WHAT CAN A CGE SAY ABOUT THE HOUSING BUBBLE BURST CRISIS AND GLOBAL IMBALANCES?

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André Lemelin [1]
Véronique Robichaud [2]
Bernard Decaluwé [3]

Poverty and Economic Policy (PEP) Research Network

1 Centre INRS-UCS, Université du Québec, Montréal
2 Département d'économique, Université Laval, Québec
3 Département d'économique, Université Laval, Québec

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by

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Introduction

« Global imbalances » is a shortcut expression for the United States current account deficit and its counterparts, East Asian surpluses and petrodollar recycling. For several years, growing global imbalances have claimed the attention of, among others, the International Monetary Fund (IMF). In its April 2007 *World Economic Outlook*, the Fund observed that « The persistence of global imbalances brings with it an important financial stability issue — the problem of sustaining the financing flows needed to support the imbalances. The April 2007 World Economic Outlook projects that imbalances are unlikely to fall much over the short term, and thus continued large cross-border net capital flows will be needed to finance current accounts at close to their present levels. This is clearly the case for the United States, which had an estimated current account deficit of $848 billion, or 6.4 percent of GDP, in 2006. The rising dependence on fixed-income inflows to finance the U.S. current account deficit suggests that capital flows may have become more sensitive both to changes in world interest rate differentials and to expected exchange rate shifts » (IMF, 2007-04, p. 15).

Confronted with the same facts, the World Trade Organization (WTO) 2007 *World Trade Report* stated that « In part, larger current account imbalances reflect the impact of greater capital and financial market integration. A current account deficit reflects dissaving by domestic residents, an excess of absorption over income. The fact that it is occurring reflects a willingness by foreigners to finance that excess absorption by accumulating future claims on the earnings of domestic residents. It is important to emphasize that sustained imbalances are primarily a macroeconomic phenomenon and they have little to do with trade policy » (WTO, 2007, p. 25-26). In other words, trade policy may influence trade flows, but current accounts are constrained by symmetric capital account balances, or imbalances, on which trade policy has little effect, according to the WTO.

Since then, of course, the U.S. real estate bubble has burst, triggering a worldwide financial, and then economic crisis. Governments have stepped in with financial rescue packages for institutions « too big to fail » and energetic recovery plans. Preoccupations are now focused on « Sustaining the recovery » (IMF, 2009), with global imbalances only partially resolved (Blanchard and Milesi-Ferretti, 2009).

In this paper, we present a worldwide recursive dynamic CGE model with international financial assets. We use our model to simulate some implications of the 2007-2008 speculative bubble burst, and subsequent economic recovery plans and ballooning government debts.

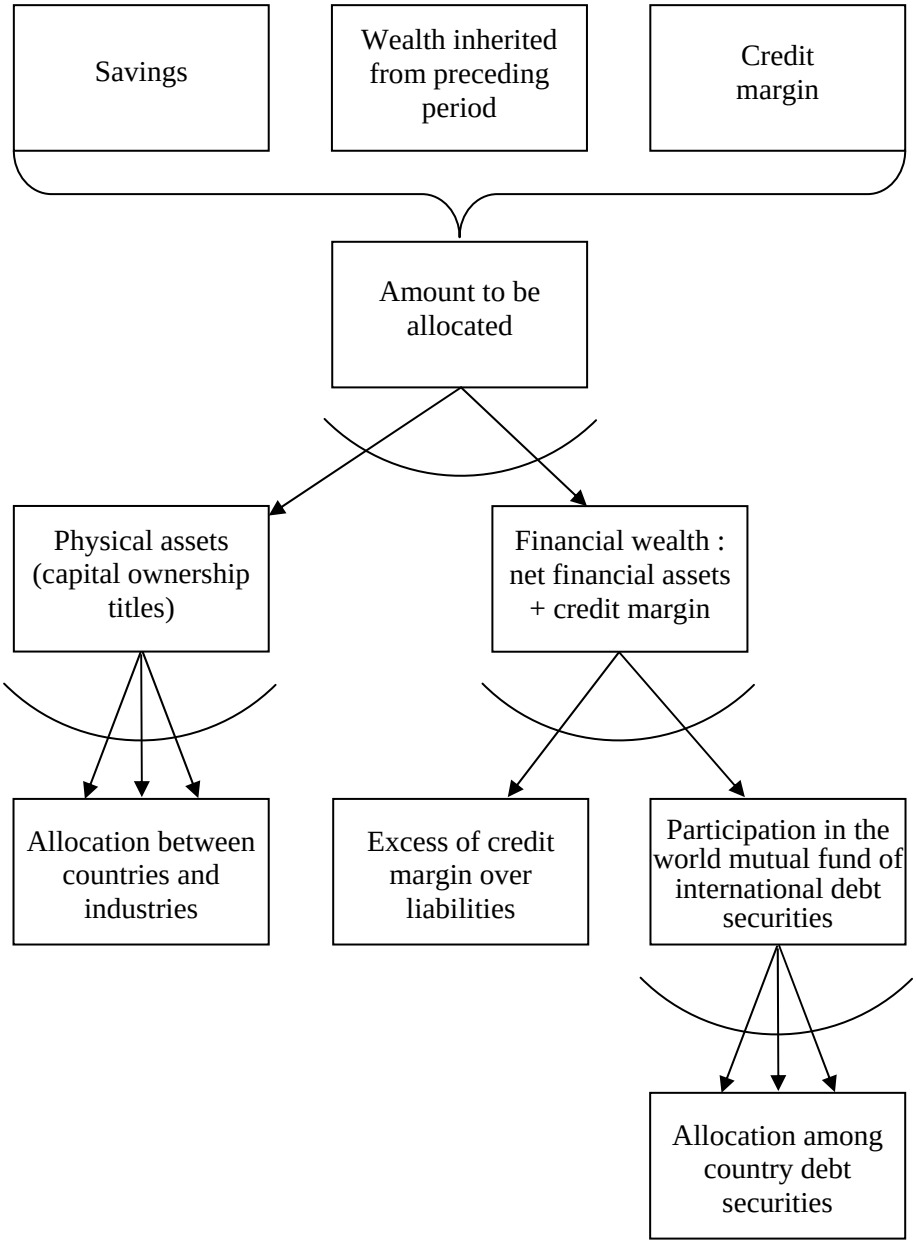
1. Model

Our model is the last-born of a family of standard models developed by our team for the Poverty and Economic Policy (PEP) Research Network. It is calibrated using GTAP data, and Lane and Milesi-Ferretti's (2006) « External Wealth of Nations, Mark II » data on country international investment positions (IIP).

