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Abstract

This paper uses a multicountry macroeconometric model to estimate the macroeconomic effects of a Chinese yuan appreciation. The estimated effects on U.S. output and employment are modest. Positive effects on U.S. output from a decrease in imports from China are offset by negative effects on U.S. output from increased inflation and from a decrease in U.S. exports to China because of a Chinese contraction.

1 Introduction

At the time of this writing (February 2010) many feel that the United States economy is being hurt by the Chinese policy of essentially pegging the yuan to the dollar. For example, Krugman (2010) states that "My back-of-the-envelope calculations suggest that for the next couple of years Chinese mercantilism may end up reducing U.S. employment by around 1.4 million jobs." He notes that the

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standard arguments against protectionism do not hold in a world of less than full employment.

The question of what a Chinese appreciation of the yuan would do to the world economy is complicated. There are many economic links among countries, and these links need to be accounted for in analyzing the effects of exchange rate changes. This paper uses a multicountry econometric model, denoted the "MC model," to estimate the effects of a yuan appreciation. It will be seen that when all links are taken into account, the effects on U.S. output and employment are modest. Kruman's job loss estimate does not appear accurate.

The general story from the model is the following. The yuan appreciation leads to an increase in Chinese export prices in dollars, which leads to a decrease in U.S. imports from China. This has, other things being equal, a positive effect on U.S. output from the substitution away from Chinese produced goods toward U.S. produced goods. On the other hand, the appreciation leads to a decrease in Chinese output, which leads to a decrease in Chinese imports, some of which are from the United States. This fall in U.S. exports to China has, other things being equal, a negative effect on U.S. output. In addition, the rise in U.S. import prices (from the rise in Chinese export prices) leads to an increase in U.S. domestic prices. The increase in U.S. domestic prices results in a decrease in real wealth and real wages and an increase in the short term interest rate, all of which have, other things being equal, a negative effect on U.S. aggregate demand and output. It will be seen that the net effect of the yuan appreciation on U.S. output and employment is close to zero—in fact slightly negative.

The main message from analyzing the model's results regarding the effects on

U.S. output from a yuan appreciation is that one cannot look only at the positive output effect from the fall in U.S. imports from China. U.S. exports to China fall, which is contractionary, and inflation increases, which is also contractionary.

2 The MC Model

The MC model is presented in Fair (2004), and it has been updated for purposes of this paper (version dated January 30, 2010). The updated version is on the author's website. The U.S. part of the MC model will be denoted the "US model," and the rest of the model will be denoted the "ROW model." Sometimes the US model is analyzed by itself, but in this paper the entire MC model is used. The methodology behind this modeling is compared to the methodology of dynamic stochastic general equilibrium (DSGE) modeling in Fair (2009b). The ability of the US model to forecast recessions and booms is analyzed in Fair (2009a). The MC model is completely estimated (by 2SLS); there is no calibration.

In the US model there are three estimated consumption equations, three investment equations, an import equation, four labor supply equations, two labor demand equations, a price equation, a nominal wage equation, two term structure of interest rate equations, and an estimated interest rate rule of the Federal Reserve, among others. In the interest rate rule the Fed responds to inflation and unemployment. There are a total of 28 estimated equations and about 100 identities in the US model. The unemployment rate is determined by an identity; it equals unemployment divided by the labor force. In the identities all flows of funds among the sectors (household, firm, financial, state and local government, federal

government, and foreign) are accounted for. The federal government deficit is determined by an identity, as is the federal government debt. There is an estimated equation determining the interest payments of the federal government as a function of interest rates and the government debt.

