Closing China's Trade Surplus
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The Chinese economy has been exploding in recent years. The output of the economy is nearly four and half times larger than it was in 1992, or, for a more recent comparison it is more than twice the size that it was in 2000. In recent years that growth has been led by exports. They are now about four times as large as they were seven years ago. The mounting trade surpluses in recent years have led to reserves topping one trillion US dollars. US policy makers have made trips to Beijing to discuss this issue and the mounting trade imbalance between the US and China.

In all the analyses of trade surpluses/deficits one must keep in mind that the problems and the solutions are primarily domestic in nature. In the case of a surplus there is a surplus of savings over investment and in the case of a deficit there is a deficit of savings less investment. Thus, the problem from this perspective looks mainly at domestic policies rather than export controls and/or managed trade for a solution.

This paper will examine several scenarios to examine the effects of possible policies that China could do that would narrow and/or close its merchandise trade gap over the next ten years. How would such policies change the structure of the Chinese economy? the trade balances with its major trading partners? the incomes of its citizens? which sectors of the economy would suffer? employment repercussions?

MUDAN the model

MUDAN (Multisector Dynamic Analysis tool) is a 59-sector dynamic macroeconometic input-output model of China. It is part of Inforum's system of some 13 such national models and is connected to them by a model of bilateral trade at the level of 120 commodities.

MUDAN is macroeconometric. Macro means that it has the main economic aggregates that are inherent in most macroeconomic models: GDP, aggregate consumption, investment, exports, imports, government, wages, taxes, depreciation, profits, employment, the price level, etc. In addition it is econometric meaning it uses econometrically estimated structural equations to explain economic behavior. In fact there are over a thousand such equations. To do this a unique historical data base of the Chinese economy has been developed. The database now covers the years 1992-2005. These data are fully consistent with the recently revised national accounts. It entailed several years of effort to create. The database is under constant revision as new data become available and older data is revised or new sources become available.

MUDAN is dynamic. Past levels of economic activity impact current levels of investment, production, profits, prices, income and employment. Thus when the model is used to study the impacts of a particular economic policy (such as WTO entry) it is able to show the impact path and timing of the effects of that policy shift. Policy makers are often as interested in the path of the results as in the ultimate results. China's entry into

the WTO is a prime example. The initial effects were negative as imports were allowed to gain a significant foothold (such as the automotive industry) while certain positive impacts (greater efficiency in the use of labor and capital) took more time to become apparent. One has only to recall the controvers ies regarding Chinese growth during 2003 (could it be contracting despite the official statistics?) or was it growing approximately as stated by the government statisticians. The main direct gain for China's entry into the WTO has been to free it from MFA restraints which we are now seeing the huge increases of Chinese exports to the US of apparel this year.

MUDAN is a 59 sector input-output model**.** A list of the sectors is attached. The input-output characteristics ensure that the sector forecasts are mutually consistent. That is, the forecast of coal mining (5) is consistent the domestic production of steel (29) which is, in turn, consistent with the production of the automotive sector (34). The input-output relationships themselves are changing over time as industries become more energy efficient for example or as the use more electronic equipment in the production process.

MUDAN has significant industrial feedbacks to the behavior of the entire economy. Aggregate exports and imports, for example, are the sum of exports and imports at the level of 59 sectors. The same is true for employment, profits, investment and depreciation. This means that a change in the labor productivity in the steel industry will affect not just steel employment and prices but employment and the price level for the entire economy. This makes the MUDAN model ideal for studying effects of industry specific policies such as WTO entry, trade policy and the like. The inherent consistency of the forecast ensures that the various connections in the economy have been considered.

MUDAN has been used to study such economically important subjects as the following: (1) the impact of its entry into the WTO on the USA ; (2) how China is affecting current raw material prices on the world market; (3) the accuracy and consistency of Chinese economic data; (4) the economic causes of the social upheavals in the late 1980's; and (5) the economic effects of a free trade area consisting of Japan, Korea and China.