Most CGE trade models fix current account balances exogenously, in accordance with the widely accepted view that trade policy may influence trade flows, but that current accounts are constrained by symmetric capital account balances, on which trade policy has little effect (see WTO, 2007, quoted above). Our model was developed to make explicit the international capital flows which must take place to balance the current account implications of the simulated trade flows, and to compute the cumulative consequences of such capital flows on the international investment positions (IIP) of countries. In our model, current account balances and their capital account counterparts are endogenous. Each country or group of countries is modeled as a single agent. Every country-agent owns a portfolio of assets which constitutes its net wealth. There are two types of wealth : financial wealth, and physical assets. The latter are ownership titles to productive capital or, equivalently, claims on the flow of income generated by the capital. The financial component of the portfolio is made up of assets and liabilities (debt). The asset-liability structure of the financial portfolio is endogenous, and it is possible for a country-agent to have negative net financial assets (liabilities in excess of assets). The possibility of borrowing is limited, however, by the willingness of other country-agents to lend, which reflects their own portfolio choices, and by the competition from other borrowing countries. The allocation of capital among countries and industries is determined by an investment supply and demand equilibrating mechanism. Investment supply is the demand for new physical capital ownership titles resulting from the wealth allocation process, while investment demand is a constant elasticity function of Tobin's q in the Jung-Thorbecke (2001) style.

Country-agent wealth allocation behavior is represented in a three-tier portfolio management model (Lemelin, 2008, 2009), as illustrated below. A more elaborate presentation of the portfolio management model is to be found in Appendix A.

Portfolio allocation in the PEP-w-t model



In its current version, the model has four industries, each producing one commodity: the primary sector, industry, services, and public administration. There are two kinds of labor, skilled and unskilled, and three other production factors : capital, land, and natural resources. The countries of the world are aggregated into 14 regions :

Africa South of the Sahara (AfriSS)
China (incl. Hong Kong) (ChinaHK)
European Union Fifteen (EU15)[4]
Rest of the EU (before 2007) (EUplus)
India
Japan
Middle-East and North Africa (MENA)
Latin American developing countries (LAmDev)
Asia-Pacific developing countries (AsPaDev)
Rest of Latin America (RoLAm)
Rest of Asia (RoAsia)
Rest of the world (RoW)
Transition economies (Transit)
United States of America (USA)

The model is admittedly quite aggregated. The moderate size of result files allowed a detailed examination and facilitated diagnostics during model development. The GAMS code would nonetheless allow to apply a finer classification, both in terms of industries/commodities and in terms of regions. However, the current level of aggregation is not so coarse as to render results uninteresting.

2. Simulations

In order to simulate consequences of the 2007-2008 crisis, we must devise a way of representing the speculative bubble burst. It is important to emphasize that our purpose is not to represent the mechanism whereby the bubble came to be, and then burst, because recursive dynamic CGE models are not suited to take into account the dynamics of expectations which play a key role in such phenomena. Here, the burst is treated as an exogenous shock that depresses demand and creates unemployment.

More specifically, we view the burst of the real-estate bubble in the United States as a sudden fall in the (perceived) wealth of households, which forces them to save more, for two reasons. First, their borrowing capacity, especially mortgage borrowing, diminishes, forcing a reduction of debt-financed consumption. Second, prudent households are likely to feel the need to reconstitute their wealth, and this acts as an incentive to save more. Indeed, savings rates have in fact increased in the United States in 2009, although there are signs that the increase may be at least partly temporary (Blanchard, 2009).

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4 Member countries in 1995.

So the shock is a fall in household consumption due to an exogenous rise in savings. But this is not the end of the story. In our default model closure, investments are endogenous, savings-driven, so that an increase in savings would normally result in an increase in investment spending which would compensate for the drop in consumption expenditures. Here, however, the increase in savings is a consequence of a burst bubble, and the accompanying fall in entrepreneurial confidence will dampen investment. So there is a mechanism in the model which sterilizes the increase in household savings (see Appendix B).

Specifically, the model switches from a neoclassical to a Keynesian closure for the US economy, and two other "rich" regions: the EU15 and Japan. Under the Keynesian closure, investment expenditures are capped at 90% of their BAU level in 2008, and at 97% in 2009 and 2010, while the overall rate of capacity utilization in these regions becomes endogenous, and wage rigidity impedes labor market clearing. With the exogenous increase in the intercept of household savings function, and fixed investment expenditures, the only way to restore the savings-investment equilibrium is through a fall in endogenous savings (government savings, and the variable portion of household savings). And since endogenous savings increase with income, this forces a reduction of income, or GDP, made possible by less than full employment of the factor endowment. Such is our Keynesian economic crisis mechanism, quite similar, really, to the Sixties simplified textbook version of Keynes' macroeconomic model (see Appendix B). This is admittedly somewhat *ad hoc*, but, once again, our purpose is to study the consequences of the drop in final demand that resulted from the bubble burst, not to explain how that drop happened.

In our model, we have implemented various forms of wage rigidity. One is a wage curve mechanism à la Blanchflower and Oswald (1995; also see Card, 1995). Another is a pure fixed wage closure, where unemployment is the difference between exogenous labor supply and endogenous demand, given the fixed nominal wage level[5]. In the end, we have chosen to apply a mixture of the pure fixed wages closure and a less extreme hypothesis where nominal wages are assumed to be sticky, which prevents them to fall by more than 0.1% relative to the previous period's. Wage rigidity is applied only to rich regions, in accordance with the view that it is a reflection of worker bargaining power, which is relatively weak outside OECD countries.

Just as the bubble burst is treated as an exogenous shock, so are recovery plans. Their treatment is less problematic, and more conventional: specifically, they are exogenous fiscal policy shocks. We focus on the increase in deficit-financed public expenditures. Our model has no representation of financial markets

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5 The hypothesis of fixed *real* wages would be a lot more restrictive, and perhaps unrealistic. Note that under the rigid nominal wages hypothesis, it is possible for real wages to fall.

other than international markets, so financial rescue packages are outside its scope. Moreover, the model does not include money among its assets, and so monetary policy is also beyond its reach.

Using our worldwide CGE model, we compare the bubble-burst crisis scenario with, and without recovery plans, to a BAU scenario. Emphasis will be on the differential evolution of trade and international investment positions.

3. Results and discussion

For our reference scenario (BAU), we have chosen to simulate a smooth evolution of the world economy, where exogenous variables such as the labor supply grow at a rate which combines the predicted growth rate of population and a constant growth rate of GDP per capita. The latter is computed as the average compound growth rate of each region over the 2004-2020 horizon[6]. We have not attempted to track predicted regional GDPs.

