MONGOLIA'S INVESTMENT PRIORITIES FROM A NATIONAL DEVELOPMENT PERSPECTIVE

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ABSTRACT

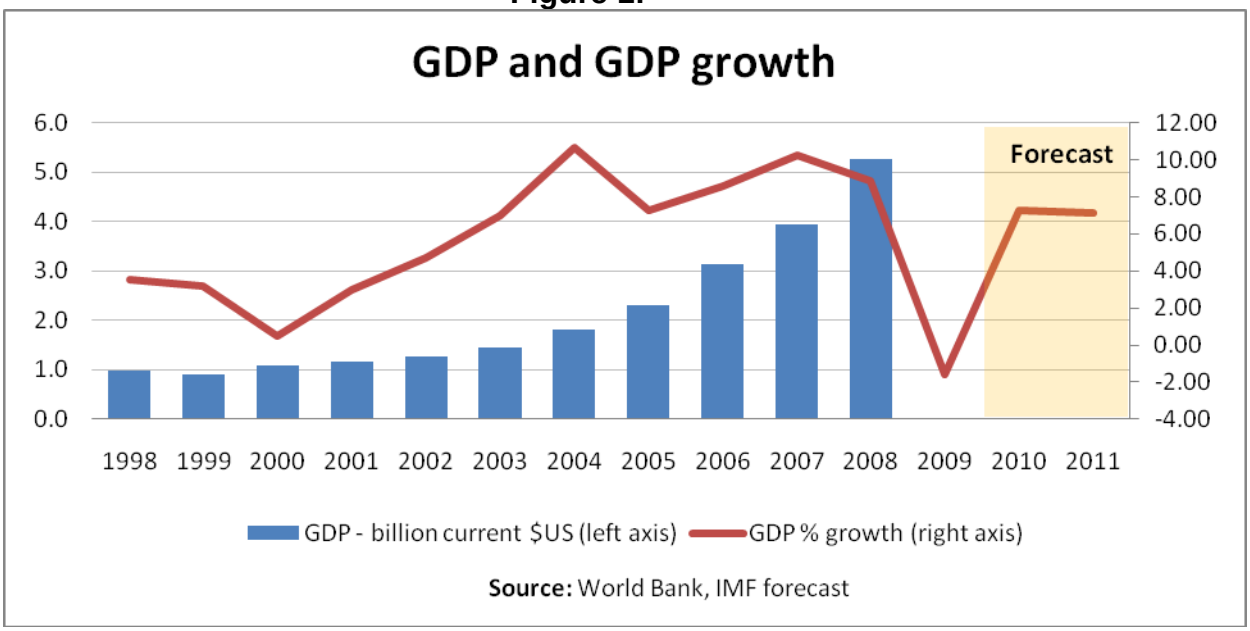
Mongolia is an economy remarkably rich in natural resources, at the outset of an ambitious national agenda for sustained development. By committing to an extensive series of large scale development projects and investment partnerships, the Government of Mongolia plans to leverage its abundant resource base for long term transition from a predominately rural, subsistence society to a modern, diversified, higher income country. The extent to which the country's considerable potential can be realized will depend not only on successful extraction and marketing of resources, but the extent to which these targeted activities and revenues general net-positive spillovers for the rest of the economy, enhancing the basis for market oriented entrepreneurship, higher labor productivity, and sustainable increases in living standards for the majority of Mongolians.

To assess these opportunities, and particularly the interactions and linkages needed to facilitate balanced and sustained growth, we developed and new dynamic economic forecasting model for Mongolia. Calibrated to a new, 2008 Social Accounting Matrix for the country, this economywide decision support tool was used to assess 26 of the country's highest priority development projects. Our results suggest that each of these can make an important contribution to the national development agenda, but they differ in important ways in both the scope and timing of their impacts. Because of their scale, these projects are very pervasive in their effects across the economy, and many different stakeholders will be implicated by them and have their livelihoods and opportunities affected directly and indirectly. By using scenario analysis such as that undertaken in this study, it is hoped the Government of Mongolia can more clearly identify both beneficiaries and those who will face adjustment challenges.

1 INTRODUCTION

1. Mongolia is a country extremely rich in natural resources, yet the economic potential of these resources is far from fulfillment. With responsible national development policy, these endowments can support sustained growth in the Mongolian economy and prosperity for its people. The Mongolian economy likely will be one of the fastest growing in the world in the coming decade, but the country faces many challenges, not only attaining this growth, but also establishing an inclusive and stable growth model while avoiding the many difficulties associated with natural resource-intensive development in a country with an extensive subsistence sector.

Figure 1:



2 ECONOMIC OVERVIEW

A. General

2. Mongolia experienced steady economic growth throughout the last decade but was hit hard by the financial crisis. Tumbling commodity prices and contracted levels of inbound FDI caused GDP to fall 1.6 percent in 2009 to approximately US$1,900 per capita.[1] The economy began to recover in the final quarter of 2009 and is expected to achieve a growth rate of 7 percent in 2010 (see Figure 1).[2] The main driver of GDP growth in 2010 is expected to be a result of the inflow of capital investment in the Oyu

[1] Estimated at current prices; Asian Development Bank (2009)
[2] International Monetary Fund (2010c)

Tolgoi mine. The IMF forecasts that the project will amount to 20 percent of GDP for the year.[3]

3. From 2004 through 2008 Mongolia experienced strong growth averaging approximately 9 percent annually. Rising commodity prices, copper prices in particular, contributed to the impressive growth of the country's economy. Plummeting copper and other commodity prices in 2008 upset the favorable terms of trade and was a major negative shock to the economy. Expansionary macroeconomic policy during the years of strong growth had lead to high inflation by mid-2008, strains on the underdeveloped banking system, and worsening fiscal and external balances. In the wake of the collapse of commodity prices the contractionary macroeconomic policy with a higher policy interest rate put increased downward pressure on investment and consumption.[4] Reports indicate that consumer spending in 2009 contracted by an estimated 17.5 percent for the year.[5] Since May of 2009 interest rates have been lowered by the central bank, but due to impending inflationary pressures it is likely that the central bank will need to raise interest rates this year. Authorities are currently adhering to a neutral bias for monetary policy but tightening money supply may be necessary.[6]

B. International trade

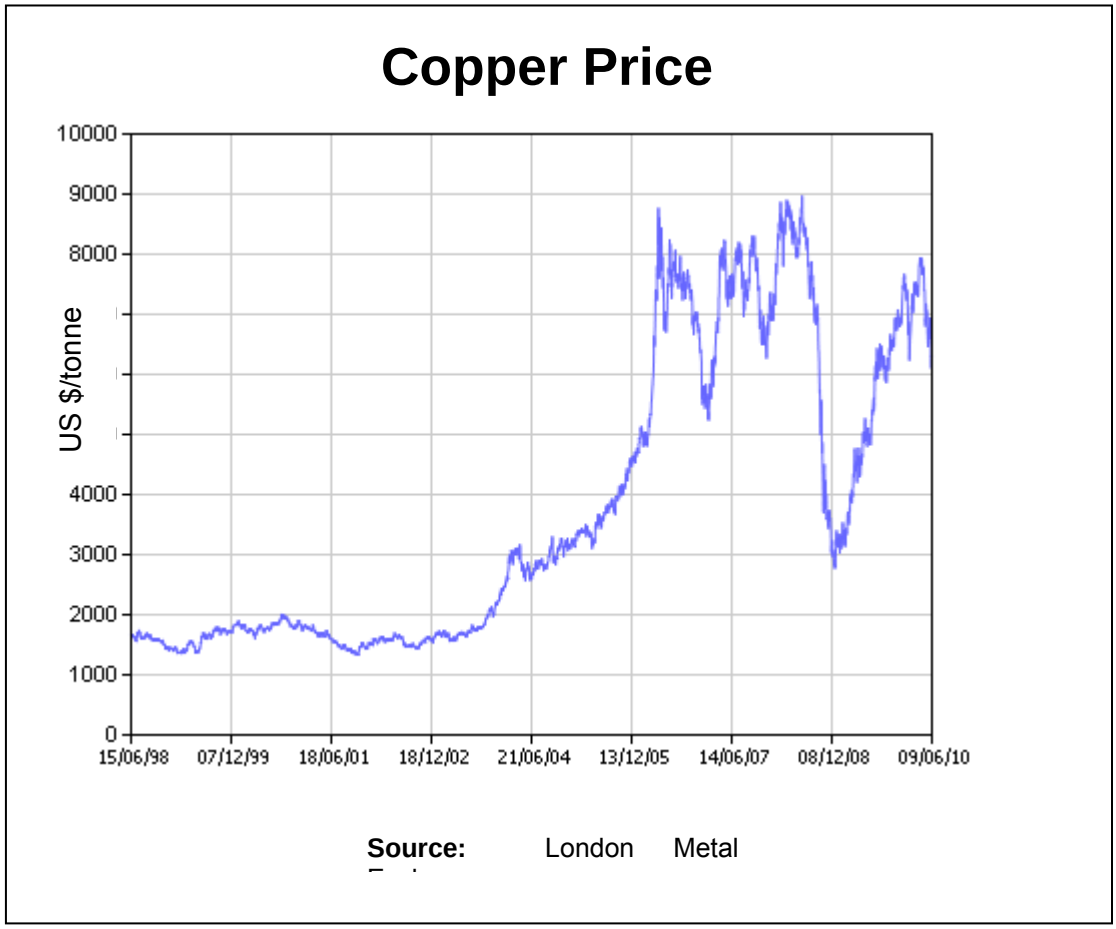
4. Strong Chinese demand for Mongolian exports and the rebounding prices of metals along with a US$224 million 18 month Stand-by Arrangement extended by the IMF has helped to stabilize the Mongolian economy after the terms of trade shock that depressed economic growth in the country.[7] China is Mongolia's largest trading partner. Mongolian exports to China account for 64.5 percent of total exports while 27.8 percent of imports are supplied by the PRC. Although Russia accounts for 38.4 percent of Mongolian imports China provides the majority of produce and consumer goods.[8] When the PRC closed the principle border crossing in 2006 to protest a Mongolian meeting with the Dalai Lama food shortages in Ulaanbaatar promptly followed.[9]