The ROW model consists of estimated equations for 37 countries. There are up to 13 estimated equations per country and 16 identities. There are a total of 274 estimated equations in the ROW model. The estimated equations explain total imports, consumption, fixed investment, inventory investment, the domestic price level, the demand for money, a short term interest rate, a long term interest rate, the spot exchange rate, the forward exchange rate, the export price level, employment, and the labor force. The specifications are similar across countries. The short term interest rate for each country is explained by an estimated interest rate rule for that country. In some cases the U.S. interest rate is an explanatory variable in the estimated rule, where the Fed is estimated to have an effect on the decisions of other monetary authorities. The exchange rates are relative to the dollar or the euro. The two key explanatory variables in the exchange rate equations are a relative interest rate variable and a relative price level variable.

The two key explanatory variables in the domestic price equation are a demand pressure variable and a cost-shock variable—the price of imports. In the price of exports equation, the price of exports in local currency is a weighted average of the domestic price level and a variable measuring the world export price level (translated into local currency using the exchange rate). The weights are estimated. These two equations for China are important for the present results. There is no estimated exchange rate equation for China: the yuan/dollar exchange rate is

exogenous.

There are 59 countries in the MC model (counting an "all other" category), and the trade share matrix is 59×59. Data permitting, a trade share equation is estimated for each country pair. In a trade share equation, the fraction of country i's exports imported by country j is a function of the price of country i's exports in dollars relative to a weighted average of all other countries' export prices in dollars (excluding oil exporting countries). The weights are trade shares lagged one quarter. A total of 1,302 trade share equations are estimated. Trade shares for which there are no estimated equations are still used in the solution of the MC model; they are simply taken as exogenous. The trade share data are from the IFS Direction of Trade data. Quarterly data are available back to 1960. While the trade share equations are all quarterly, the structural equations for some countries are estimated using annual data. Interpolation is used when necessary to convert annual variables to quarterly variables.

There are many links among countries. The use of the trade shares means that the differential effects of one country's total demand for imports on other countries' exports are accounted for. There are interest rate links through the U.S. interest rate affecting some other countries' rates in the estimated interest rate rules. In a few cases the euro (earlier German) interest rate affects other countries' interest rates. Exports are endogenous for each country, since they depend on the imports of other countries, which are endogenous. The price of exports in local currency of each country is endogenous, since they depend, as noted above, on the domestic price level and the world price level. The price of exports in dollars is endogenous because the price of exports in local currency is endogenous and the exchange

rate is (for most countries) endogenous. The price of imports in each country is endogenous because it depends on the price of exports of the other countries weighted by the trade shares. Since, as noted above, the price of imports affects the domestic price level in each country's estimated domestic price equation, there are price links among countries. An increase in the price of exports in dollars in one country leads to increases in other countries' import prices, which affects their domestic and thus export prices, which feeds back to the original country, etc. Before discussing the experiments, it will be useful to review a few of the model's properties for the United States and China.

There are important real wealth effects in the US model. An increase in household wealth, say from an increase in stock prices or housing prices, leads to an increase in consumption. Spending out of real wealth is about 4 percent per year of the wealth change. Real disposable income is an explanatory variable in the consumption equations. DSGE models like the Galí and Gertler (2007) model have that property that a positive price shock is explosive unless the Fed raises the nominal interest rate more than the increase in the inflation rate. In other words, positive price shocks with the nominal interest rate held constant are expansionary (because the real interest rate falls). In the US model, however, they are contractionary. If there is a positive price shock, the real wage initially falls because nominal wages lag prices. This has a negative effect on consumption demand (because real income is an explanatory variable in the consumption equations). In addition, household real wealth falls because nominal asset prices don't initially rise as much as the price level. This has a negative effect on consumption through the wealth effect. There is little if any offset from lower real interest rates because

households appear to respond more to nominal rates than to real rates. Positive price shocks are thus contractionary even if the Fed keeps the nominal interest rate unchanged. An increase in the price of imports of 10 percent in the MC model with the nominal interest rate unchanged leads to a decrease in real GDP of about .4 percent after four quarters. A tighter monetary policy would add to the contraction.