Figure 1 shows the evolution of real GDP for the USA, EU15, Japan, China and India, both for the BAU and for the crisis scenario. Perhaps more evocative is Figure 2, which displays percentage deviations of the crisis scenario relative to the BAU. Figures 3 and 4 show percentage deviations from the BAU for other regions.

It can be seen that our crisis scenario results in a deep recession in the USA, where the crisis originated, a less severe recession in the EU15 and Japan, and an even less severe recession in other regions. This is not entirely satisfactory, given that, for instance, Europe is supposed to have been hardest hit, according to the IMF International Financial Statistics[7]. Moreover, all regions rapidly bounce back, perhaps too rapidly, close to their BAU evolution in 2011. Nonetheless, our results do show a worldwide recession. So, while our crisis scenario needs to be better tuned to more accurately reflect what has been observed, the results presented here are encouraging.

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6 The authors thank David Laborde for having shared GDP forecast and population data from the MIRAGE model.

7 http://www.principalglobalindicators.org/

Figure 1

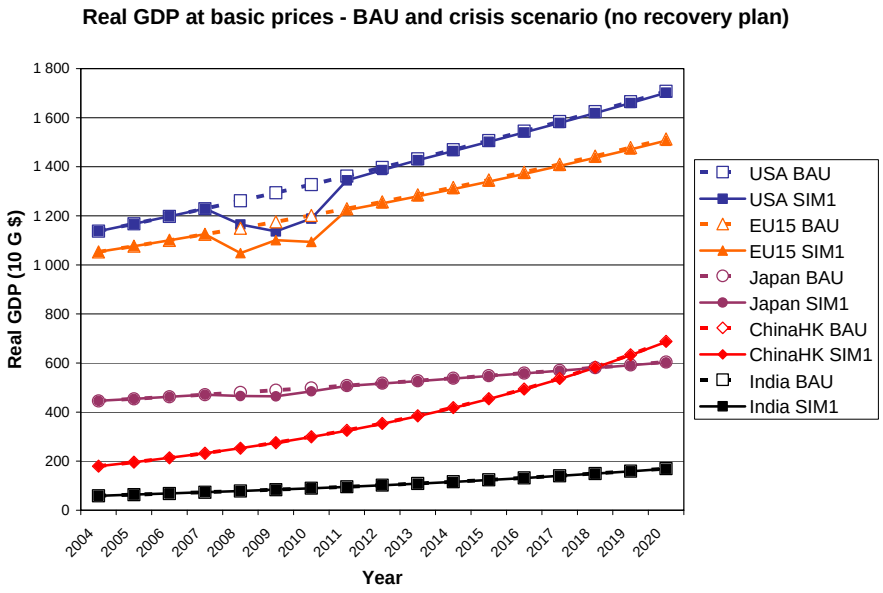


Figure 2

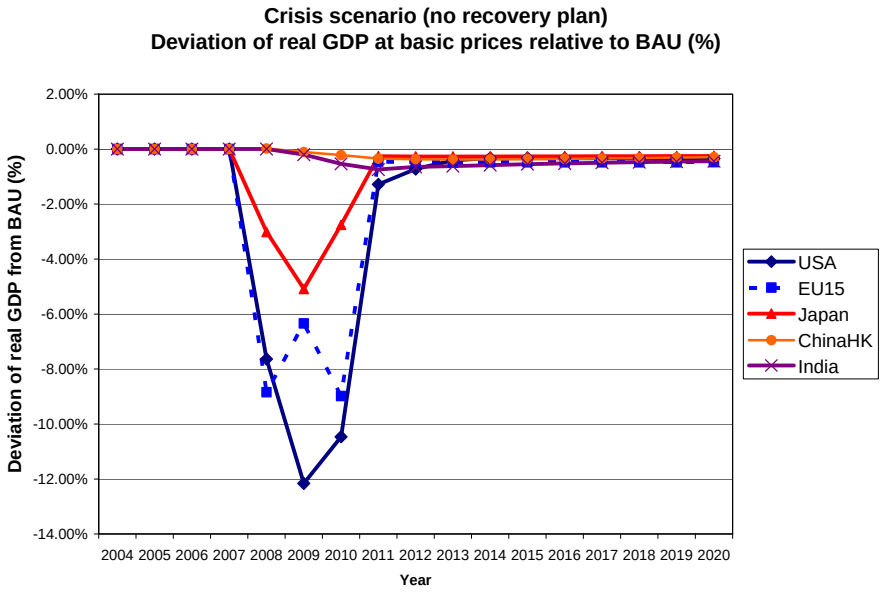


Figure 3

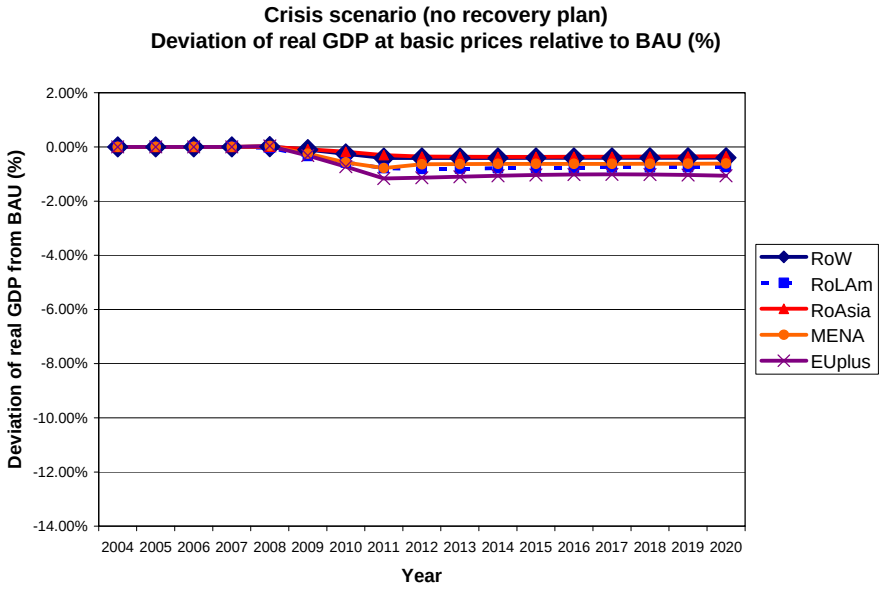
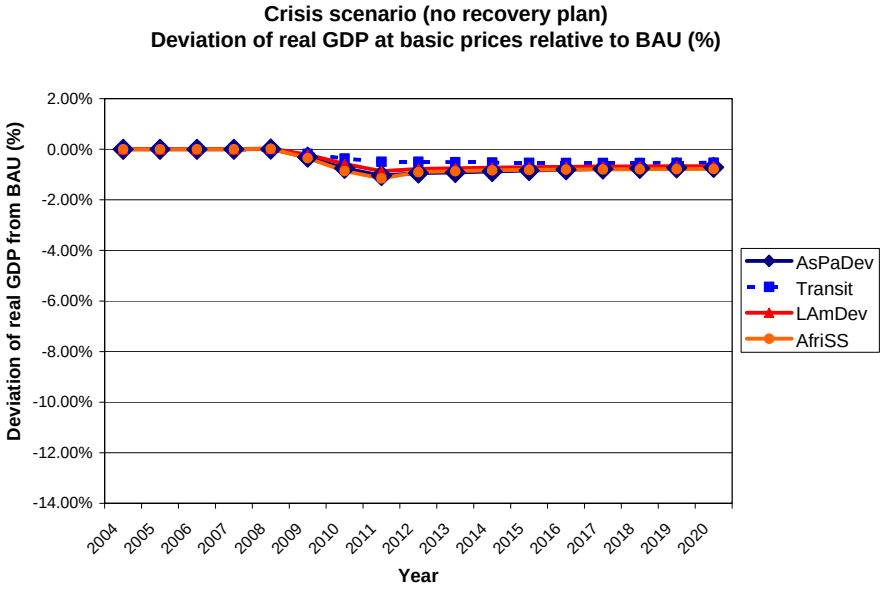