Business as usual

Table 1, on the following page, shows the general outlines of the base line scenario. The main features of this forecast are first of all rapid growth. GDP is set to grow an an average rate of some 9% over the ten year forecast period. Exports are slated to lead the way with approximately a 12% rate. The growth is projected to be relatively balanced. Investment and household consumption are both projected to grow at about the rate of overall GDP. Only government spending is projected to be lower at around 6%. Import grow is expected to slightly outpace exports as energy demands increase (China's output of crude oil is slated to remain stagnant) and China's increasingly prosperous population's diet changes adds more meat to its diet implying more grain imports. Secondly, inflation is projected to remain low - around 1% per year with the prices of imports rising ever so slightly faster than those for exports or domestically produced goods. Thirdly, net exports in current prices are set increase still further from present

levels until 2010 and then fluctuate about that value until 2017. Net exports, expressed as a percent of GDP are also expected to crest in 2010 after rising another percent or two from current levels. After that a significant lowering of the rate is expected. Finally we have the Riminbi (yuan) set appreciate about 15% (or 1.4% on average) during the period.

Table 1: China Base –Business as Usual

	2002	2005	2006	2007	2010	2015	2017	07-17
	====	====	====	====	====	====	====	=====
Values in 2002 prices, 100M yuan								
Gross Domestic Product	121859	166886	184691	205482	276418	424305	487811	9.1
Private Consumption	52571	62062	66323	74339	99779	153327	178559	9.1
Rural priv ate consumption	16272	16316	16841	18663	23158	35380	41291	8.2
Urban private consumption	36300	45746	49482	55676	76621	117947	137268	9.4
Public Consumption	19120	21486	22929	24408	29004	38184	42624	5.7
Total Fixed Investment	43632	72752	83028	91542	118910	188259	217020	9.0
Net exports	3999	11901	13473	15302	23959	26761	31283	7.6
Exports	30943	63722	77995	90631	141149	235067	280292	12.0
Imports	-26944	-51820	-64521	-75329	-117190	-208306	-249009	12.7
Deflators, 2002=100:								
GDP	100	110	112	114	117	121	124	0.9
Rural private consumption	100	112	116	116	117	122	127	0.9
Urban private consumption	100	104	108	108	110	115	119	1.0
Fixed asset investment	100	106	107	107	109	113	116	0.8
Exports	100	108	108	107	110	117	120	1.1
Imports	100	113	111	107	111	122	126	1.6
Values in current prices, 100M yuan								
Gross Domestic Product	121859	183231	207683	233597	322396	511336	607285	10.0
Private Consumption	52571	70882	78700	88152	120703	194983	235732	10.3
Rural private consumption	16272	19010	20434	22588	28553	45825	55593	9.4
Urban private consumption	36300	51871	58267	65564	92151	149158	180140	10.6
Investment	43632	77451	89103	98191	130151	212960	251874	10.0
Government	19120	26012	28704	31689	41426	61643	73211	8.7
Net exports	3999	10408	12634	15936	24959	20413	23715	2.9
Exports	30943	68744	83948	96583	155004	274263	337658	13.3
Imports	-26944	-58337	-71314	-80646	-130045	-253850	-313943	14.6
Net Trade as Percent of GDP	3.3	5.7	6.1	6.8	7.7	4.0	3.9	
Exchange rate, yuan per 100US$	828	819	798	758	713	680	661	-1.4
Household savings rate	29	26	28	28	30	31	31	

Several factors make closing the trade surplus difficult in the Chinese case. The first is that much of China's trade is in the form of "process" trade. That is, goods and services are imported solely to reprocessed and sold for export. The domestic content of goods and services is relatively low. The major domestic inputs are labor and capital. China's export producing factories are almo st all new and many use the current state-of-the-art

technologies. Thus, a change in the exchange rate lowers costs a significant amount so that export prices can fall so as to keep the foreign prices of their exports competitive. Secondly, the import content of investment is quite high. Any policy which reduces investment slows imports more than in proportion to the overall slowdown. Finally, the import content of household consumption is still relatively low, so increasing household incomes will not necessarily increase imports more that proportionally.