The structural equations for China are estimated using annual data, for the period 1984–2008. Because the data are not as good and the estimation period is smaller, less confidence can be placed on the Chinese estimated equations than on the U.S. estimated equations. Because of this, some robustness checks are reported in Section 4 using alternative specifications for the Chinese model. The first check concerns the response of Chinese export prices to the appreciation. Direct data on the price of exports for China are not available, and a series was constructed using U.S. export prices and the yuan/dollar exchange rate. Because of this, in the price of exports equation for China the weight on the domestic price level was not estimated. It was simply imposed to be 0.5, which is in line with estimated weights for other countries. For the first robustness check, the weight was change to 0.8.

The second robustness check concerns the effect of the price of imports on the domestic price level. The price of imports is an explanatory variable in the domestic price equation, and it will be seen that the estimated effect is large. The Chinese appreciation leads to a fairly large fall in the Chinese domestic price level. For the second check this effect was turned off by simply dropping the Chinese domestic price equation and taking the domestic price level to be exogenous.

The third check concerns the effect of a change in the domestic price level on real output. For the United States, as discussed above, an increase in the

domestic price level is contractionary, other things being equal, because of the fall in real wealth and real wages. Similarly, a decrease in the domestic price level is expansionary, other things being equal. This effect is not in the Chinese model because there are no data on wealth and wages in the model. If China is in fact like the United States in this respect, the fall in Chinese output from the appreciation is overestimated in the basic experiment because the expansionary effects from the fall in the Chinese domestic price level are not taken into account. In the basic experiment Chinese output simply falls because of the decrease in exports. For the third check it was assumed that Chinese government spending, which is exogenous in the basic case, is changed enough to completely offset the fall in output. In other words, it is assumed that the appreciation has no effect on Chinese output.

3 The Basic Experiment and Results

At the time of this writing trade share data are available through 2008:4. The simulation period was taken to be 1999:1–2008:4. There are a total of 1,604 estimated equations in the model counting the trade share equations, and the first step was to add the estimated residuals to these equations and take them as exogenous. This means that when the model is solved, a perfect tracking solution is obtained. The second step was to decrease the yuan/dollar exchange rate by 25 percent from its actual value for each quarter. For example, the actual yuan/dollar exchange rate in 1999:1 was 8.2787, and the new value was taken to be 0.75 times this, or 6.6090. This was done for each of the 40 quarters.

The model was then solved with this change imposed. No other changes were

made. For example, all the estimated exchange rate equations were left in. To the extent that the predicted values from these equations are not affected much, the exchange rates relative to the dollar do not change much, which means there is also an appreciation of the yuan relative to other currencies. For exchange rates that are exogenous, there is an exact 25 percent appreciation of the yuan relative to these currencies since the exchange rates are relative to the dollar.

Because of the many links among countries, the results are not easy to explain. The following is a step by step discussion, but the actual story is in fact more complicated because of the simultaneity. The results referred to below are presented in Table 1. The variables are defined at the bottom of the table and are defined in the text in the order they are listed in Table 1. When a variable is said to increase or decrease, this always refers to the new solution value relative to the base value. Results are presented in Table 1 for the fourth quarter of each year. When the variable is only annual, the results are for the year.

The appreciation of the yuan leads to a decrease in Chinese import prices (PM_{ch}), which through the domestic price equation leads to a decrease in Chinese domestic prices (PY_{ch}). After four years domestic prices are down 15.15 percent, which is a large change. The decrease in domestic prices and the decrease in the world price of exports in yuan (because of the appreciation) leads through the export price equation to a decrease in Chinese export prices in yuan (PX_{ch}). After four years export prices are down 20.10 percent, which is also a large change. The dollar price of Chinese exports ($PX\$_{ch}$) increases, but by less than it would have had Chinese export prices in yuan not fallen. The initial increase is 10.81 percent,