Figure 4



We have simulated three recovery plan scenarios (for details, see Appendix B3). Of the three, the one with the strongest impact is an increase in current government expenditures. Under that scenario, the US, EU15 and Japan increase government spending in 2009 and 2010 by an amount equal to 1.5% of their respective 2008 BAU GDP, while China does the same for an amount equal to 3.5% of its 2008 GDP. The recovery plans have a negligible effect outside these four countries: the greatest impact in absolute value is –0.04% (RoAsia, 2010). More surprisingly, the recovery plans have very little effect on China,

where their joint impact is to increase real GDP by 0.002% in 2009, and to reduce it by 0.149% relative to the crisis-without-recovery-plan scenario. In the other three regions, however, the effect is significant, as shown in the left panel of Table 1. In the right panel of Table 1, it can be seen that, in implementing its recovery plan, China seems to be helping the other three more than itself in the short run, which is rather unexpected. Although we have yet to analyze the results in more depth, our intuition is that the Chinese recovery plan cannot really boost its GDP, because the neoclassical closure implies that its resources are fully utilized anyway. So the effect of the recovery plan would be to reorient a fraction of its productive capacity towards domestic demand. Our intuition is somewhat supported by the fact that Chinese import and export volume and value indices are all marginally lower with than without a Chinese recovery plan, from the implementation year up to the 2020 horizon. The current account surplus, however, is lower by 21%, 19% and 1% in the years 2009-2011 respectively, and thereafter returns to the same level.

Table 1

	Percent change in real GDP with, relative to without recovery plans in US, EU15, Japan and China				**Percent change in real GDP with, relative to without recovery plan in China (other recovery plans in force)**			
	ChinaHK	**EU15**	**Japan**	**USA**	**ChinaHK**	**EU15**	**Japan**	**USA**
2008	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
2009	0.002%	2.210%	3.636%	4.714%	0.009%	0.289%	0.460%	0.342%
2010	-0.149%	3.972%	2.666%	3.747%	-0.112%	0.504%	0.262%	0.238%

With the neoclassical labor market closure, the rate of unemployment is constant[8] in all regions except the USA, EU15 and Japan. In the latter three, however, the model switches from neoclassical to Keynesian closure in 2008. During the crisis years (2008-2010), wages are strictly rigid; afterwards, they are allowed to fall by 0.1% each year relative to the previous year level. In the EU15 region and Japan, that is sufficient to eliminate unemployment in excess of the NAIRU from 2011 onwards, but in the USA, some unemployment persists until 2013.

Table 2 compares unemployment rates without, and with a government recovery plan. It is clear that the recovery plan reduces unemployment considerably in the two years during which it is applied (China is absent from Table 2, because its labor market is under neoclassical closure).

8 Formally, the constant rate of unemployment is set at zero, and the supply of labor may be interpreted as labor supply net of some constant rate, which, for the sake of convenience, we shall call the « Non accelerating inflation rate of unemployment » (NAIRU).

Table 2

Unemployment on the labor market (No recovery plan)

	Skilled labor			*Unskilled labor*		
	EU15	**Japan**	**USA**	**EU15**	**Japan**	**USA**
2008	6.37%	4.09%	7.09%	7.97%	4.04%	7.42%
2009	8.96%	8.39%	11.16%	10.95%	8.23%	11.82%
2010	7.36%	4.31%	9.84%	9.17%	4.27%	10.36%
2011	0.00%	0.00%	1.32%	0.00%	0.00%	1.41%
2012	0.00%	0.00%	0.54%	0.00%	0.00%	0.59%
2013	0.00%	0.00%	0.09%	0.00%	0.00%	0.13%
2014	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Unemployment on the labor market (Recovery plan - except China)

	Skilled labor			*Unskilled labor*		
	EU15	**Japan**	**USA**	**EU15**	**Japan**	**USA**
2008	6.37%	4.09%	7.09%	7.97%	4.04%	7.42%
2009	6.36%	3.35%	7.63%	7.84%	3.37%	8.13%
2010	5.20%	0.36%	6.87%	6.53%	0.47%	7.29%
2011	0.00%	0.00%	1.26%	0.00%	0.00%	1.34%
2012	0.00%	0.00%	0.54%	0.00%	0.00%	0.60%
2013	0.00%	0.00%	0.11%	0.00%	0.00%	0.14%
2014	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Unemployment on the labor market (Recovery plan - all four)

	Skilled labor			*Unskilled labor*		
	EU15	**Japan**	**USA**	**EU15**	**Japan**	**USA**
2008	6.37%	4.09%	7.09%	7.97%	4.04%	7.42%
2009	5.97%	2.60%	7.37%	7.36%	2.63%	7.84%
2010	4.89%	0.00%	6.68%	6.12%	0.00%	7.08%
2011	0.00%	0.00%	1.24%	0.00%	0.00%	1.32%
2012	0.00%	0.00%	0.52%	0.00%	0.00%	0.58%
2013	0.00%	0.00%	0.09%	0.00%	0.00%	0.13%
2014	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

In the crisis scenario, a cap is imposed on investment expenditures in the USA, EU15 and Japan for the years 2008-2010. But, as it turns out, the cap is effective neither in EU15 during the temporary rebound year 2009, nor in Japan after 2008[9].