Exchange Rate Changes

It is just about impossible to see how China can close its trade gap without a significant appreciation of its currency. Let us begin with an appreciation of twenty percent and examine its effects. The appreciation takes place over three years, 2008-2010 and is in addition to underlying appreciation of the business as usual scenario.

Table 2: Exchange Rate Assumptions—First Appreciation

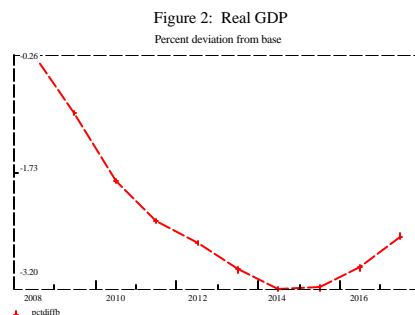|	2008	2009	2010	2012	2015	2017
Base Assumption	735	713	713	705	680	661
First Appreciation	667	600	576	573	554	539
Percent of Base	91	84	81	81	81	81

Let us look now look at the effect of this on trade balance. The pluses represent net trade as a percent of GDP (all in nominal terms) for the base and the boxes for the twenty percent appreciation case.

A couple of things become apparent from an examination of the graph. First, twenty percent is NOT enough on its own. Second, it does have a substantial effect that grows slightly over time leaving about half the original margin in ten years.

Figure 1: Net Trade
Percent of GDP
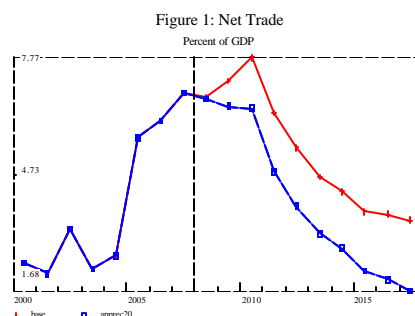
What about the effect on GDP?

Figure 2 shows these results. What is clear that is that an appreciation reduces the surplus via two mechanisms? First, it reduces real GDP and second it depresses exports. This leads us to the next steps in our explorations.

Figure 2: Real GDP
Percent deviation from base

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4

Domestic Demand Side Measures

Let us now move on to possible measures to expand domestic demand to create more demand for imports. If we look closely at Table 1 we note two areas where such policies might be help.

The first is the high personal savings rate found on the last row of the table. What measures could China initiate to reduce the high savings rate? At least two come to mind: a better social security system and more state aid to education. The current old age assistance program has evolved out of a system of employers providing it all. Now the plans are dependent upon the different provinces. This means that richer provinces provide more generous benefits than do the poorer ones. In fact the poorest ones have plans that do not even meet poverty standards. Reforming taxes and using the monies for these poorest of the poor would mean that all of the money would be spent—the net result would be lower overall household savings rates. The reform would have the side effect of reducing the need of relatively poor relatives saving out meager incomes to meet the pressing needs of their parents. There could be other measures to reduce savings as well. For purposes of this paper we will just assume that such measure reduce the household savings rate from what it would otherwise be by first 2% in 2008, 4% in 2009, 6% in 2010 and 8% thereafter. For education we approximately doubled government spending on public education.

Now how did these affect the trade surplus and overall economic growth?