5. The large mineral deposits in the country are attracting increasing levels of investment from Mongolia's southern neighbor. According to the *China Daily* Chinese capital investment in Mongolia was 7.9 times higher in 2009 than it was in the previous year amounting to US$120 million. Bilateral economic relationship between the two countries continues to grow and high level meetings between leadership in Beijing and

[3] International Monetary Fund (2010b)
[4] Asian Development Bank (2010)
[5] Business Monitor International (2010a)
[6] International Monetary Fund (2010b)
[7] World Bank (2010a)
[8] Central Intelligence Agency (2010)
[9] Jones (2009)

Ulaanbaatar have become frequent. It has also been reported that there is a free trade agreement in planning stages.[10]

Figure 1:



Source: London Metal

C. Global Cyclical Shocks

6. The Mongolian economy was heavily impacted by the recent financial crisis. With economic growth significantly dependent on the burgeoning mining industry, the country was hit hard by plummeting commodity prices. As the global economy gradually begins to pick up and commodity prices are returning to pre-crisis levels, the Mongolian economic outlook is beginning to look much more favorable. The reaching of a final agreement for the development of the massive Oyu Tolgoi copper-gold mine has also instilled confidence in investors with regard to the future of mining in the country.[11] The Oyu Tolgoi mine is a massive foreign investment project, the largest in the history of

[10] Zhou (2010)
[11] Business Monitor International (2010b)

Mongolia, and will bring large amounts of FDI into the country in 2010 and beyond. Mongolia holds the potential to become one of the key mining countries in the region, even in the world. The drop in commodity prices, copper in particular, illustrates a difficulty for Mongolian development (see Figure1). With a mining sector that is continually becoming a larger part of the overall economy, fluctuations in commodity markets will affect terms of trade and extend into the broader economy.

D. Institutional Considerations

7. In 2009 Mongolia experienced two significant changes in leadership. In May the country elected its first President from the opposition Democratic Party, Tsakhiagiin Elbegdorj defeating the incumbent Mongolian People's Revolutionary Party (MPRP). Elbegdorj managed to win 51.21 percent of the vote running an anti-corruption campaign calling for change.[12]

8. The second major leadership change occurred in October when Prime Minister Sanjaagiin Bayar resigned due to deteriorating health resulting from a Hepatitis C infection that is a major health concern affecting many middle-aged Mongolians. Former minister of Foreign Affairs and Trade Sukhbaataryn Batbold filled the vacancy. Mr. Batbold is among the wealthiest individuals in Mongolia having made a fortune in gold mining and it is expected that he will continue to support pro-mining policies initiated by Bayar.[13]

E. Resource-Intensive Industries

9. The mining industry in Mongolia holds immense potential. The sparsely populated country is host to vast reserves of gold, copper, coal, iron ore, molybdenum, fluorspar, and uranium among some 80 discovered minerals. The mining industry directly accounted for 84.6 percent of Mongolia's exports and over 20 percent of overall GDP in 2009 and this percentage will likely increase as new projects are coming online.[14] Many of the country's mineral resources remain unexplored and unexploited. Lack of infrastructure, funding, and reliable government institutions along with high state involvement and high tax rates have kept some international investors at bay. The severe weather and rugged terrain is an additional impediment to full exploitation of the vast reserves within the country.[15]

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[12] Bulag (2010)
[13] Bulag (2010)
[14] Mineral Resources Authority of Mongolia (2010)
[15] Business Monitor International (2010b)

10. The Mineral Resources Authority of Mongolia is the key governing government body of the Mongolian mining sector. This government agency created in 1997 with its various subdivisions is in charge of geological and mining surveying and research, and most importantly the registering and issuing of licenses in accordance with the Minerals Law of Mongolia.[16]

11. Mongolia has experienced impressive growth in gold mining which is at currently at about 30 times the level of 17 years ago. There was a great jump in production following the transition from socialism in the decade of the 1990s and another surge in 2004 when production increased 71 percent. Gold prices currently at all-time highs, would be expected to incentivize increases in gold mining and production. Increase in gold production has not increased largely due to the punishingly high windfall tax of 68 percent that falls on the sale of gold over a price of US$500 per troy ounce. This could be to blame for the fact that gold production has stagnated and actually fallen by about 20 percent over the last few years.[17]

12. In the mid-70s the Erdenet mine, a Russian-Mongolian joint venture, began copper production. Since the Erdenet mine came online copper has been a substantial driver of Mongolian growth. The mine produces 120,000 to 135,000 tonnes of copper annually and has been a major part of the Mongolian mining sector and broader economy. The primary consumers of Mongolian copper are the U.S., Russia, and China.[18]

13. Fluorspar, or fluorite, is also an important product of the Mongolian mining sector. The primary consumers are Russia and Ukraine and the primary operation extracting the mineral is a Russian-Mongolian joint venture Mongolrostsvetmet. Fluorspar production grew 57 percent from 2008 to 2009 from 219.1 to 344.2 thousand tones.[19]

14. Mongolia holds significant coal reserves totaling approximately 162.3 billion tons, of which 10 billion are currently deemed “recoverable reserves” by the Mineral Resources Authority of Mongolia. Over 75 percent of total coal resources are located in the eastern region of the country.[20] Coal production has averaged approximately 5 million tonnes in recent history however over the last two years this has risen to approximately 8 million tones the majority of which is now exported to China. Given China’s growing appetite for coal, especially coking coal for steel production, and the sharing of a large border with Mongolia China is very interested in exploiting this potential.[21]

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[16] Mineral Resources Authority of Mongolia (2010)
[17] Business Monitor International (2010b)
[18] Business Monitor International (2010b)
[19] Mineral Resources Authority of Mongolia (2010)
[20] Mineral Resources Authority of Mongolia (2010)
[21] Business Monitor Intenational (2010b)

15. Uranium mining will likely be a significant part of the Mongolian economy in the future. With various countries, including China, looking to expand the role of nuclear power for electricity generation it is likely that uranium prices will rise. Recently there has been increasing interest in Mongolia's proven uranium reserves. In July of 2009 parliament declared all Mongolian radioactive mineral deposits strategically important and other regulation in relation to the nuclear energy industry was formalized in a Nuclear Energy Law.[22]

16. Russia in particular has shown interest in the development of Mongolian uranium potential. In August Mongolian state-owned firm AtomMon and Russian state-owned firm AtomRedMetGold together established Dornod Uranium established for the purpose of developing the Dornod uranium deposit in a northeastern part of the country.[23]