Table 1
Chinese Appreciation of 25 Percent
Percentage Deviations from Base in Percentage Points

qtr	PM_{ch}	PY_{ch}	PX_{ch}	$PX\$_{ch}$	$X_{ch,us}$	EX_{ch}	Y_{ch}	IM_{ch}
1999.4	-24.91	-8.06	-16.89	10.81	-3.48	-1.50	-0.50	-0.16
2000.4	-24.90	-11.93	-18.65	8.47	-5.75	-3.01	-1.23	-0.53
2001.4	-24.88	-13.94	-19.56	7.25	-7.32	-4.10	-1.75	-1.02
2002.4	-24.85	-15.15	-20.10	6.53	-8.34	-4.85	-2.30	-1.59
2003.4	-24.81	-16.07	-20.50	6.00	-8.90	-5.50	-2.97	-2.27
2004.4	-24.77	-16.75	-20.78	5.63	-9.23	-5.84	-3.43	-2.95
2005.4	-24.74	-17.37	-21.03	5.29	-9.32	-6.14	-3.97	-3.63
2006.4	-24.71	-17.83	-21.21	5.05	-9.30	-6.29	-4.32	-4.25
2007.4	-24.68	-18.11	-21.30	4.93	-9.29	-6.62	-4.45	-4.72
2008.4	-24.66	-18.35	-21.39	4.82	-9.11	-7.14	-4.64	-5.12

qtr	PM_{us}	PY_{us}	PX_{us}	AA_{us}	YD_{us}	RS_{us}	IM_{us}	$X_{us,ch}$	EX_{us}	C_{us}
1999.4	0.64	0.11	0.18	-0.14	-0.12	0.02	-0.21	-0.32	-0.01	-0.06
2000.4	0.53	0.15	0.20	-0.15	-0.11	0.01	-0.32	-0.99	-0.03	-0.08
2001.4	0.56	0.18	0.24	-0.16	-0.11	0.01	-0.35	-1.70	-0.01	-0.09
2002.4	0.66	0.23	0.29	-0.19	-0.12	0.02	-0.36	-2.50	0.01	-0.10
2003.4	0.82	0.28	0.36	-0.22	-0.15	0.02	-0.39	-3.56	-0.01	-0.11
2004.4	0.95	0.34	0.43	-0.25	-0.17	0.03	-0.44	-4.76	0.04	-0.13
2005.4	1.04	0.40	0.49	-0.28	-0.19	0.03	-0.49	-5.75	0.00	-0.15
2006.4	1.19	0.47	0.57	-0.30	-0.21	0.03	-0.54	-6.54	0.07	-0.16
2007.4	1.26	0.53	0.64	-0.34	-0.22	0.04	-0.58	-6.93	0.08	-0.18
2008.4	1.31	0.59	0.69	-0.42	-0.22	0.03	-0.59	-7.15	0.18	-0.19

qtr	Y_{us}	J_{us}	J^a_{us}
1999.4	-0.05	-0.03	-40.8
2000.4	-0.05	-0.05	-68.0
2001.4	-0.04	-0.05	-67.1
2002.4	-0.03	-0.05	-57.1
2003.4	-0.04	-0.05	-58.7
2004.4	-0.04	-0.05	-60.8
2005.4	-0.05	-0.05	-68.2
2006.4	-0.04	-0.05	-64.0
2007.4	-0.03	-0.04	-54.1
2008.4	-0.02	-0.03	-43.8

[a]units in thousands of jobs
Simulation period 1999:1–2008:4.
PM = import price level, PY = domestic price level, PX = export price level,
$PX\$$ = export price level in dollars, $X_{i,j}$ = exports from i to j,
EX = total exports, Y = real output, IM = total imports,
AA = real wealth, YD = real disposable income, RS = short term interest rate,
C = consumption, J = employment.

and after four years the increase is down to 6.53 percent.