Figure 3: Net Trade: percent of GDP

Base, +20% Appreciation, +Lower savings rate, +Goverment

The upper two lines repeat the results shown in Figure 1. The lower two lines represent the results on the trade balance with first the household savings rate reduced and then with the addition of government spending added as well. The differences are relatively small by adding the additional government spending but clearly in the right direction. The additional government spending was purely government expenditure and was not financed by higher taxes.
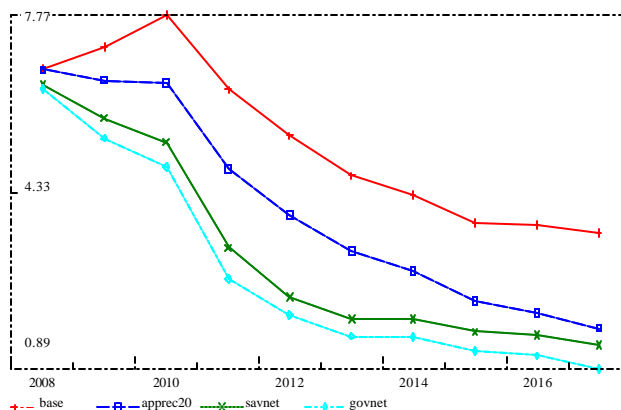
The additional stimulus from lowering the savings rate by eight percentage points is substantial. The losses in GDP are erased entirely for the first five years and the losses in the outer years are moderated as well. Table 3 shows how the changes in the household

savings rate affected various components of GDP for the year 2012, the first full year of all the effects.

Table 3 Direct and Indirect Effects of Lower Savings Rate

	2002 prices 2012	Percent of base GDP in 2012
Total Gains	12697	3.8
Household Direct	10286	3.1
Household Indirect	1505	0.5
Investment	6070	1.8
Net Trade	-6679	-2.0
Inventory	1515	0.5

Figure 4: GDP: Percent deviation from base

Figure 4 shows how the combination of lowering the savings rate and increasing government spending affects GDP. The intermediate effect is to lessen the appreciating exchange rate's negative effects on output while, at the same time, reducing the trade surplus (see Figure 3).
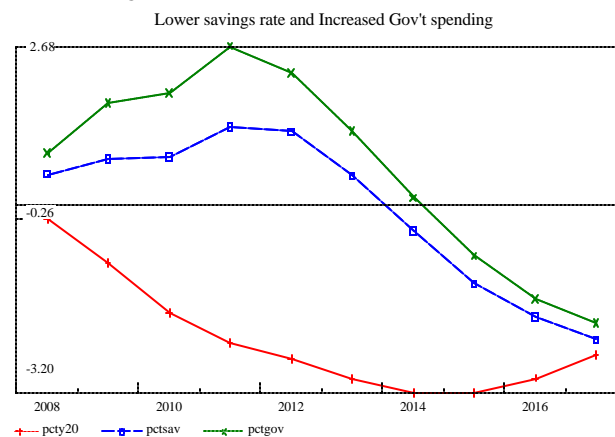

Lower savings rate and Increased Gov't spending

Figure 5: Net Trade

From these results we conclude that a twenty percent appreciation is not enough. Let us try thirty-five. The results are shown in Figure 5 below. Note that Figure 5 is only different from Figure 3 by the addition of the 35% appreciation line. From this picture it is apparent that an appreciation of about 35% does yield the desired closure in about 8 years.
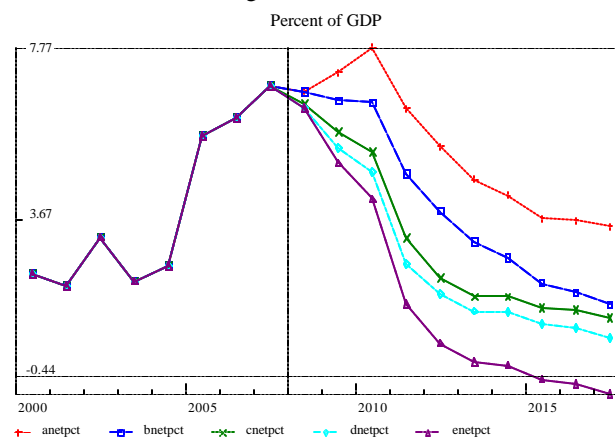

Percent of GDP

Figure 6 shows the net trade in terms of US dollars. Keep in mind in the previous the values were all calculated in Chinese currency and here they are shown in US$. Thus, both exports and imports grow faster but since exports are larger to begin with the resulting net grows even faster when expressed in dollars rather than in yuan.

