this sector has high relative import exposure). Table 3.5 indicates gains of over 1.3 million domestic and regionally-local jobs in health services and related sectors over the short to medium term (around 16.9% of total employment gains). It is quite possible also that this boost in capacity will become permanent as part of the government's ongoing healthcare reforms (Meng et al. 2019), and to prevent future outbreaks.

Table 3.5 Employment Outcomes for Health Services and Related Sectors

	Health services	Medical products	Medical equipment
%GTVA	1.80%	0.87%	0.11%
Added Value of Labor Input Requirement (in 10 thousand yuan)	¥ 9,745,694.85	¥ 1,485,298.29	¥ 157,007.34
No. of Additional Domestic Workers	1,099,191	191,042	13,280

Source: Authors' calculation for 2018 IO Table

Additionally, with China's aging population (Flaherty et al. 2007), healthcare will gradually occupy larger shares of total value-added over time and are certain to become important sources of future employment. Many of these jobs will need to be generated across China, with particular need in rural areas where the majority of health centers and village clinics are located, including many practicing TCM or TCM/western integrated practices (Xu and Yang 2009).

5. Discussion and Policy Recommendations

Our analysis highlights the salience of considering the economic and social shocks of pandemics and development from a SEICA perspective. Accordingly, the following conclusions and recommendations may be relevant for other economies in various stages of development, particularly those with sharply uneven development patterns and large populations of rural residents. First, in light of uneven development and structural inequalities, we find that the current stimulus has not done enough to generate economic activity and strengthen the recovery of rural provinces. Although there are some employment gains expected to be spread across regions including in construction, agriculture, and public health, the bulk of employment effects of the stimulus favor employment growth in urban areas. This is mainly by design, since a large portion of employment losses during the height of the pandemic were indeed concentrated in these areas, impacting also employment opportunities for hundreds of millions of migrant workers. However, this view failed to recognize that rural areas suffered disproportionate economic impacts from the COVID-19 shock despite having much lower infection rates than urban areas.

Accounting for the disproportionate effects of the pandemic on less developed provinces (i.e. Gansu, Guizhou, Xinjiang and Yunnan) and rural areas, residents in these areas may be more vulnerable to acute food and resource shortages as a result of the travel restrictions and production stoppages. Maintaining commitments to the prevention and reduction of poverty and hunger in these areas will require continued attention paid to the situation of poor households and individuals facing emergency situations. The provision of relief packages and transfers have been limited in the present stimulus to emergency situations, which has plausibly excluded many rural residents and migrant workers whose cases have gone unmonitored and without access to government representation. Future reforms must inevitably turn to overturning the hukou system, allowing more universal access to quality education and urban services.

Second, given the emphasis on supply-side matters of the stimulus the government will also need to focus more attention on restoring broader domestic demand as a means of achieving sustainable recovery. In order to maintain momentum in the present recovery, policy makers should continue to facilitate job creation for less-skilled workers in both urban and rural areas through tax support for MSMEs and job training programs and improve market expectations by maintaining a resilient front against future outbreaks through vaccination drives and international cooperation. Additionally, rural residents may require augmented relief packages and direct transfers in the interest of ensuring the sustainable recovery of household expenditures. On a structural level, the present crisis calls for pro-labor policies intended to stimulate domestic demand via rising incomes.

This strategy for China has its precedent in a previous recession. Just before the 2008 financial crisis, a team of economists from UNCTAD, of which one of the authors was a member, advised the Chinese government to focus more on domestic demand from a wage-led growth strategy. In addition, Khan (2008; 2010) suggested a more sustainable development approach by focusing on renewable energy use that seems to have been adopted by and large by the Chinese policymakers.

Third, China must continue to build up national innovation systems (NIS). The growth of China's large FIRE sector should be curbed in favor of developments in the real economy,[9] emphasizing instead technological progress and innovation in health, education, engineering, ICT, and other sectors. NIS supports strategic efforts toward lessening dependence on foreign sources for key inputs in addition to providing an important driver for long-run growth. In addition to planned public investments in high-tech infrastructure projects, a great deal of resources still needs to be mobilized in order to extract the full benefit from NIS. Such channels for resource mobilization include the development of national and regional innovation banks, education policy, industrial policy, and more optimal incentive structuring through the provision of grants, education spending, and high-tech infrastructure spending.

6. Conclusion

Calculations based on the 2018 IO table for China identified the direct and indirect effects of counter COVID-19 government expenditures on overall employment in the Chinese economy. We find that the real estate sector is the largest in terms of sectoral value-added, followed by the

[9] As the relative size and importance of FIRE sectors grows, these sectors begin to drain resources after a certain level (Khan 2021).

wholesale trade, financial services, public administration, and agricultural products sectors. The largest value-added sectors among manufacturing industries are electricity and heat production, steel rolled products, coal mining products, metal products, and petroleum and natural gas mining products. While these sectors are undoubtedly important for supporting local economic activity and employment, it should be noted that among the most strategically important manufacturing sectors are those with the greatest exposure to imports. Critically dependent on imports are the following sectors in terms of import exposure: electronic components (341.3%), petroleum and natural gas mining products (201.2%), and automobiles (40.2%).

The calculated multipliers indicate that households are most likely to benefit from changes in final demand for wholesale and retail trade, transportation services, agricultural products, residential construction, and accommodations sectors. In terms of modeled employment effects, we find that the greatest source of added employment is found in construction, agriculture, the pandemic-sensitive service industries, and in the public health and social work sector. For construction and public health/social work, in particular, these employment gains come largely from direct additional government expenditures in these sectors as part of counter-COVID-19 economic and social welfare goals. Since infrastructure projects and healthcare spending are targeted across China, it is likely that direct employment gains in construction and public health will be distributed fairly evenly across regions. The increase in agricultural employment is highly significant given a growing need for the creation of job opportunities in rural areas and under-developed provinces. For growth in services and manufacturing, we should expect job growth for low- and middle-skilled workers, providing jobs for low-income urban residents as well as migrant workers.

Employment gains for construction, public health services, and public administration come largely from direct additional government expenditures in these sectors as part of counter COVID-19 economic and social welfare goals. Significant employment gains are found to come also from indirect increase in intermediate demand through backward linkages. Sectors that have seen the largest indirect employment gains are agriculture and the pandemic-sensitive service industries. Employment gains have also been seen across manufacturing sectors to a lesser extent on account of backward linkages tied to the construction sector. The increase in agricultural employment is significant given the growing need for the creation of job opportunities in rural areas and under-developed provinces. For growth in services and manufacturing, we should expect job growth for low- and middle-skilled workers, providing jobs for low-income urban residents as well as migrant workers. Even after adjusting our modeled employment effects for import exposures, we were able to estimate that total domestic employment gains from the present stimulus would be significant and expected to meet the Central Committee's overall employment creation goals, with a large portion of these gains concentrated in construction and allied-manufacturing sectors.

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