The higher dollar price of Chinese exports relative to the dollar price of other countries' exports leads through the trade share equations to a decrease in the demand for Chinese exports. For example, exports to the United States ($X_{ch,us}$) are down 3.48 percent initially and 8.34 percent after four years. Total Chinese exports (EX_{ch}) are down 1.50 percent initially and 4.85 percent after four years. The fall in exports has a negative effect on Chinese GDP (Y_{ch}), which in turn has a negative effect on total Chinese imports (IM_{ch}).

Turning to the United States, the import price deflator (PM_{us}) is higher because of the higher price of Chinese imports. This leads to an increase in U.S. domestic prices (PY_{us}) through the domestic price equation. This in turn leads to an increase in the price of U.S. exports (PX_{us}) through the export price equation. The increase in the U.S. price level leads to a decrease in real wealth (AA_{us}) and a decrease in real disposable income (YD_{us}). There is a slight increase in the short term interest rate (RS_{us}). According to the U.S. estimated interest rate rule, RS_{us} responds positively to an increase in inflation and negatively to a fall in output. The fall in output is small (discussed below), and the inflation effect dominates in that the short term interest rate is up slightly.

There are both positive and negative effects on U.S. GDP. Total U.S. imports (IM_{us}) are down, in large part because of the fall in imports from China, which is a positive effect. U.S. exports to China ($X_{us,ch}$) are down because of the decreased demand from China due to the contraction of the Chinese economy. Total U.S. exports (EX_{us}) are, however, down only slightly, and so there is only a small effect on U.S. output from export changes. U.S. consumption (C_{us}) is down because of

the fall in real wealth and real income, which is a negative effect on U.S. output. The increase in the short term interest rate also has a negative effect on U.S. output, although this effect is small because the change in the interest rate is small.

The net effect on U.S. output is negative but small. The decrease is 0.05 percent after one year and 0.03 percent after four years. The net effect on U.S. jobs is correspondingly small: a decrease of 0.03 percent (40,800 jobs) after one year and 0.05 percent (57,100 jobs) after four years.

To summarize, the main expansionary effect on U.S. output from the appreciation of the yuan is the fall in U.S. imports from China. The main contractionary effect is through higher U.S. prices and the fall in exports to China. The net effect on U.S. output could go either way, and it is in fact slightly negative. The net effect is, however, very small, and as a rough approximation one might say that the Chinese appreciation is a wash relative to U.S. output and employment.

The present results are certainly at odds with Krugman's estimate of 1.4 million fewer jobs. (This may show the danger of back-of-the-envelope calculations when it comes to exchange rate effects!) They suggest that even if the United States convinced China to appreciate the yuan, there would be little effect on U.S. output and employment.

4 Robustness Checks

As discussed at the end of Section 2, three robustness checks were made. For the first the weight on the domestic price level in the Chinese export price equation is changed from 0.5 to 0.8. No other changes were made. The results are presented

in Table 2. In this case the price of exports in yuan fall less and so the price of exports in dollars rises more. The initial increase in $PX\$_{ch}$ is now 17.59 percent compared to 10.81 percent in Table 1. This results in Chinese exports, output, and imports all falling more. Also, U.S. import prices rise more due to the larger increase in Chinese export prices, which leads to U.S. domestic prices rising more. U.S. imports from China are down more because of the higher Chinese export price. U.S. output and employment are down slightly more in this case, but again the output and employment effects are modest.

For the second check, reported in Table 3, the Chinese domestic price equation is dropped. No other changes were made from the Table 1 experiment. This leads to a smaller decrease in the Chinese export prices in yuan because, unlike in Table 1, there is no effect from a fall in the domestic price level on export prices. The increase in Chinese export prices in dollars is thus larger. Tables 2 and 3 are thus similar relative to Table 1 in that Chinese export prices in dollars are higher. The increase is larger in Table 3 (except for the first year). The story for Table 3 is thus similar to that for Table 2, only the differences between Tables 3 and 1 are larger than those between Tables 2 and 1. U.S. output falls by 0.09 percent after four years, and employment falls by 137,300 jobs. These effects are still quite small.