17. The Mongolian economy is highly dependent on the mining sector. With the Oyu Tolgoi mine coming online, in the years to come the economy will become increasingly more dependent on mining investment and global commodity prices. Prudent management of the mining sector will be extremely important as more projects are developed and the economy continues to grow. Appropriate management of mining revenue will continue to be a challenge for the Mongolian government and related government agencies. The Mongolian Parliament (The State Great Hural) is currently in the process of developing a Fiscal Stability Law and an Integrated Budget Law in an effort to solidify the foundation for such management.[24]

The Oyu Tolgoi copper-gold mine

18. In October of 2009 an Investment Agreement was finalized that confirms the development of the Oyu Tolgoi copper-gold mine in the South Gobi region of Mongolia. This mine, discovered in the 1990s, is the most highly anticipated project in the country and is projected to be a major catalyst of economic growth in the coming decades. The project is a partnership between the Mongolian government, mining giant Rio Tinto, and Vancouver-based Ivanhoe Mines. The mine is scheduled to begin producing in 2013 with a plan of reaching full production by 2018. At full capacity the mine is expected to produce 450,000 tonnes of copper per year and 330,000 ounces of gold with a projected mine life of 35 years.[25]

19. Ivanhoe Mines Mongolia LLC is the license holder of the mine. The Mongolian government will hold a 34 percent stake in the company while the remainder will be held by Ivanhoe Mines Ltd. in which Rio Tinto holds a 9.95 percent stake with an obligation acquire another 9.95 percent at US$388 million upon the conclusion of an unconditional

[22] Bulag (2010)
[23] Bulag (2010)
[24] World Bank (2010a)
[25] Rio Tinto (2010); Business Monitor International (2010b)

investment agreement with the Mongolian government (Tranche 2).[26] Under the financing agreement Rio Tinto will have the right to increase its holdings in Ivanhoe up to a 46.6 percent stake.[27]

20. In May Ivanhoe Mines released a press release confirming that a joint mandate letter had been signed by Ivanhoe with the European Bank for Reconstruction and Development (EBRD) and the World Bank Group's International Finance Corporation (IFC) for a major financing package for the development of the Oyu Tolgoi mine in order to meet the objective of commencing production in 2013. According to the terms of the letter the EBRD and the IFC will evaluate the possibility of extending a two-part financing package including US$300 million from each of the two organizations in limited-recourse project financing with an additional US$1.2 billion under a "B loan" structure from commercial lenders.[28]

21. A major sticking point in the negotiations of this project between Ivanhoe, Rio Tinto, and the Mongolian government was the windfall tax on copper and gold. The tax applies to gold and copper exports at a rate of 68 percent when gold price exceeds US$500 per troy ounce and when copper exceeds US$2,600 per tonne on the London Metal Exchange. This was a particularly contentious issue as Ivanhoe and Rio Tinto refused to enter into an agreement under this arrangement. In August of 2009 the Mongolian conceded abolishment of the tax effective January 2011 enabling the finalization of the Oyu Tolgoi Investment Agreement.[29] Many large mining corporations around the world were watching the Oyu Tolgoi negotiations closely and with the successful conclusion of the investment agreement confidence in the Mongolian mining sector has risen.

The Tavan Tolgoi coal mine

22. Mongolia holds some of the largest coal reserves in the world. As Chinese demand for coal continues to grow, outpacing growth in domestic production, the geographic proximity of Mongolia's large coal deposits has become extremely attractive.

23. Tavan Tolgoi is believed to be the largest coal deposits in Mongolia. In fact, it is said to be the largest undeveloped deposit of coal in the world at an estimated 6.4 billion tonnes valued at approximately US$2 billion.[30] The government announced its interest to develop the mine late in 2009 accepting bids from various companies. The plan was for the state to hold 51 percent interest and companies were bidding for the remaining 49 stake. In February of 2010 Prime Minister Batbold announced that the auction would

[26] Rio Tinto (2009)
[27] Mining and Quarry World (2009)
[28] Ivanhoe Mines (2010)
[29] Business Monitor International (2010b)
[30] Mineral Resources Authority of Mongolia (2010)

be cancelled. Batbold announced that this was done in order to achieve the best possible revenue from the mine and the government would consider developing on a contract basis rather than auctioning equity in the mine.[31]

24. At present the government is reconsidering joint ownership of the Tavan Tolgoi mine but remains undecided on what percentage a Mongolian state-owned company will retain. This dilemma illustrates a balance that the Mongolian government dealing with. On the one hand the government does not wish to concede sovereignty over its natural resources to foreign companies while at the same time it needs in the inflow of foreign investment to develop and exploit these resources. It has been reported that parliament will decide on this matter in mid-July.[32]

25. The Chinese are particularly interested in the development of Tavan Tolgoi. Chinese companies were among those that bid on the Tavan Tolgoi project but regardless of who develops the mine it is quite certain that the majority of the mine's produce will be shipped south where the Chinese demand for coal is high and growing.[33]

F. Transport infrastructure

26. The lack of modern, reliable cargo transport also contributes to the difficulty of mining in Mongolia. Rail lines are a vital component in the transport of minerals in the country and the Soviet-era rail lines are insufficient, largely outdated, unreliable, and plagued by transportation bottlenecks. Mongolia's transition to a market economy began in 1990 when the socialist system was abandoned. Beginning in 1921, when Russian troops helped the country realize its independence from China, Mongolia had close ties with the Soviet Union and much of the infrastructure that Mongolia still depends on today was built by the Soviet Union, including roads, railways, and power plants. The Soviet-constructed Trans-Mongolian railway remains the only large-scale rail artery in the country.[34]

27. The Infrastructure Development Company was formed in August of 2009 by the signing of an agreement between the Russian and Mongolian governments. Under the terms of the agreement Russian Railways (RDZ) obtained a 50 percent stake in Ulaanbaatar Railways, the state-owned Mongolian railway company. The 50 percent share granted to Russia has presented Mongolia difficulty in maintaining sovereignty over its own railway system. RDZ blocked the implementation of a rail project would

[31] Business Monitor International (2010b)
[32] Duce (2010)
[33] Jones (2009)
[34] MacNamara (2010)

have been funded by US$188 million from the U.S. Millennium Challenge Account and the funds were directed elsewhere.[35]

28. Further complications arise due to the inconsistency in gauge of railway track between Russia and China. Mongolian tracks use the Russian broad gauge 1520 mm tracks for all rail lines in the country.[36] Chinese railways use narrower 1435 mm gauge tracks which necessitates the conversion of trains when crossing the border. The city of Erenhot in northern Inner Mongolia at the Chinese-Mongolian border is the main port of entry of Mongolian goods entering China. 70 percent of all trade between the two countries occurs at this land port where the Trans-Mongolian Railway meets the PRC. Massive bottlenecks occur as the trains' chassis must be changed from broad to narrow gauge upon entering the PRC. In addition to trains, hundreds of trucks cross the border at the land port on a daily basis and it is not uncommon for drivers to be required to stop overnight due to traffic congestion.[37]

29. Earlier this year Prime Minister Batbold reported to investors in Hong Kong that an "east-west" railway had been approved unanimously by the Mongolian parliament and plans to begin construction are underway.[38] The crucial objective of this railway would be to connect the numerous and valuable mineral deposits, particularly in the South Gobi region to the Trans-Mongolian Railway so they could then be shipped south to China where a vast majority of the minerals are needed. Construction is scheduled to begin this year on the first phase of this project which will include six new rail lines totaling 1,800 km of new track. In 2011 the next phase is planned to follow with 1,400 km of new track and 2,000 km of additional track after 2015. With Russian involvement in the railway construction industry and China the largest export market, what gauge to use was an issue of contention. The final conclusion, citing "strategic interests" was that the newly constructed state-funded tracks are all planned to be Russian gauge.[39]

30. Chinese interest in building narrow gauge track connecting mines in Mongolia to the PRC is growing and is in the planning stages. Any narrow gauge line construction must be privately funded.[40] The Chinese energy giant Shenhua has bid on the Tavan Tolgoi project and is in the planning stages of developing a narrow gauge railway through Mongolian territory which would be an extension of the Gan Quan Railway in order to deliver Tavan Tolgoi coal to the PRC without railway gauge change disruption.[41] In addition, company called Jilin Sino-Mongolia Railway Energy (Investment and Development) Ltd. has been formed through cooperation between Chinese state-owned Jilin Zhongji Group and Bank of China Group Investment, Ltd. The company is currently