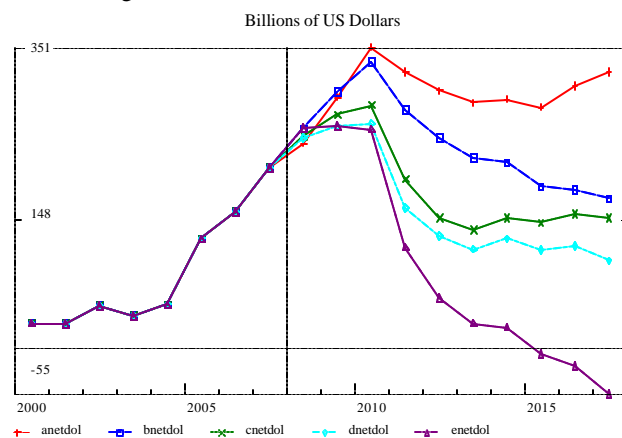Figure 6: Net Trade in Billions of US Dollars

Billions of US Dollars

Table 4 shows the changes in the trade balance for 2017. It is crucial to note that both exports and imports fall but that exports fall by more. Both series fall in nominal terms

Table 4: Trade Balance in 2017 (100 Million Yuan)

		2017 Base	2017 Closing	Percent Change
Exports				
	Nominal	335555	234199	-30.2
	Real	280609	241725	-13.9
	Price	120	97	-19.2
Imports				
	Nominal	314218	236698	-24.7
	Real	249345	264597	6.1
	Price	126	89	-29.4
Net	Nominal	21337	-2499	
	Real	31264	-22872	

because the prices change. Imports prices because of the exchange rate appreciation and export prices fall as exporters struggle to maintain markets both foreign and domestic.

Figure 7 shows the development of exports and imports in nominal yuan over time in the two cases.

Figure 8 looks broadly at changes in the structure of the domestic economy. One of the truly amazing features of the Chinese economy from 2000 to 2007 has been the very sharp decline in the share of the economy devoted to consumption—both household and government. The rapid rise of trade and investment during that period has reduced quite dramatically the importance of domestic household consumption. Each of the policies implemented has a direct effect increasing the portion of consumption in GDP. Lowering the savings rate and raising government spending on education quite obviously add directly to the share. Changing the exchange rate lowers the price of imported household goods. If these are price elastic then their share of GDP will increase.
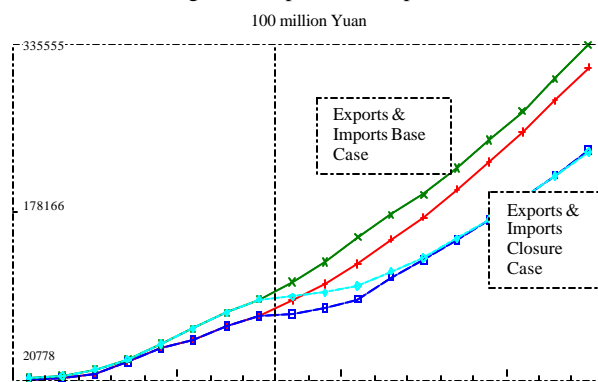
Figure 7: Exports and Imports