9 Note that the cap had to be relaxed in 2010 for Japan, because a more restrictive constraint made the model infeasible for 2010.

Table 3

Investment as a percentage of the investment cap

Crisis scenario without recovery plan

	EU15	Japan	USA
2008	100.00%	100.00%	100.00%
2009	93.58%	98.17%	100.00%
2010	100.00%	96.06%	100.00%
2011	No cap	No cap	No cap

Table 4 is the mirror image of Table 3. If a constraint is not binding, then the corresponding neoclassical full-employment condition must be verified (100% capacity utilization), and, reciprocally, if the full-employment condition is not verified, then the constraint must be binding. No investment cap is imposed after 2010, so capacity utilization must be 100% everywhere.

Table 4

Rate of capacity utilization

Crisis without recovery plan

	EU15	Japan	USA
2008	89.32%	98.59%	91.57%
2009	100.00%	100.00%	86.62%
2010	91.25%	100.00%	89.42%
2011	100.00%	100.00%	100.00%

We now take a look at the mechanisms at work in the crisis scenario (detailed macroeconomic indicators are presented in Appendix C; Tables 5 and 6 reproduce key results from Appendix C). The upward shift in the U.S. household savings function reduces consumption expenditures. The reduction in demand exerts a downward pressure on consumer prices, but the fall is not sufficient to prevent a decrease in real consumption. Government expenditures are exogenous, and they grow at their BAU scenario rate, while the price index of government spending rises a little, but not enough to make government consumption fall in real terms[10]. Investment diminishes, both in nominal and in real terms, constrained under the investment cap (see Table 3 above). As expected, the fall in private consumption and investment are not compensated by the increased public consumption, and the drop in aggregate domestic demand entails an economic slow-down, with unemployment in excess of the NAIRU and a rate of capacity utilization below 100% (Tables 2 and 4). Household income declines, and so does government income, which consists mostly of taxes. With exogenous and growing public expenditures, government savings fall much more than household savings increase, so domestic savings as a whole are reduced.

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[10] Note that the rise in the price index of government spending is a *relative* price increase, the U.S. GDP deflator being the numeraire.

Table 5

Selected domestic macroeconomic indicators - Crisis without recovery plan

(2007 = 100 for positive values; 2007 = -100 for negative values)

		ChinaHK	EU15	India	Japan	USA
Household consumption expenditures	2007	100.0	100.0	100.0	100.0	100.0
	2008	104.2	89.8	103.2	95.6	92.5
	2009	107.2	89.5	105.3	92.9	90.5
	2010	117.3	92.9	115.0	99.1	94.6
	2011	130.9	110.1	127.7	110.7	109.2
Real household consumption	2007	100.0	100.0	100.0	100.0	100.0
	2008	106.9	90.2	106.8	97.1	93.0
	2009	114.5	95.1	113.9	96.9	91.4
	2010	122.2	94.5	120.5	101.4	95.4
	2011	131.7	109.1	128.2	108.0	109.5
Real government spending	2007	100.0	100.0	100.0	100.0	100.0
	2008	111.8	101.5	111.4	102.3	102.5
	2009	126.9	106.7	125.5	105.3	105.1
	2010	136.3	106.6	133.3	106.4	108.0
	2011	144.3	108.0	139.0	104.9	111.1
Domestic savings	2007	100.0	100.0	-100.0	100.0	100.0
	2008	105.6	85.5	-149.8	97.8	99.6
	2009	109.5	85.5	-226.4	92.4	93.5
	2010	123.5	85.8	-237.9	103.8	105.2
	2011	141.4	112.6	-218.0	121.3	117.2

Moreover, the fall in U.S. demand extends to imports and so becomes a fall in global demand, depressing the world prices of U.S. imports. The prices of U.S. exports also fall, but less, so that the U.S. terms of trade improve. Due to the worldwide recession, the volume of U.S. exports falls, while the volume of imports decreases slightly in 2008, and then keeps growing, albeit at a much slower rate than in the BAU scenario. Overall, however, although the drop in the value of imports is proportionately more pronounced than the drop in the value of exports, the current account balance deteriorates, in absolute terms and also, after 2008, relative to the BAU scenario.

Table 6

Selected trade indicators - Crisis without recovery plan

(2007 = 100 for positive values; 2007 = -100 for negative values)

		ChinaHK	EU15	India	Japan	USA
Fisher index of export prices	2007	100.0	100.0	100.0	100.0	100.0
	2008	96.8	99.4	96.8	98.7	99.6
	2009	92.5	94.5	92.6	96.0	97.4
	2010	94.3	98.5	95.2	98.4	99.7
	2011	97.6	101.1	99.1	102.4	101.5
Fisher index of import prices	2007	100.0	100.0	100.0	100.0	100.0
	2008	99.0	98.1	98.0	97.2	96.9
	2009	95.9	93.2	94.1	93.0	93.1
	2010	99.3	96.8	98.1	95.8	95.3
	2011	103.1	100.4	102.2	99.5	99.2
Fisher index of export volume	2007	100.0	100.0	100.0	100.0	100.0
	2008	107.6	91.3	107.5	99.1	94.8
	2009	115.6	97.5	114.5	98.1	89.0
	2010	125.0	95.5	121.8	103.6	96.4
	2011	135.4	108.7	128.8	107.3	111.8
Fisher index of import volume	2007	100.0	100.0	100.0	100.0	100.0
	2008	103.8	94.9	102.6	99.9	98.6
	2009	109.7	97.6	107.8	102.6	103.3
	2010	115.8	99.5	111.9	106.9	104.4
	2011	124.8	111.2	120.1	116.3	112.1
Current account balance	2007	100.0	-100.0	-100.0	100.0	-100.0
	2008	117.8	-431.1	-75.4	105.9	-101.2
	2009	126.8	132.9	-72.0	100.7	-124.8
	2010	151.1	-436.3	-68.0	111.6	-119.6
	2011	172.1	-375.0	-91.6	101.6	-123.7

In other regions, the details of the economic situation are more or less in line with the evolution of real GDP. Despite the economic slowdown, real household consumption continues to grow everywhere, except in EU15 and Japan, though at a slower pace than in the BAU scenario. Nominal government expenditures are exogenous, and they continue to grow in real terms. The growth of real investment slows, but remains generally positive; the notable exceptions are EUplus (2008-2010), where the decline is most pronounced, and EU15 and LAmDev (2008-2009). Growth in the volume of world trade slows down, but does not reverse itself: all bilateral trade flows increase in volume, but for the weighty exceptions of imports by the U.S., EU15 and Japan. World prices fall, though, and, generally, the value of imports from, and exports to the U.S., EU15 and Japan is reduced, while the value of other bilateral trade flows increases. There is a peculiar pattern in the evolution of the EU15 current account balance: volumes fall quite steeply in 2008, and then, in 2009, prices drop and volumes recover somewhat; the net effect on the (initially negative) current account balance is that it temporarily turns positive (it is always negative in

the BAU scenario after 2005). This effect of trade may be the source of the temporary rebound observed in the EU15 real GDP in Figure 2.