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[35] Bulag (2010)
[36] Central Intelligence Agency (2010)
[37] Zhou (2010)
[38] MacNamara (2010)
[39] MacNamara (2010)
[40] Sumiyabazar (2010)
[41] Shinebayar (2010)

conducting feasibility studies surrounding a proposed project to construct railway in eastern Mongolia connecting the Mongolian cities of Choibalsan and Tamsag Bulag to Baicheng in north-eastern China.[42]

G. Taxation and government revenue

31. Although Mongolia is mineral-rich it remains a very poor and underdeveloped country. The balance that the country is dealing with today is how to remain competitive as an FDI destination while maintaining regulatory and taxation structures that will extend the benefits of mining and increased foreign investment to all Mongolians. With regard to mining the key legal framework is The Minerals Law of Mongolia that was reformed in October of 2006. During these reforms royalty rates and license fees were raised (for current tax rate see Table 1).[43]

32. The Windfall Profits Tax has been a major hurdle to acquiring new sources of FDI. As discussed previously this tax is scheduled to be abolished in January of 2011. It is expected that the abolishment of this tax will encourage inflow of FDI as there will be more incentive for international mining corporations that wish to take advantage of the vast Mongolian mineral resources and high prices such minerals may fetch. With the abolishment of this tax a large source of revenue will no longer be available to the Mongolian government but it is hoped that the increase in FDI spurred by its abolishment will help to offset the loss.[44]

Table 1

Mining Sector Taxation

	Coal	Iron ore	Copper	Gold
VAT on sales, paid by buyer	10%			0%
Royalties on sales, paid by buyer	2.5%	5%		
Corporate tax rate on net revenue	10% (≤ 3 billion MNT); 25% (> 3 billion MNT)			
Windfall profit tax on net revenue*	0%		68%	
Effective marginal tax rate	27.5%	30%	73%	

* Windfall tax to be abolished effective January 2011

Source: Mineral Resources Authority of Mongolia

[42] Greater Tumen Initiative (2010)
[43] Mineral Resources Authority of Mongolia (2010)
[44] World Bank (2010a)

33. In 2009 the fiscal balance deficit amounted to 5.4 percent of GDP. The support of international financial institutions was crucial in meeting spending requirements.[45] In April of 2009 the IMF extended a Stand-by Arrangement (SBA) to Mongolia worth US$236 million.[46] SBAs are designed to assist countries in dealing with short-term balance of payments difficulties. They are generally disbursed over 12-24 months and repaid within 3.5 to 5 years of disbursement. In addition, they are generally accompanied by specific 'conditionalities' and countries often do not draw upon the entire approved amount but retain the right to do so in the event that conditions in the country deteriorate.[47]

H. Banking

34. The banking system in Mongolia is in a period of transformation. In December of 2008 the failing Anod Bank was taken over by the government. Following Anod's failure, in attempt to improve the banking system leadership strengthened banking laws and raised capital requirements while the central bank extended increased liquidity and initiated deposit protection. Despite these efforts another bank, Zoos Bank, foundered in November of 2009 and was put into receivership while bank lending fell by 26.2 percent.[48] Meanwhile the percentage of non-performing loans climbed to nearly 20 percent by the end of the year.[49] Access to capital in Mongolia also remains very difficult. Credible credit evaluation and obstacles to recovery from bankruptcy and debt make banks reluctant to lend causing high interest rates for borrowers and high collateral requirements.[50]

35. The central bank (The Bank of Mongolia) recently released a "bank restructuring strategy".[51] Under the comprehensive bank restructuring process there has been an effort to incentivize private investment and prevent the central bank from picking up the tab. In January of this year a new banking law provided a framework for consolidation of supervision along with other measures and is an important step toward instilling confidence in the country's financial system. An expeditious and effective bank restructuring is necessary in order to reach a point where banks are willing to lend and businesses, households, and herders can obtain access to credit at reasonable rates.[52]

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[45] Asian Development Bank (2009)
[46] International Monetary Fund (2010c)
[47] International Monetary Fund (2010a)
[48] Asian Development Bank (2010)
[49] International Monetary Fund (2010b)
[50] World Bank (2007)
[51] World Bank (2010a)

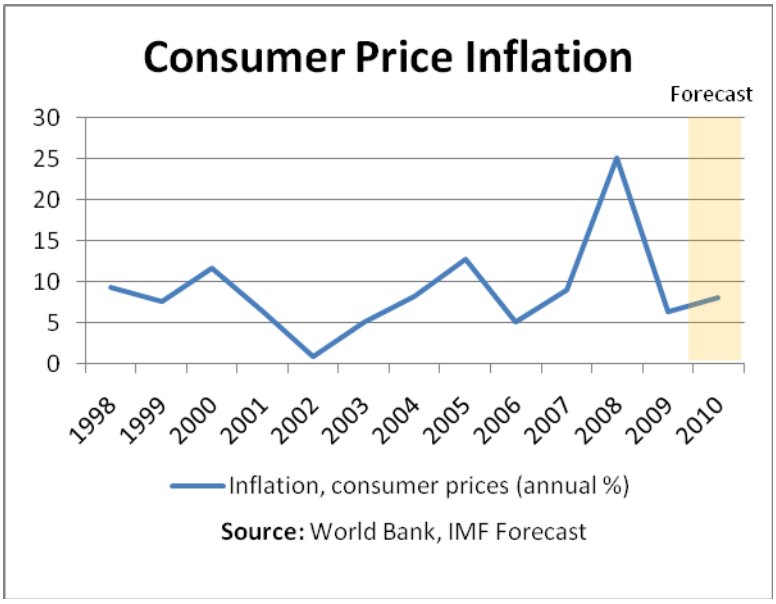
I. Regulatory and Institutional Quality Considerations

36. In many industries standards fall below those acceptable by the international community. This has been an obstacle in particular for the livestock sector. A ban on Mongolian meat in Russia, a principal export market for the Mongolian meat industry, due to occurrences of foot-and-mouth disease is an example of this problem which had a major impact in this sector. Corruption due to lack of accountability and transparency is also a major impediment to the growth of the Mongolian economy. In a 2006 report the World Bank Investment Climate Survey estimated that bribes and other "unofficial fees" cost investors approximately 40 percent of official fees.[53]

J. Inclusive and stable economic growth

37. With economic stability and strong forecast growth combating inflationary pressure will be a challenge for the Mongolian economy.[54] Due in large part to falling commodity prices, consumer price inflation dropped back down to 6.3 percent in 2009 from high levels in 2008 when it reached approximately 25 percent (see Figure 4).[55] With commodity prices back on the rise it will be a challenge to keep inflationary pressure under control. Both the IMF and the Asian Development Bank have forecast that consumer price inflation rates will reach near 8 percent for 2010.

Figure 2



[52] International Monetary Fund (2010b)
[53] World Bank (2007)
[54] World Bank (2010a)

38. Agriculture supports approximately 40 percent of the population of Mongolia. Falling cashmere and other agriculture-related prices in 2009 resulted in meager growth of 1.5 percent in the sector. [56] During the past year herders in Mongolia have been heavily impacted by the 'dzud' that has devastated livestock in the country. A 'dzud' occurs when a summer drought causes low levels of hay production and inadequate pasture growth which is followed by a severe winter characterized by strong winds, heavy snow, and unusually low temperatures making the access to pastures and hay even more difficult. According to the National Statistical Office of Mongolia in the first 5 months of 2010 20 percent of all livestock had been lost, amounting to 8.8 million adult animals. Losses of goats represent 49.6 percent of this amount.[57] The heavy losses in livestock will push up meat prices and likely cause further inflationary pressure.

39. With a total population of less than 3 million, on a per capita basis Mongolia is one of the most mineral rich countries in the world, however in reality its citizens remain very poor by international standards.[58] Rising unemployment and falling real wages in 2009 worsened the plight of low-income Mongolians. As of 2008 35.2 percent of the population was living below the national poverty line while 13.6 percent of the population was living on US$2 a day or less.[59]

40. During the 2008 parliamentary elections both political parties claimed they would provide around US$1000 to every citizen as a payout from mining revenue once the Oyu Tolgoi deal was signed.[60] Now the deal has been signed but it remains to be seen whether the parties will make good on their campaign promises. There has been discussion in parliament on how to extend the payouts through social programs. In the first days of April around 5,000 protesters took to the streets demanding their payouts.[61]

41. In January of this year a social transfer reform law was submitted to parliament and is expected to be passed in the parliament's spring session. The law will be an effort to reach the most impoverished Mongolian households at an expected cost of 1 percent of GDP.[62] Effectively targeting the poverty benefits will be a challenge in implementing such policy.