100 million Yuan

Exports & Imports Base Case

Exports & Imports Closure Case

Figure 8: Consumption as a Percent of GDP

Percent of GDP

+ aconsum   □ econsum
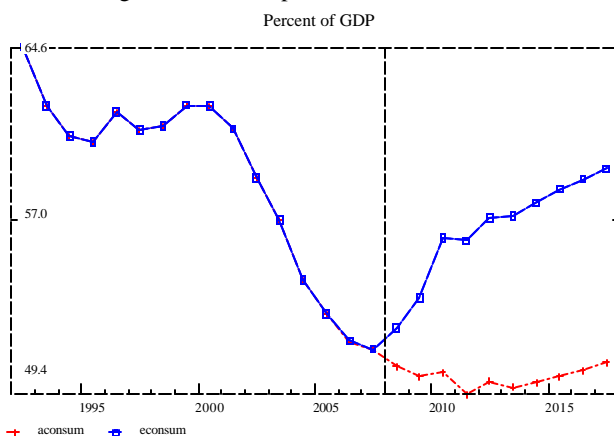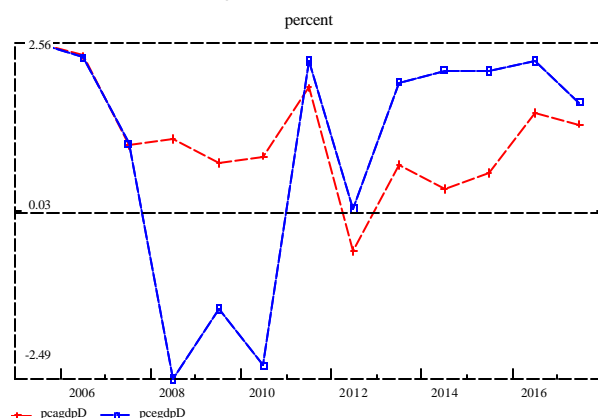
Figure 9 shows the effects of appreciation on inflation. We start with one very important fact: the price of imports does *not* enter into the price of GDP. It is the gross *domestic* product that we are measuring. So, then, why does it change the GDP deflator? Harking back to our discussion on nominal exports we recall that the price of exports fell as

Figure 9: GDP deflator

percent

+ pcagdpD   □ pcegdpD

exporters lowered their prices to maintain markets abroad and domestic manufacturers lower prices in order to maintain domestic markets. The lower prices mean lower profits.

Figure 10 shows the US trade deficit with China under the two scenarios. The reduction in the US trade deficit with China is substantial but it the gap still grows

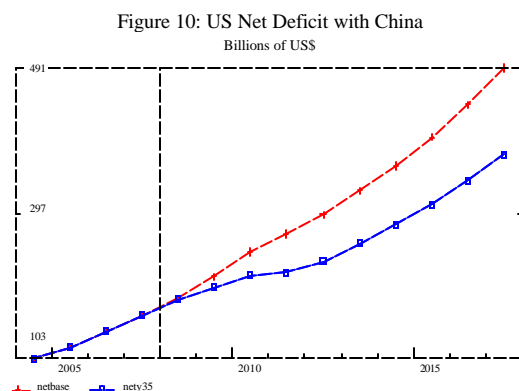Figure 10: US Net Deficit with China
Billions of US$

Figure 11 shows net trade with Japan. The gap here is negative and changes only slightly. This is because of the concentration of heavy machinery in Japanese exports to China. China's imports of these goods increases only modestly in the closure scenario. Figure 12 shows the net trade of China with the UK, France, Germany, Spain, Italy, Belgium and Austria. In several re spects this picture is similar to that of the one with the US except that the values are somewhat smaller.

Figure 11 China-Japan net trade
Billions of US$

Figure 12 China-Europe net trade
Billions of US$
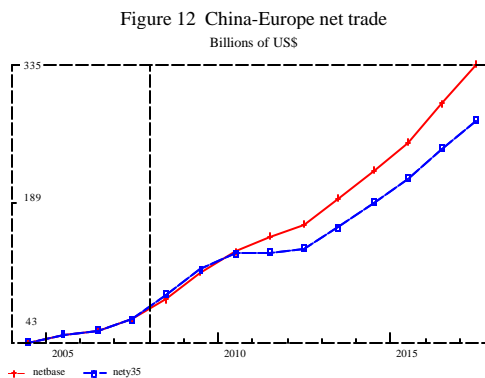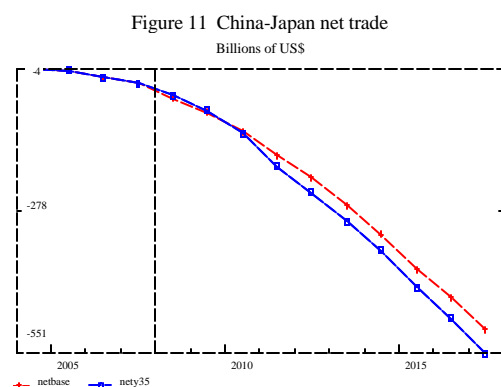
Industrial Effects

The following sets of tables will show where changes have been proportionally the greatest and how the largest sectors were affected. We begin with gross output.