The recession has a moderate effect on current account balances (CAB), except for the US, where the effect is more substantial. Figures 5-7 display differences in current account balances (simulation value minus BAU value).

Figure 5

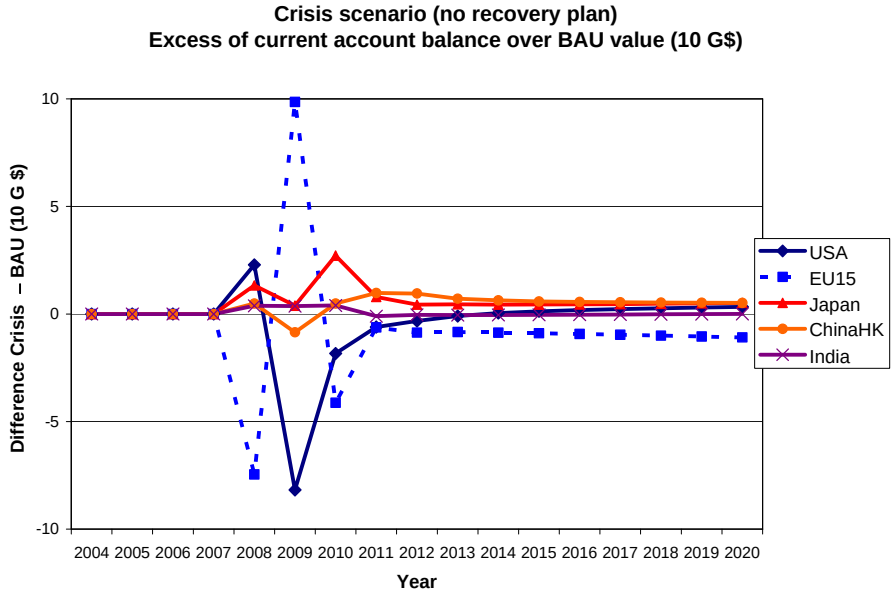


Figure 6

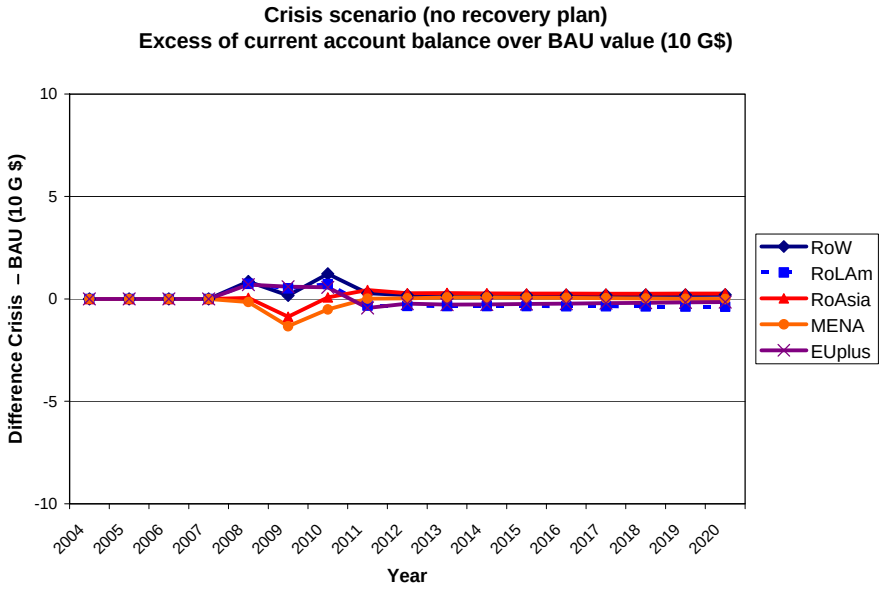
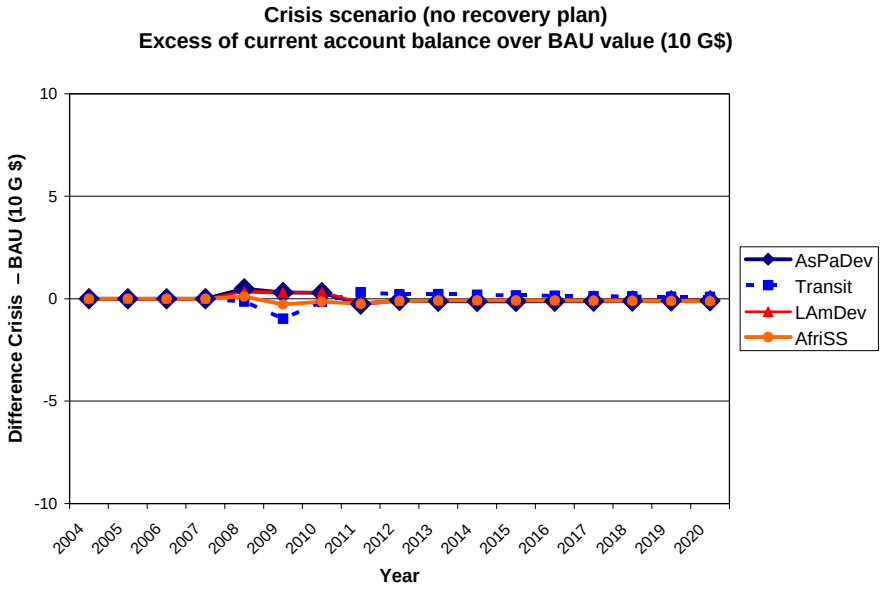