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[55] Central Intelligence Agency (2010)
[56] Asian Development Bank (2010)
[57] National Statistical Office of Mongolia (2010)
[58] World Bank (2010b)
[59] Asian Development Bank (2010); World Bank (2010b)
[60] Jones (2009)
[61] Pressly (2010)
[62] International Monetary Fund (2010b)

3 PRIORITY INVESTMENT SCENARIOS FOR MONGOLIA

42. In recognition of the challenges and opportunities discussed above, the government of Mongolia has committed itself to a diverse array of large scale public investments that are intended to help realize the nation's mineral, agricultural, and human resource potential. These priorities are represented by 26 different large scale projects articulated in the current five year plan and summarized in Table 2 below. To assess the long term implications of these projects across the Mongolian economy, we us a new forecasting tool, Calibrated General Equilibrium (CGE) model combined with a new (2008) Social Accounting Matrix (SAM) for Mongolia. The technical structure of the model is summarized in an annex below and fully documented elsewhere, but it represents a new standard for long term decision support to promote balanced and sustainable development.

Table 2: Large-scale Projects Announced for Priority Implementation by the Government of Mongolia

	Label	Title	Description	Budget (USDM)	Start	End	Implementing Agencies
1	Oyu	Oyu Tolgoi	Exploitation of Oyu Tolgoi deposit and construction of ore concentrator plant with capacity of 35.0 million tons per annum (100,000tons/day). Further, the capacity will be increased to 56.0 million tons per annum (150,000 tons/day).Open-pit and underground mining technologies will be used. Underground mining will be block cavemine method.	4,000	2010	2015	Ministry of Mineral Resources and Energy (MMRE), Government of Mongolia, Ivanhoe Mines Ltd.
2	Tavan	Tavan Tolgoi	Coal mine capacity is up to 20.0 million tons per annum and the coal refinery plant will produce15.0 million tons of coke concentrate per annum. Energy coal will be supplied to power station and the rest will feed the refinery plant. The coal refinery plant will be the base for further development of coke-chemical industry.	800	2010	2015	MMRE, Erdenes-MGL LLC
3	Copper	Copper Smelting Plant	Copper concentrates will be processed at the copper smelting plant to produce 70,000 tons of cathode copper per annum.	1000	2010	2015	MMRE, Mining and Heavy Industry Department
4	Steel	Steel &Metallurgical Complex	The project aim is to process 2.0 million tons of iron ore and produce steel plates, railway rails and other large-sized metal parts. Detailed study, implementation plan and feasibility study (FS)are yet to be carried out.	1000	2011	2016	MMRE, Fuel Policy Department
5	Coke	Coke-Chemical Plant	The project aim is to produce metallurgical coke based on coke concentrate of Tavan Tolgoi coking coal deposit. Further, chemical industry will be developed to process combustible gas, bitumen and other chemical substances that are generate das the by-products in the process of coke production. FS needs to be carried out.	700	2010	2015	MMRE, Fuel Policy Department
6	OilRef	Oil Refinery Plant	” Mongolia is becoming an oil producing nation. An appropriate technology will be selected to process domestic crude oil and a refinery will be constructed to meet domestic demand for petroleum and petroleum products. MMRE is currently studying 3 project proposals.	900	2011	2015	MMRE, Fuel Policy Department
7	Coal	Coal-Chemical Plant	The project aim is to produce combustible gas, methanol, DME and other chemical products by processing brown coal and develop coal-chemical	1000	2010	2015	MMRE, Fuel Policy Department

			industry. Clean coal technology will be applied to produce clean fuel that solve heat supply and air pollution problems of urban settlements. Coal chemical industry development program and FS need to be carried out.				
8	Const	Construction Materials Plant	Construction of cement plants with capacities: - 1.0 million tons per annum (TPA) in Sainshand; - 30,000-50,000 TPA in Bayankhongor soum of Bayankhongor aimag; - 50,000 TPA in Taishir soum of Gobi-Altai aimag; - 30,000 TPA in Undurkhaan soum of Khentii aimag; Production of building materials: steel structures and other products with capacity of 2.0 million TPA, ceramic billets with capacity of 50.0 million pieces per annum, heat-insulating materials and concrete blocks, will be set up.	1000	2010	2015	Ministry of Road, Transportation, Construction and Urban Development (MRTCUD), Construction, Housing and Public Utilities Policy Department
9	Food	Healthy Food	project to boost meat and milk production upon improving animal health The project aim is to install 50,000 tons a year industrial meat production capacity and increase the meat production from intensive livestock farming to 10,000 tons a year, install at least 20,000 tons a year industrial milk processing capacity and setting up a dairy farm with at least 8,000 milking cows nearby the urban settlements.	150	2010	2015	Ministry of Food, Agriculture and Light Industry (MFALI), Department of Livestock Policy Implementation, Department of Food Industry, Trade and Service Policy Implementation
10	Irrig	Promotion of Irrigated Cropland	The project aims to develop irrigated crop production. 25,000 ha area will be planted that produce 80,000-87,000 tons of wheat per annum. Annual vegetable production will be substantially increased upon cultivating 10,000 ha area. Also, fodder and industrial crops will be planted at 5,000 ha area to support development of intensive livestock farming.	50	2010	2015	MFALI, Crop Production Policy Implementation Department
11	AgFood	Agricultural Origin Raw Materials and Products Exchange	The project aims to support production of finished goods by processing wool, cashmere and other livestock origin raw materials. Some technological solutions have been tested.	50	2010	2011	MFALI, Food Industry, Trade and Service Policy Implementation Regulation Department
12	HiTech	High-tech Industrial Complex, Science-Industrial Park	Technologies to build 22 high-tech industries have been developed such as, biotechnology factory to produce preventive products from cardiovascular diseases and cancer with annual sales of US$ 600 million; biotechnology plant to process human blood plasma (30,000 liters) with annual sales of US$ 65 million; egg	400	2010	2015	National Development and Innovation Committee, Department of Innovation Policy

			processing biotechnology plant with annual sales of US$ 600 million; milk processing biotechnology plant with annual sales of US$ 65 million etc				
13	TTPowr	Tavan Tolgoi Power Station	Construction of 400 MB modern technology power plant connected with central electricity grid that consumes less water and equipped with air-cooler and dry ash disposal systems etc. PPP (public private- partnership) scheme is considered for the plant construction. Detailed project study, implementation plan and negotiations with potential investors need to be started.	400	2010	2015	MMRE, Energy Policy Department
14	Railway	New Railway	Consists of 3 projects that construct prime railway links from Tavan Tolgoi to Gashuun Sukhait; from Nariin Sukhait to Shivee Khuren; and a link between Tavan Tolgoi, Tsagaan Suvarga, Zuunbayan and Sainshand.	800	2010	2015	MRTCUD, Railway Authority
15	GobiH2O	Water Supply to Gobi Region from Orkhon River	Supply Gobi region with water flow of 2,500 liters per second. The project FS is underway.	540	2010	2015	Ministry of Nature, Environment and Tourism (MNET), National Water Committee
16	Satellite	Mongolia's National Communicatio n Satellite	The project aim is to launch a small-scale satellite designed for information and communication systems. Detailed project study and implementation plan need to be carried out.	600	2010	2015	Information Communication Technology and Post Authority
17	UBRoad	Ulaanbaatar City Road Reconstruction	Within this project, 350 km existing road will be renovated and 212 km new road will be constructed along with roadside engineering facilities that extend Ulaanbaatar city road network.	900	2010	2015	MRTCUD, A Working Group will be established.
18	MonRoa d	International, National and Local Road Construction	Construction of more than 4,500 km paved road at the territories of Umnugobi (Minami-Gobi), Dundgobi (Middle-Gobi), Dornod, Arkhangai, Bayankhongor, Khuvsgul, Zavkhan, Khovd, Bayan-Ulgii, Gobi-Altai and Uvurkhangai aimags.	1200	2010	2015	MRTCUD, A Working Group will be established.
19	Expway	Altanbulag-. Ulaanbaatar-Zamyn- Uud Expressway	Construction of 990 km expressway connecting Altanbulag, Ulaanbaatar and Zamyn-Uud. Detailed project study and implementation plan need to be carried out.	1200	2010	2015	
20	5thPower	The Fifth Power Plant	Construction of a new source for heat and electricity supply to Ulaanbaatar City. FS is underway by funding of ADB. Detailed project study and implementation plan need to be carried out.	300	2011	2016	MMRE, Department of Energy
21	Housing	Housing Supply	Thee project aim is to construct: - 41,200 households new apartment buildings in new towns and residential	2100	2010	2015	MRTCUD, Construction, Housing and Public Utilities