Inforum-University of Maryland   9
September 2007

Table 5 Gross output percentage changes in 2017

	Sector	Output	Volumes 2017 Percent Difference
	Total Gross Ouput		-4
Gainers	57 Education		21
	56 Health Care & sports		20
	24 Medicines		18
	12 Beverages		18
	53 Restaurants		10
Losers	8 Non-ferrous Mining		-66
	7 Ferrous Mining		-20
	26 Rubber Products		-18
	30 Metal Products		-18
	30 Non-ferrous Metals		-18
Largest in 2007			
	39 Electronic & Comm Mach.		-8
	45 Construction		1
	55 Real Estate		1
	52 Trade		-5
	42 Electricity		-5

Total gross output is down four percent. Since there is considerable double counting in such a sum. (For example the value coal mining is counted at the mine and again when used to make steel and again when used to make a machine tool.) The largest gainers in output are those directly impacted by the increased government spending on education and health.   Medicines are indirectly impacted by government health expenditures and by the high real incomes o f households. The household income effect shows up in the restaurant and beverage sectors. The losing industries are those that are affected both directly (through export losses and import competition) and indirectly as their sales to those sectors negat ively impacted are reduced. Thus, mining shows up very high on the list. In addition we see that metals and rubber (tires) are also sharply curtailed. What about the sectors with largest gross outputs in 2007? Once again we see the realigning of the ec onomy visible in Figure 8 where consumption regains its prominence. Thus, the largest sector, Electronic and Communications Machinery, is down while Construction and Real Estate are up slightly. Trade is down as the wholesale component drops and its reta il side gains. Electricity consumption drops as industrial production is lower under the closing scenario.

Next we turn our attention to imports.

Table 6 Import Volume Percentage Changes in 2017

	Sector	Import Volumes 2017 Percent Difference
	Total Import Volume	6
Up	28 Building Materials	161
	1 Farming	45
	24 Medicines	36
	56 Health Care	33
	8 Non-Ferrous Mining	31
Down	7 Ferrous Mining	-3
	22 Petroleum Refining	-5
	27 Plastics	-5
	9 Non-Metallic Mining	-4
	29 Iron and Steel	-3
Largest	39 Electronic Machinery	3
	32 Machinery	5
	23 Chemicals	-5
	38 Electric Machinery	4
	40 Instruments	-3

Imports are up some what. The largest proportional gain is in building materials. While substantial the increase expressed as a proportion of domestic demand is relatively modest—from 2.2% in the base case to 6.0% in the closing case. The change in Farming is similarly modest. The other areas where imports increased were where there was a strong increase in domestic demand—namely Medicines and Health Care. Imports were down in some of the mining sectors, Iron and Steel and for Petroleum Refining. In these later sectors the domestic demand factor also dominated. Looking at the sectors where imports are largest we see increases for Electronic Machinery and Non-electrical Machinery. In both these sectors the price effect dominated the demand effect for imports. For example the import share (in 2017) for Electronic Machinery rose from 40.1% to 43.3% in the two scenarios. For Non-electric Machinery the changes were from 36.7% to 41.7%.

Now, our next table, we look at export volumes.