Figure 7



But the impact on net international investment positions (IIP) is not great, as can be seen from Table 7, where the BAU and crisis scenario are virtually undistinguishable. In both scenarios, the US IIP continues to fall, as it goes from a 2004 value of –2 240 billion dollars, to a rather impressive –15 000 billion in 2020. Symmetrically, China's positive stance goes from 610 billion dollars in 2004 to close to 70 000 billion in 2020, overtaking Japan's in 2016 in the BAU scenario, and 2017 in the crisis scenario. Other accumulating regions are RoAsia, which includes the Asian « Tigers », and MENA, which includes Middle-East oil-producing countries. As for the recovery plans, they have virtually no effect on 2020 net IIPs:

Table 7

Net international investment position (10G $)

	2004	2020			
		BAU	Crisis without recovery plan	Crisis with US, EU15 and Japan recovery plan	Crisis with US, EU15, Japan and China recovery plan
AfriSS	-14.27	-27.96	-29.41	-29.11	-29.05
AsPaDev	-27.24	-37.96	-38.16	-37.93	-37.87
ChinaHK	60.69	695.64	702.28	703.41	692.43
EU15	11.71	-198.17	-209.03	-209.27	-203.78
EUplus	-33.15	-182.35	-182.93	-182.72	-182.71
India	-6.41	-39.42	-38.64	-38.59	-38.57
Japan	192.72	507.52	516.89	512.56	514.03
LAmDev	-14.92	-53.09	-52.96	-52.82	-52.79
MENA	40.31	286.83	285.20	286.17	286.48
RoAsia	64.92	463.37	465.45	466.42	466.92
RoLAm	-67.46	-60.42	-62.01	-61.45	-61.33
RoW	0.27	-22.13	-17.96	-16.47	-16.02
Transit	16.40	154.95	155.35	155.88	156.04
USA	-223.56	-1486.80	-1494.08	-1496.08	-1493.80

Another way of looking at the evolution of net IIP is to consider the liability-asset ratio of regions. These are shown in Table 8.

Table 8

Liability-asset ratio

	2004	2020			
		BAU	Crisis without recovery plan	Crisis with US, EU15 and Japan recovery plan	Crisis with US, EU15, Japan and China recovery plan
AfriSS	1.56	1.50	1.54	1.53	1.53
AsPaDev	2.06	1.58	1.59	1.59	1.59
ChinaHK	0.74	0.15	0.14	0.14	0.15
EU15	1.00	1.03	1.03	1.03	1.03
EUplus	1.91	9.26	9.94	9.89	9.88
India	1.41	2.90	2.87	2.86	2.86
Japan	0.55	0.47	0.46	0.46	0.46
LAmDev	1.67	2.44	2.46	2.46	2.45
MENA	0.61	0.15	0.14	0.14	0.14
RoAsia	0.64	0.19	0.18	0.18	0.18
RoLAm	2.25	1.38	1.40	1.39	1.39
RoW	1.00	1.02	1.02	1.02	1.02
Transit	0.78	0.31	0.30	0.30	0.30
USA	1.22	1.91	1.93	1.93	1.93

The 2020 situation in the crisis scenario is pretty much the same as in the BAU. Perhaps it is remarkable that the US ratio, although it does deteriorate significantly, does not explode. Latin American developing countries and India begin and end up with higher ratios than the US. As for the spectacular ratio of the EUplus region, it does not appear sustainable. At the opposite end of the spectrum, China, MENA (which includes oil-producing countries), the Rest of Asia (Asian Tigers), and, to a lesser extent, Japan have ratios that approach zero.

Concluding remarks: preliminary assessment of the model

The model presented here should be considered a prototype. It contains two innovations. First, we wanted to reproduce a worldwide shock similar to the financial and economic crisis that hit the global economy in 2008 with the burst of the housing market bubble and the failure of Lehman Brothers. The results displayed above show that, although a lot of fine tuning remains to be done, our model satisfactorily captures the main macroeconomic features of the crisis. The second innovation, perhaps more fundamental, was to introduce international financial assets in the model, in order to take into account the cumulative financial implications of trade flows. We have done so in such a way that current account balances are now endogenous, regulated by the willingness of surplus regions to lend to deficit regions. Our model demonstrates that our approach is feasible.

It is nonetheless acknowledged that several aspects of our model are in need of improvement. Some of the things on our relatively short term agenda are : to adjust our crisis scenario parameters so that the model tracks recent economic history more accurately; to refine the portfolio management model in order to accommodate vanishing assets[11]; to examine more closely why debt accumulation is not curbed as much as we would have expected. Also, it is not entirely satisfactory that the composite international financial asset of each country consists of shares in a world mutual fund that includes liabilities of that same country[12]. The model could be improved in that respect if it were possible to construct bilateral (origin-destination) international financial data. Absent such data, it may nonetheless be possible to define an international financial asset rate of return specific to each region, which excludes that regions own debt securities.

In our original overall design of the model, there are foreign direct investments (FDI) and they are distinct from portfolio investments. As a matter of fact, data do exist on bilateral FDI, so the next version of the model should include a portfolio allocation mechanism of capital between regions and industries, and a

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11 Recall that, in our model, Chinese debt securities are such a vanishing asset. As the supply dwindles, the price is pushed up, which, in the framework of our portfolio model, takes the form of rates of return that fall to the point of turning negative.

12 Maybe that is not totally unlikely, however, since the single agent representing each country in the model is really an abstraction from the large number of actual agents whose aggregate behavior it is meant to represent.

supply-and-demand equilibrium between the demand for new capital in each industry of each region and the demand for new shares (ownership titles to the new capital created).

Finally, we are eager to experiment with more regional and industry detail.

In the longer term, the model's credibility would be enhanced if portfolio elasticities and initial marginal rates of return on debt securities – arbitrary in the current version – were given an empirical basis. Simulations with different sets of elasticity values were run to test model robustness, and results showed that many combinations lead to infeasible solutions after just a few periods.

One might also question the stability of the portfolio management model parameters over a seventeen-year period. For example, the recent emergence of sovereign funds has resulted in shifts in some countries' investment strategies, most notably China's. One could also point to the many volatile factors omitted from the model that intervene in financial markets. It should be emphasized however that the objective here is to show that, even assuming stable parameters, some commonly made hypotheses relative to exogenous current account balances may not be compatible with rational international financial behavior, especially on the part of lenders. Moreover, computing the evolution of « global imbalances » consistent with trade scenarios is a way of displaying potential sources of instability that could make these scenarios improbable.

But Rome was not built in a single day, and our ambition must be patient.

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APPENDIX A: PORTFOLIO MODEL

Our presentation of the model follows a bottom-up approach.