			districts; - 24,800 household apartment buildings within the framework of re-development plan of ger area into housing districts; - 9,000 household apartment buildings to improve population density; - 14,000 household apartment buildings in satellite cities; - 5,000 household apartment buildings in the regional hub cities; - 6,000 household apartments in aimags and local areas.				Policy Department
22	BioErg	Energy Production from Waste and Biomass	Production of a combustible gas from organic waste and biomass processing. Detailed project study and implementation plan need to be carried out.	200	2010	2015	MNET, Environment and Natural Resources Department
23	ITT	Information Technology Training and Production Town	The project aim is to establish an outsourcing center that produces information-technology products and supplies to domestic and foreign markets along with a training center to prepare IT specialists. A working group has been set up to develop the project strategy and implementation plan and considers reconciling it with the "Student Town" project.	100	2010	2015	Information Communication Technology and Post Authority
24	STown	Student Town	The project FS has been carried out to construct an education, research, production and experimental town with 20,000-25,000 inhabitants. Educational, research, production and experimental building complexes equipped with all the engineering facilities and residential houses for faculty personnel and students, facilities for social, cultural and community services, roads, parks, gardens and other greeneries will be built in the town.	300	2010	2015	MRTCUD, Urban Development and Land Affairs Policy Department
25	KKXIII	Khar Khorum XIII Century	Aimed at receiving 1.0 million tourists a year, this project plans to build a modern technology museum and exhibits, international standard hotels, airport and other service facilities in the Mongolian ancient capital-city of Khar-khorin. Detailed project study, strategy and implementation plan need to be carried out.	500	2010	2015	MNET, Tourism Department
26	Eco	Eco	Project for sewage and industrial waste water treatment The project aims to renovate sewage and some industrial waste water treatment facilities in soums, urban settlements and tourist camps; build units to recycle sludge composts into fertilizers and introduce waste-free technology. Detailed project study, strategy and implementation plan need to be carried out.	200	2010	2015	MNET, Environment and Natural Resources Department

43. This assessment is not intended to be exhaustive, either in terms of policy detail or incidence, but only to give general indications about salient opportunities and challenges that the government will face in terms of benefits and adjustment challenges. Because they capture economywide linkages and extensive indirect effects that can significantly outweigh direct policy effects, forecasting tools like this can improve visibility for decision makers in important ways. By conducting *ex ante* scenario analysis along the lines set forth in this preliminary analysis, policymakers can more effectively recruit beneficiary support and anticipate the adjustment needs of others. The result is often more inclusive, complementary policy design and more politically sustainable implementation.

44. More than two dozen policies are too many to be assessed individually in this general exercise. For that reason, we group the Mongolian government's main investment projects in five generic categories, summarized in the Table 4. In Table 3, we describe the corresponding policy scenarios, one for each project group and corresponding assumptions regarding finance and induced productivity responses within the economy. It should be emphasized that many of the latter are indicative only, and more extensive scenario analysis is needed to ascertain their significance.

Table 3: Investment Project Scenarios

	Scenario	Description
1	Mining	Primary mining and mineral resource development. Assumed to contribute 5% per annum to target sector total factor productivity.
2	Energy	Energy sector development. Contributes 5% per annum to target sector TFP.
3	AgFood	AgroFood development. Contributes 5% per annum to agrofood TFP.
4	Infra	Infrastructure development. Assumed to increase infrastructure dependent sectors TFP by 5% per annum.
5	Ted	Technology and education investment. Assumed to increase skill intensive sector TFP by 5% per annum.

Table 4: Concordance between Investment Projects and Scenarios

	Scenario				
Project	Mining	Energy	Infra	AgFood	TED
Oyu	Oyu				
Tavan	Tavan				
Copper	Copper				
Steel	Steel				
Coke		Coke			
OilRef		OilRef			
Coal		Coal			
Const			Const		
Food				Food	
Irri				Irri	
AgFood				AgFood	
HiTech					HiTech
TTPower		TTPower			
Railway			Railway		
GobiH2O				GobiH2O	
Satellite					Satellite
UBRoad			UBRoad		
MonRoad			MonRoad		
Expway			Expway		
5thPower		5thPower			
Housing			Housing		
BioErg		BioErg			
ITT					ITT
STown					STown
KKXIII					KKXIII
Eco			Eco		

45. Each of these groups represents a composite scenario with very substantial amounts of investment. Assuming equal disbursement of estimated budgets over the next decades, the corresponding outlays are depicted in Table 5. For an economy the size of Mongolia, these investments will in the first instance be externally financed, either by loans or joint venture agreements that entail foreign direct investment. In either case, the early years of these projects will present very large cash inflows and significant capital account imbalances, putting upward pressure on real exchange rates and possibly distorting domestic resource allocation.

Table 5: Annual Assumed Investment Outlays by Project Group (millions of 2010 USD)

	Mining	Energy	AgFood	Infra	Ted
2011	580	362	79	740	190
2012	690	362	79	740	190
2013	690	362	79	740	190
2014	690	362	79	740	190
2015	690	362	79	740	190
2016	690	362	79	740	190
2017	690	362	79	740	190
2018	690	362	79	740	190
2019	690	362	79	740	190
2020	690	362	79	740	190
Total	6,790	3,620	790	7,400	1,900

46. To contend with these transitory influences, we assume that Mongolia negotiates external finance for these projects that is amortized at 5 percent over 30 years, which nearly equalizes net external capital flows by 2020. For the first eleven years we consider, the flows are expressed in Table 6, in terms of one dollar of inbound project FDI for each of the years 2010-2020.

Table 6: Capital Flows (per USD) of Project Finance, 2010-2021

	Funding	Repay	Net
2010	1		1.00
2011	1		1.00
2012	1		1.00
2013	1		1.00
2014	1		1.00
2015	1	-0.39	0.61
2016	1	-0.46	0.54
2017	1	-0.52	0.48
2018	1	-0.59	0.41
2019	1	-0.65	0.35
2020	1	-0.72	0.28
2021		-0.72	-0.72

47. Scenarios are all carried forward to 2030 to capture project net impacts after most of primary cash flows have stabilized. This allows for “relaxation” of real exchange rate pressures, transient wealth effects, and resource pulls that may arise from these.

4 RESULTS

48. For the five investment scenarios set forth in the last section, macroeconomic impact estimates are presented in Table 7. Clearly, these projects have the potential to make important contributions to Mongolian living standards. Leaving aside distributional issues, all of the groups taken from the government's priority list will increase cumulative GDP by double digit percentages, in some cases by more than half. Indeed, our assumptions for these scenarios are quite conservative given the initial conditions for this economy, so it is reasonable to expect even more dramatic growth effects.