For the third check, reported in Table 4, the output effect on China was turned off by having government spending offset any contractionary effects. No other changes were made from the Table 1 experiment. In this case Chinese domestic prices do not fall as much as in Table 1 because there is no negative demand effect from lower output. This leads to a smaller fall in Chinese export prices in yuan and so a larger rise in export prices in dollars. The price effect on the United States is

Table 2
Chinese Appreciation of 25 Percent: PY_{ch} Weight of 0.8 for PX_{ch}
Percentage Deviations from Base in Percentage Points

qtr	PM_{ch}	PY_{ch}	PX_{ch}	$PX\$_{ch}$	$X_{ch,us}$	EX_{ch}	Y_{ch}	IM_{ch}
1999.4	-24.86	-8.22	-11.81	17.59	-5.58	-2.36	-0.79	-0.25
2000.4	-24.85	-12.39	-15.02	13.31	-9.01	-4.61	-1.88	-0.82
2001.4	-24.82	-14.64	-16.76	10.99	-11.24	-6.12	-2.62	-1.55
2002.4	-24.77	-16.08	-17.87	9.50	-12.55	-7.09	-3.39	-2.38
2003.4	-24.72	-17.24	-18.76	8.32	-13.12	-7.90	-4.28	-3.33
2004.4	-24.68	-18.08	-19.40	7.47	-13.33	-8.21	-4.85	-4.26
2005.4	-24.65	-18.84	-19.98	6.70	-13.18	-8.49	-5.51	-5.15
2006.4	-24.61	-19.37	-20.38	6.16	-12.87	-8.51	-5.86	-5.91
2007.4	-24.58	-19.65	-20.57	5.91	-12.59	-8.78	-5.93	-6.46
2008.4	-24.57	-19.86	-20.72	5.70	-12.14	-9.33	-6.09	-6.88

qtr	PM_{us}	PY_{us}	PX_{us}	AA_{us}	YD_{us}	RS_{us}	IM_{us}	$X_{us,ch}$	EX_{us}	C_{us}
1999.4	1.02	0.18	0.28	-0.23	-0.19	0.03	-0.34	-0.51	-0.03	-0.10
2000.4	0.81	0.24	0.32	-0.23	-0.17	0.02	-0.49	-1.54	-0.05	-0.13
2001.4	0.83	0.28	0.36	-0.24	-0.16	0.02	-0.53	-2.59	-0.03	-0.13
2002.4	0.94	0.33	0.42	-0.28	-0.17	0.03	-0.53	-3.73	-0.01	-0.14
2003.4	1.12	0.40	0.50	-0.31	-0.20	0.03	-0.55	-5.22	-0.05	-0.15
2004.4	1.26	0.47	0.59	-0.34	-0.23	0.04	-0.59	-6.86	0.03	-0.17
2005.4	1.35	0.55	0.65	-0.36	-0.25	0.03	-0.63	-8.13	-0.02	-0.19
2006.4	1.50	0.62	0.74	-0.39	-0.27	0.04	-0.67	-9.07	0.08	-0.21
2007.4	1.57	0.69	0.82	-0.42	-0.27	0.04	-0.70	-9.44	0.10	-0.22
2008.4	1.60	0.75	0.88	-0.53	-0.26	0.04	-0.70	-9.57	0.24	-0.23

qtr	Y_{us}	J_{us}	J^a_{us}
1999.4	-0.09	-0.05	-66.0
2000.4	-0.08	-0.09	-108.4
2001.4	-0.07	-0.08	-104.8
2002.4	-0.05	-0.07	-86.3
2003.4	-0.06	-0.07	-83.0
2004.4	-0.05	-0.06	-81.6
2005.4	-0.06	-0.07	-86.4
2006.4	-0.04	-0.06	-76.8
2007.4	-0.04	-0.05	-60.5
2008.4	-0.02	-0.04	-45.2