Table 7 Export Volume Percentage Changes in 2017

Sector	Export Volumes 2017 Percent Difference
Total Export Volume	-14
Down Least	
6 Crude Petroleum	-1
24 Medicines	-2
21 Cultural items	-4
5 Coal Mining	-6
Down Most	
34 Motor Vehicles	-48
4 Fishing	-42
25 Chemical Fibers	-40
17 Sawmills	-38
23 Chemicals	-34
Largest 39 Electronic Machinery	-7
14 Textiles	-16
52 Commerce	-14
38 Electric Machinery	-11
40 Instruments	-18

The changes are uni-directional—downward. The total change of 14% appears at first to be somewhat modest given the 35% appreciation. But one must recall that exporters absorbed much of the appreciation themselves as overall export prices of manufactures fell some 23%. The sectors with least negative impacts were all small sectors (as exporters) or where there were distinctly other factors as work (Cultural items). The greatest impact was felt in Motor Vehicles where the price increases cut deeply into a fledgling export market. Apparently the exports of the basic manufacturing sectors were most deeply impacted. This is evident from the appearance of Fishing, Chemicals and Sawmills on the list. The largest exporting sector is once again Electronic Machinery where the impact was a relatively modest 7% --less than one year's growth of exports. The fall in Commerce reflects the overall drop in exports as it consists of the trading margins necessary to get the products to the port for transport abroad.

Next we look at employment. The total change in employment in 2017 was an increase of some 1.15 million jobs. This is less than half a percent of the labor force. The result, while driven by the overall properties of the model, is *not* a result by assumption. Indeed, as shown in Figure 13, if we look at the total employment over then entire time period of the experiment we see that total employment falls by about 24 million jobs in 2010 and then only then begins a long slow climb back up.

Figure 13: Employment Difference
in 10,000 jobs
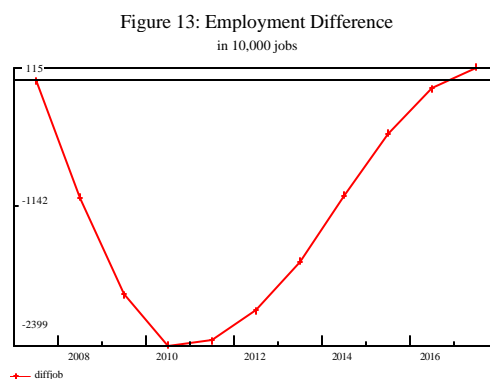
In this table we look at proportional changes and, for the largest sectors at the actual level of the change.

Table 8 Employment Differences in 2017

Employment

	Sector	2017 Percent Difference	
	Total Employment		0
Lose	6 Non-metal Mining		-65
	29 Machinery		-22
	4 Ferrous Ore Mining		-20
	28 Metal Products		-17
	27 Primary Non-ferrous Metals		-14
Gain	21 Medicines		21
	49 Health Care		18
	9 Beverages		17
	50 Education		16
	46 Restaurants		12
		Difference 10,000 Persons	
Largest	Total		115
	1 Agriculture		834
	38 Construction		14
	52 Public Administration		-2
	48 Real Estate		10
	50 Education		255

The sectors with largest gains and loses in employment closely, but not precisely, follow those given in Table 5 on gross output. The differences arise because the employment coefficients, or level of labor productivity, vary because they are dependent in varying

degrees on the level of the capital stock in that sector. In showing the results for the largest employment sectors we see, at once, the dominance of Agriculture in the overall employment picture of China. In the closing scenario we see more than 8 million more jobs in Agriculture. This is a result of higher consumer incomes and more consumption of food in restaurants for example and more consumption of higher protein foods. With the exception of Education the changes in employment in the other sectors is trivial. The large increase in Education is due entirely to assumption of greater government spending on education.

Summary

The solution to China's merchandise trade surplus problem clearly reflects its domestic savings investment problem. Policies that make it easier for households to buy goods from abroad tend to reduce savings. These should include policies that provide for the security of households as they pass through various life stages also reduce the need to save. Further, a realignment of domestic versus international prices facilitates the process by making it easier for households and capital investors to buy foreign produced goods for household consumption and for capital investment.