Table 7: Macroeconomic Results
(Cumulative percent change in real 2010 PPP values, 2010-2030)

	Mining	Energy	AgFood	Infra	Ted
Output	38%	11%	33%	43%	80%
GDP	38%	11%	28%	48%	85%
HH Income	14%	8%	21%	33%	43%
Consumption	18%	12%	19%	36%	59%
Exports	41%	8%	43%	51%	96%
Imports	22%	6%	23%	35%	54%
CPI	-1%	-3%	4%	-4%	-10%
Wage	8%	0%	13%	11%	5%
Rental	-10%	4%	4%	6%	8%

49. From other aggregate perspectives, household income mirrors Output and GDP growth in direction, but captures less because of the significant external partnership component of most of the projects. Personal consumption growth mirrors or exceeds real income, in some cases exceeding it because productivity gains lower domestic resource costs (CPI) and increase household purchasing power.[63] Wages rise in all cases, particularly those associated with the largest investments and labor-intensive investment. The rental rate rises except in the mineral scenario, which targets sectors with the highest prior capital constraints.[64]

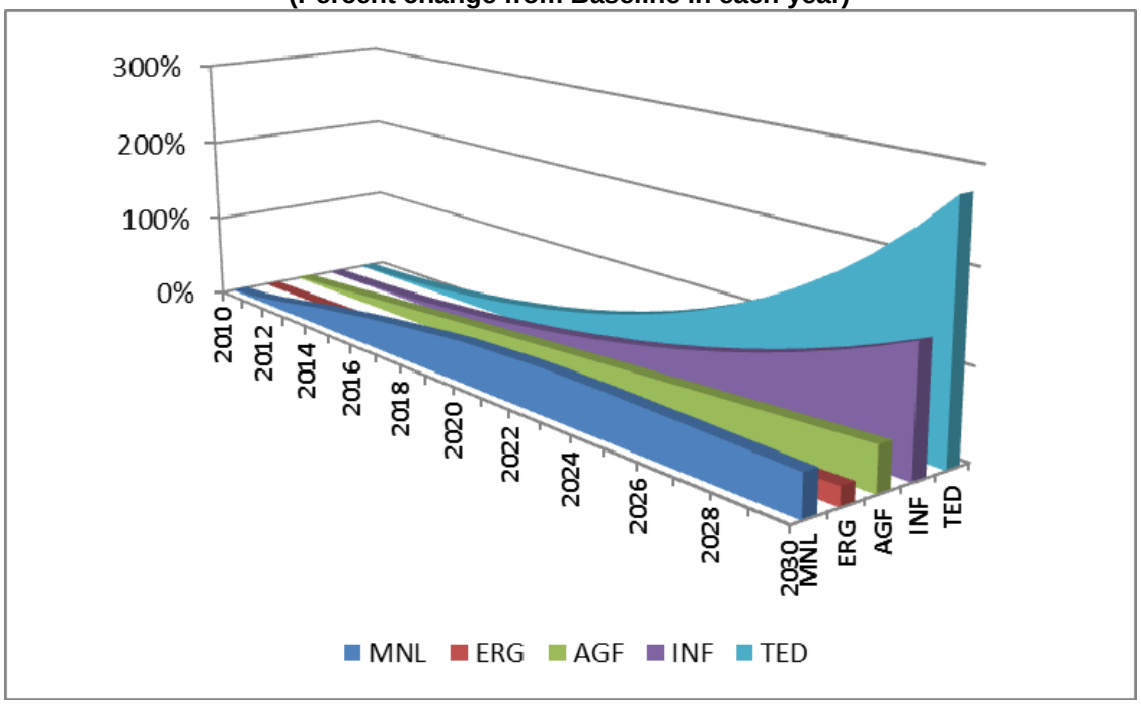
50. While the scenarios have many similarities in terms of aggregate growth stimulus, they exhibit important differences in the way they contribute to Mongolia's growth over time. This is dramatically illustrated in Figure 4, which shows real GDP differences from the Baseline trend annually. Here we see that, even though all are assumed to be invested at constant annual rates, each contributes over time in quite different ways. For example, the Mining group of projects makes early contributions to GDP, but then stabilizes. By contrast, the Infrastructure and TED scenarios, which represent

[63] Real household income is corrected for the economywide price level, while the CPI is corrected on the basis of consumption goods.

[64] One of the concerns about underinvestment in Mongolia has been high cost of capital, especially in sectors eligible for large enterprise investment, like minerals (see, e.g. Ianchovichina:2009).

investments in economywide productivity and economic efficiency, begin to yield returns that are low in the beginning continue growing long after the direct resource investment projects have plateaued. The most dramatic case is technology and education investment, which is of course laying the foundation for Mongolia's sustained transition to a higher income economy. It is also worth noting that the TED scenario yields the most dramatic long term expansion, in terms of domestic output, income, and competitiveness (exports).

Figure 4: Trend GDP Impacts of Investment by Project Group
(Percent change from Baseline in each year)



51. Herein lies an essential lesson for policy makers. All these projects are attractive in terms of total return over the period considered, but some offer much more attractive long term gains. To avoid the resource boom syndrome that has plagued many emerging economies since the 19th century, Mongolia needs to secure its investments in long term systemic efficiency and productivity growth. Only these commitments will secure the basis for market forces and entrepreneurial initiative to do its part in building and diversifying the economy. This in turn is a necessary condition for transition to a modern, self-sustaining consumer society.[65]

[65] For more on the growth benefits and characteristics of such emerging societies in Asia, see ADB: 2010.

52. In addition to a better understanding of trend impacts from these projects, it will be essential for policy makers to have more reliable evidence on distributional effects. Many of these projects are very narrowly targeted, and this make lead to wide disparities in the domestic distribution of benefits and costs. To the extent that that scenario analysis can identify these, it will be easier to recruit beneficiaries in support of these policies, anticipate the adjustment needs of others, and design complementary policies to reconcile the two.

53. To do this effectively will require further data development. The Mongolia model already has the capacity to capture more institutional detail, but this project will need to exploit household survey and other public data resources to extend the Mongolia SAM so it can support more detailed distributional, labor market, and fiscal analysis. To capture environmental impacts, it would also be desirable to add in data on emissions and technology adoption costs.

54. For the time being, we do have information on the sector composition of adjustments to the projects being considered. In terms of output, these are summarized in Table 8. These results exhibit a significant amount of "diagonal dominance," meaning that target sectors experience the biggest output change, but in most cases there are substantial spillovers to the rest of the economy. Such spillovers arise from intermediate linkages to target sectors, as well as final demand induced by aggregate GDP growth. We do not detail these linkages in the present discussion, but this information is available from the model.

Table 8: Output Changes by Sector and Project
(cumulative percent change, 2010-30)

	Mining	Energy	AgFood	Infra	Ted
AgroFood	24%	9%	65%	28%	61%
Mining	232%	9%	9%	53%	80%
Energy	25%	236%	5%	103%	168%
Manufactures	9%	10%	3%	91%	152%
MetMin Products	48%	17%	0%	53%	101%
Construction	40%	12%	9%	61%	77%
Utilities	31%	45%	21%	55%	90%
Trade	24%	10%	20%	69%	109%
TransComm	31%	2%	22%	109%	170%
Other Services	14%	6%	9%	21%	58%
Total	38%	11%	33%	43%	80%

55. The next table shows the trade effects of the policies at the sector level. As the macroeconomic results suggested, these investments have a very expansionary effect on Mongolian export opportunities, and indeed leveraging external demand as a growth stimulus is a primary justification of the policies themselves. This strategy is at the heart

of the “Asian Miracle” export oriented growth experience, and these results make it clear that the potential exists for Mongolia to harness similar dynamics. As we have seen in other East Asian leading sector development strategies, targeted stimulus for primary sectors (Mining and Energy) can lower costs for others and propagate export competitiveness (and attendant growth) across the economy. When the target of investment is infrastructure or factor productivity (TED), the diffusion of competitiveness benefits is even more widespread.

56. The result for AgroFood investment, by contrast, is relatively isolated, but this finding is strongly biased by initial conditions, where the data describe a large subsistence enclave and agricultural exports dominated by relatively unrefined primary products. If investments in Mongolian agrofood instead facilitate the development of higher value products, especially including domestic supply chains with higher food processing value added, this sector will contribute to growth across the entire economy.

Table 9: Export Changes by Sector and Project (cumulative percent change, 2010-30)

	Mining	Energy	AgFood	Infra	Ted
AgroFood	23%	10%	82%	21%	56%
Mining	4764%	-4%	-10%	217%	254%
Energy	5%	1038%	-9%	103%	151%
Manufactures	2%	7%	-10%	84%	131%
MetMin Products	52%	20%	-8%	45%	87%
Construction	47%	8%	-4%	51%	81%
Utilities	12%	302%	-2%	30%	93%
Trade	7%	4%	-7%	107%	161%
TransComm	31%	2%	-22%	109%	170%
Other Services	9%	5%	-7%	0%	89%
Total	41%	8%	43%	51%	96%

5 CONCLUDING REMARKS

57. Mongolia is an economy remarkably rich in natural resources, at the outset of an ambitious national agenda for sustained development. By committing to an extensive series of large scale development projects and investment partnerships, the Government of Mongolia plans to leverage its abundant resource base for long term transition from a predominately rural, subsistence society to a modern, diversified, higher income country. The extent to which the country's considerable potential can be realized will depend on not only the successful extraction and marketing of resources, but the extent to which these targeted activities and revenues general spillovers for the rest of the economy, enhancing the basis for market oriented entrepreneurship, higher labor productivity, and sustainable increases in living standards for the majority of Mongolians.