See notes to Table 1

Table 3
Chinese Appreciation of 25 Percent: Chinese PY Equation Dropped
Percentage Deviations from Base in Percentage Points

qtr	PM_{ch}	PY_{ch}	PX_{ch}	$PX\$_{ch}$	$X_{ch,us}$	EX_{ch}	Y_{ch}	IM_{ch}
1999.4	-24.88	0.00	-13.29	15.61	-4.98	-2.12	-0.71	-0.22
2000.4	-24.83	0.00	-13.25	15.66	-9.21	-4.58	-1.86	-0.79
2001.4	-24.77	0.00	-13.20	15.73	-12.81	-6.75	-2.84	-1.59
2002.4	-24.69	0.00	-13.13	15.83	-15.68	-8.53	-3.99	-2.62
2003.4	-24.59	0.00	-13.03	15.96	-17.79	-10.25	-5.46	-3.93
2004.4	-24.50	0.00	-12.92	16.11	-19.47	-11.40	-6.66	-5.37
2005.4	-24.41	0.00	-12.80	16.27	-20.69	-12.62	-8.12	-6.93
2006.4	-24.30	0.00	-12.67	16.44	-21.69	-13.50	-9.23	-8.47
2007.4	-24.18	0.00	-12.52	16.65	-22.62	-14.80	-9.95	-9.81
2008.4	-24.10	0.00	-12.40	16.80	-23.11	-16.62	-10.77	-11.04

qtr	PM_{us}	PY_{us}	PX_{us}	AA_{us}	YD_{us}	RS_{us}	IM_{us}	$X_{us,ch}$	EX_{us}	C_{us}
1999.4	0.91	0.16	0.25	-0.20	-0.17	0.03	-0.30	-0.45	-0.02	-0.09
2000.4	0.94	0.25	0.35	-0.26	-0.20	0.02	-0.52	-1.49	-0.05	-0.14
2001.4	1.13	0.33	0.44	-0.31	-0.21	0.02	-0.65	-2.69	-0.04	-0.17
2002.4	1.44	0.45	0.58	-0.40	-0.27	0.04	-0.76	-4.16	-0.04	-0.20
2003.4	1.89	0.59	0.76	-0.48	-0.35	0.05	-0.92	-6.25	-0.12	-0.25
2004.4	2.27	0.75	0.96	-0.57	-0.43	0.06	-1.10	-8.76	-0.07	-0.31
2005.4	2.63	0.93	1.15	-0.67	-0.51	0.06	-1.29	-11.07	-0.19	-0.37
2006.4	3.14	1.12	1.39	-0.78	-0.60	0.08	-1.48	-13.15	-0.09	-0.43
2007.4	3.41	1.33	1.62	-0.89	-0.64	0.08	-1.65	-14.49	-0.09	-0.48
2008.4	3.72	1.51	1.83	-1.17	-0.66	0.08	-1.76	-15.50	0.11	-0.53

qtr	Y_{us}	J_{us}	J^a_{us}
1999.4	-0.08	-0.05	-58.7
2000.4	-0.09	-0.09	-112.6
2001.4	-0.10	-0.11	-132.3
2002.4	-0.09	-0.11	-137.3
2003.4	-0.12	-0.13	-161.4
2004.4	-0.13	-0.15	-186.8
2005.4	-0.16	-0.17	-222.2
2006.4	-0.16	-0.18	-239.9
2007.4	-0.16	-0.18	-241.7
2008.4	-0.15	-0.18	-228.8

See notes to Table 1

Table 4
Chinese Appreciation of 25 Percent: No Change in Chinese Output
Percentage Deviations from Base in Percentage Points

qtr	PM_{ch}	PY_{ch}	PX_{ch}	$PX\$_{ch}$	$X_{ch,us}$	EX_{ch}	Y_{ch}	IM_{ch}
1999.4	-24.91	-7.74	-16.74	11.01	-3.54	-1.52	0.00	0.00
2000.4	-24.90	-11.05	-18.23	9.02	-5.97	-3.10	0.00	0.00
2001.4	-24.86	-12.49	-18.88	8.17	-7.79	-4.33	0.00	0.00
2002.4	-24.82	-13.13	-19.13	7.83	-9.13	-5.25	0.00	0.00
2003.4	-24.76	-13.39	-19.20	7.74	-10.06	-6.13	0.00	0.00
2004.4	-24.70	-13.49	-19.18	7.76	-10.79	-6.70	0.00	0.00
2005.4	-24.64	-13.52	-19.12	7.84	-11.30	-7.29	0.00	0.00
2006.4	-24.56	-13.51	-19.04	7.94	-11.71	-7.73	0.00	0.00
2007.4	-24.48	-13.47	-18.95	8.07	-12.11	-8.41	0.00	0.00
2008.4	-24.42	-13.44	-18.87	8.18	-12.29	-9.35	0.00	0.00

qtr	PM_{us}	PY_{us}	PX_{us}	AA_{us}	YD_{us}	RS_{us}	IM_{us}	$X_{us,ch}$	EX_{us}	C_{us}
1999.4	0.65	0.11	0.18	-0.15	-0.12	0.02	-0.22	-0.07	-0.01	-0.06
2000.4	0.56	0.16	0.22	-0.16	-0.12	0.01	-0.33	-0.15	-0.01	-0.09
2001.4	0.64	0.20	0.26	-0.18	-0.12	0.02	-0.37	-0.18	0.03	-0.10
2002.4	0.79	0.26	0.33	-0.23	-0.14	0.03	-0.41	-0.22	0.07	-0.11
2003.4	1.04	0.34	0.44	-0.27	-0.18	0.04	-0.47	-0.26	0.11	-0.13
2004.4	1.26	0.44	0.55	-0.32	-0.22	0.05	-0.56	-0.32	0.20	-0.17
2005.4	1.48	0.54	0.67	-0.37	-0.26	0.06	-0.66	-0.38	0.21	-0.20
2006.4	1.77	0.67	0.81	-0.44	-0.30	0.08	-0.76	-0.44	0.37	-0.24
2007.4	1.93	0.79	0.95	-0.50	-0.32	0.08	-0.85	-0.50	0.43	-0.27
2008.4	2.13	0.91	1.08	-0.66	-0.33	0.08	-0.91	-0.54	0.56	-0.30

qtr	Y_{us}	J_{us}	J^a_{us}
1999.4	-0.05	-0.03	-40.9
2000.4	-0.05	-0.05	-68.3
2001.4	-0.04	-0.05	-67.1
2002.4	-0.03	-0.05	-56.9
2003.4	-0.04	-0.05	-57.7
2004.4	-0.03	-0.04	-56.3
2005.4	-0.04	-0.05	-62.0
2006.4	-0.02	-0.04	-47.1
2007.4	-0.01	-0.02	-29.5
2008.4	-0.01	-0.01	-15.9

See notes to Table 1

thus somewhat larger. Chinese imports do not fall, and so U.S. exports are larger in Table 4 versus Table 1. The positive effect from higher U.S. exports is roughly offset by the negative effect from higher U.S. prices, and the effects on U.S. output and employment are similar in Table 4 versus Table 1. The estimated effects thus continue to be small.

The results are thus all similar in showing small effects on U.S. output and employment. One other change to the Chinese model that might make the effects on U.S. output and employment positive would be to have total Chinese imports (IM_{ch}) respond to Chinese import prices relative to domestic prices. In the estimation work the price of imports relative to the domestic price level was not significant in the import demand equation for China (contrary to the case for the United States and many other countries). If this effect were imposed on China and the experiment in Table 4 performed (i.e., no Chinese output effect), IM_{ch} would rise rather than be unchanged. This rise could be large enough to lead to a large enough rise in U.S. exports to have the net effect on U.S. output and employment be positive. The net effect, however, would still likely be quite small.

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