58. To assess these opportunities, and particularly the interactions and linkages needed to facilitate balanced and sustained growth, we developed and new dynamic economic forecasting model for Mongolia. Calibrated to a new, 2008 Social Accounting Matrix for the country, this economywide decision support tool was used to assess 26 of the country's highest priority development projects. Our results suggest that each of these can make an important contribution to the national development agenda, but they differ in important ways in both the scope and timing of their impacts. Because of their scale, these projects are very pervasive in their effects across the economy, and many different stakeholders will be implicated by them and have their livelihoods and opportunities affected directly and indirectly.

59. The results presented here are indicative and remain preliminary pending discussion with Mongolian official counterparts. To more fully utilize this research capacity, we intend to elaborate the database with more detailed institutional information to increase the resolution of incidence analysis. In order to build domestic consensus, anticipate adjustment needs, and especially to achieve more effective and sustained improvement in Mongolian livelihoods, it is necessary to apply this methodology to more intensive data on distributional and spatial characteristics of the population and economic activity.

60. By using scenario analysis such as that undertaken in this study, it is hoped the Government of Mongolia can more clearly identify both beneficiaries and those who will face adjustment challenges. The current project will be extended to include training and collaborative technical support for Mongolian official and allied counterparts, transferring this decision technology to strengthen the country's capacity for evidence based policy design, negotiation, and implementation.

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ANNEX 1: SUMMARY OF THE MONGOLIA CGE MODEL

The Mongolia CGE model is in reality a constellation of research tools designed to elucidate economy-environment linkages in Mongolia. This section provides a brief summary of the formal structure of the Mongolia model. For the purposes of this report, the 2003 Mongolia Social Accounting Matrix (SAM), was aggregated along certain dimensions. The current version of the model includes activity sectors and households aggregated from the 2008 Mongolia SAM. The equations of the model are completely documented elsewhere (Enkhbayar and Roland-Holst: 2005), and for the present we only discuss its salient structural components.

A. Structure of the CGE Model

Technically, a CGE model is a system of simultaneous equations that simulate price-directed interactions between firms and households in commodity and factor markets. The role of government, capital markets, and other trading partners are also specified, with varying degrees of detail and passivity, to close the model and account for economywide resource allocation, production, and income determination.

The role of markets is to mediate exchange, usually with a flexible system of prices, the most important endogenous variables in a typical CGE model. As in a real market economy, commodity and factor price changes induce changes in the level and composition of supply and demand, production and income, and the remaining endogenous variables in the system. In CGE models, an equation system is solved for prices that correspond to equilibrium in markets and satisfy the accounting identities governing economic behavior. If such a system is precisely specified, equilibrium always exists and such a consistent model can be calibrated to a base period data set. The resulting calibrated general equilibrium model is then used to simulate the economywide (and regional) effects of alternative policies or external events.

The distinguishing feature of a general equilibrium model, applied or theoretical, is its closed-form specification of all activities in the economic system under study. This can be contrasted with more traditional partial equilibrium analysis, where linkages to other domestic markets and agents are deliberately excluded from consideration. A large and growing body of evidence suggests that indirect effects (e.g., upstream and downstream production linkages) arising from policy changes are not only substantial, but may in some cases even outweigh direct effects. Only a model that consistently specifies economywide interactions can fully assess the implications of economic policies or business strategies. In a multi-country model like the one used in this study, indirect effects include the trade linkages between countries and regions which themselves can have policy implications.

The model we use for this work has been constructed according to generally accepted specification standards, implemented in the GAMS programming language, and calibrated to the new Mongolia SAM estimated for the year 2008.[66] The result is a single economy model calibrated over the twenty year time path from 2010 to 2030.[67]

B. Production

All sectors are assumed to operate under constant returns to scale and cost optimization. Production technology is modeled by a nesting of constant-elasticity-of-substitution (CES) function.

In each period, the supply of primary factors — capital, land, and labor — is usually predetermined.[68] The model includes adjustment rigidities. An important feature is the distinction between old and new capital goods. In addition, capital is assumed to be partially mobile, reflecting differences in the marketability of capital goods across sectors.[69] Once the optimal combination of inputs is determined, sector output prices are calculated assuming competitive supply conditions in all markets.

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[66] See e.g. Meeraus et al (1992) for GAMS. Berck et al (2004) for discussion of the Mongolia SAM.

[67] The present specification is one of the most advanced examples of this empirical method, already applied to over 50 individual countries and/or regions.

[68] Capital supply is to some extent influenced by the current period's level of investment.

[69] For simplicity, it is assumed that old capital goods supplied in second-hand markets and new capital goods are homogeneous. This formulation makes it possible to introduce downward rigidities in the adjustment of capital without increasing excessively the number of equilibrium prices to be determined by the model.

Consumption and Closure Rule

All income generated by economic activity is assumed to be distributed to consumers. Each representative consumer allocates optimally his/her disposable income among the different commodities and saving. The consumption/saving decision is completely static: saving is treated as a "good" and its amount is determined simultaneously with the demand for the other commodities, the price of saving being set arbitrarily equal to the average price of consumer goods.

The government collects income taxes, indirect taxes on intermediate inputs, outputs and consumer expenditures. The default closure of the model assumes that the government deficit/saving is exogenously specified.[70] The indirect tax schedule will shift to accommodate any changes in the balance between government revenues and government expenditures.

The current account surplus (deficit) is fixed in nominal terms. The counterpart of this imbalance is a net outflow (inflow) of capital, which is subtracted (added to) the domestic flow of saving. In each period, the model equates gross investment to net saving (equal to the sum of saving by households, the net budget position of the government and foreign capital inflows). This particular closure rule implies that investment is driven by saving.

C. Trade

Goods are assumed to be differentiated by region of origin. In other words, goods classified in the same sector are different according to whether they are produced domestically or imported. This assumption is frequently known as the *Armington* assumption. The degree of substitutability, as well as the import penetration shares are allowed to vary across commodities. The model assumes a single Armington agent. This strong assumption implies that the propensity to import and the degree of substitutability between domestic and imported goods is uniform across economic agents. This assumption reduces tremendously the dimensionality of the model. In many cases this assumption is imposed by the data. A symmetric assumption is made on the export side where domestic producers are assumed to differentiate the domestic market and the export market. This is modeled using a *Constant-Elasticity-of-Transformation* (CET) function.

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[70] In the reference simulation, the real government fiscal balance converges (linearly) towards 0 by the final period of the simulation.

D. Dynamic Features and Calibration

The current version of the model has a simple recursive dynamic structure as agents are assumed to be myopic and to base their decisions on static expectations about prices and quantities. Dynamics in the model originate in three sources: i) accumulation of productive capital and labor growth; ii) shifts in production technology; and iii) the putty/semi-putty specification of technology.

E. Capital accumulation

In the aggregate, the basic capital accumulation function equates the current capital stock to the depreciated stock inherited from the previous period plus gross investment. However, at the sector level, the specific accumulation functions may differ because the demand for (old and new) capital can be less than the depreciated stock of old capital. In this case, the sector contracts over time by releasing old capital goods. Consequently, in each period, the new capital vintage available to expanding industries is equal to the sum of disinvested capital in contracting industries plus total saving generated by the economy, consistent with the closure rule of the model.

F. The putty/semi-putty specification

The substitution possibilities among production factors are assumed to be higher with the new than the old capital vintages — technology has a putty/semi-putty specification. Hence, when a shock to relative prices occurs (e.g. the imposition of an emissions fee), the demands for production factors adjust gradually to the long-run optimum because the substitution effects are delayed over time. The adjustment path depends on the values of the short-run elasticities of substitution and the replacement rate of capital. As the latter determines the pace at which new vintages are installed, the larger is the volume of new investment, the greater the possibility to achieve the long-run total amount of substitution among production factors.

G. Dynamic calibration

The model is calibrated on exogenous growth rates of population, labor force, and GDP. In the so-called Baseline scenario, the dynamics are calibrated in each region by imposing the assumption of a balanced growth path. This implies that the ratio between labor and capital (in efficiency units) is held constant over time.[71] When alternative scenarios around the baseline are simulated, the technical efficiency parameter is held constant, and the growth of capital is endogenously determined by the saving/investment relation.

[71] This involves computing in each period a measure of Harrod-neutral technical progress in the capital-labor bundle as a residual. This is a standard calibration procedure in dynamic CGE modeling.