A1. Country international debt securities

A1.1 ALLOCATION OF LOANS BETWEEN REGIONS

Each region owns international financial assets and, simultaneously, has international financial liabilities. For simplicity, each region issues a single international debt security. Its total external debt is renegociated in every period[13]. Individual region financial assets are pooled in what could be called a world mutual fund of international debt securities.

$$PTF\_W_t = \sum_z Fasset_{z,t} \qquad [001]$$

where

PTF_W_t is the world portfolio of debt securities

$Fasset_{z,t}$ is the value of region z's international financial assets

Such a pooling mechanism, which is obviously a radical simplification of world financial markets, was made necessary for lack of credible complete data on bilateral debt. Moreover, it implies that the composite asset owned by each region includes portions of its own international debt, an incongruity which we were unable to resolve. However, since the single agent representing each region in the model is really an abstraction from the large number of actual agents whose aggregate behavior it is meant to represent, perhaps the incongruity is not so great.

The world fund is allocated among individual country securities followingan approach derived from the Decaluwé-Souissi portfolio model (Decaluwé *et al.*, 1993; Souissi, 1994; Souissi and Decaluwé, 1997; Lemelin, 2005, 2007, 2008 and 2009; Lemelin and Decaluwé, 2007). Here, the manager's objective is to maximize

$$\text{Target} = \left\{ \sum_z \beta_z^{PTF\_W} \left[\left(1 + RR_{z,t}^{Debt}\right) Debt_{z,t} \right]^{-\rho^{PTF\_W}} \right\}^{-\frac{1}{\rho^{PTF\_W}}} \qquad [002]$$

subject to

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13 Redemption does not follow the term structures of bond issues, and past interest rates have no bearing on current transactions. This is completely different from what is proposed in Lemelin (2007b).

$$PTF\_W_t = \sum_z Debt_{z,t} \qquad [003]$$

where

$Debt_{z,t}$ is the value of region z's international financial liabilities

$RR_{z,t}^{Debt}$ is the rate of interest paid on international financial liabilities

with elasticity of substitution

$$\sigma^{PTF\_W} = \frac{1}{\rho^{PTF\_W} + 1},\ 0 < \sigma^{PTF\_W} < \infty, \text{ which implies } \rho^{PTF\_W} = \frac{1 - \sigma^{PTF\_W}}{\sigma^{PTF\_W}} \text{ and}$$

$$-1 < \rho^{PTF\_W} < \infty$$

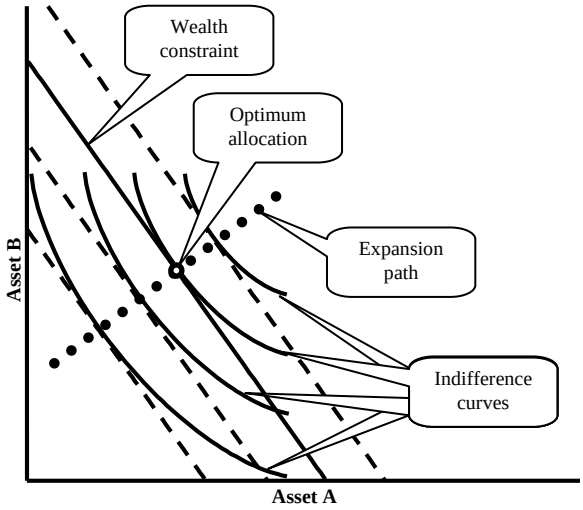
The CES target function reflects the assumption that the capitalized values of different assets are not perfect substitutes in the eyes of the portfolio manager. This can be motivated by risk aversion and a desire to diversify the portfolio. But, while diversification in the original Decaluwé-Souissi model is formulated in terms of begining-of-period holdings, diversification in this model takes into account expected returns from the various assets. It is as if returns were automatically reinvested in the same asset, and the manager allocated his/her portfolio in such a way as to achieve the desired diversification in the end-of-period portfolio. This model is much simpler than the Decaluwé-Souissi model. But it can be shown that, with the proper choice of parameters, it is equivalent.

The debt security demand functions derived from the model are given by

$$Debt_{z,t} = \frac{\left(\beta_z^{PTF\_W}\right)^{\sigma^{PTF\_W}} \left(1 + RR_{z,t}^{Debt}\right)^{\sigma^{PTF\_W}-1}}{\sum_{zj}\left(\beta_{zj}^{PTF\_W}\right)^{\sigma^{PTF\_W}} \left(1 + RR_{zj,t}^{Debt}\right)^{\sigma^{PTF\_W}-1}} PTF\_W_t \qquad [004]$$

The interest rate on each region's security adjusts to clear the market : *ceteris paribus*, an increase (decrease) in the interest rate paid on a country's debt security is an incentive for the world debt portfolio manager to acquire more (less) of it. All other portfolio allocation mechanisms in our CGE model have the same structure as this one. The general portfolio allocation mechanism is illustrated in Figuer A1.

Figure A1 – Portfolio allocation



A1.2 MARGINAL RATE OF RETURN ON INTERNATIONAL FINANCIAL ASSETS

It follows from [004] that the aggregate rate of return of the world mutual fund of debt securities is

$$1 + RR_{zj,t}^{Fasset} = \frac{\sum_z \left(1 + RR_{z,t}^{Debt}\right) Debt_{z,t}}{PTF\_W_t} = \frac{\sum_z \left(1 + RR_{z,t}^{Debt}\right) Debt_{z,t}}{\sum_z Debt_{z,t}} \qquad [005]$$

$$RR_{zj}^{Fasset} = \frac{\sum_z RR_{z,t}^{Debt} Debt_{z,t}}{\sum_z Debt_{z,t}} \qquad [006]$$

where

$RR_{z,t}^{Fasset}$ is the rate of return on international financial assets

A1.3 INCOME RECEIVED AND PAID ON INTERNATIONAL FINANCIAL ASSETS AND LIABILITIES

The rate of return on the composite financial asset must be the same for all regions, since they all hold stakes in the same mutual fund. In reality, however, the observed ratio of foreign financial investment income to the value of foreign assets varies from region to region. So, in order for the model to reproduce the base-year data, the income of each region from its holdings of international debt securities is modeled as a linear function of its assets, with the slope (marginal return) for all regions equal to the current equilibrium rate of interest, but with the intercept calibrated, specific to each region.

$$RFass_{z,t} = rfa0_z + RR_{z,t}^{Fasset} Fasset_{z,t} \quad [007]$$

where,

$RFass_{z,t}$ is region *z*'s income from international financial assets (shares in the world mutual fund of debt securities)

$rfa0_z$ is the intercept

While model specification demands that the rate of return on the composite financial asset be the same for all regions, there is no such requirement for the income paid on liabilities. So, in principle, we could have

$$RDebt_{z,t} = RR_{z,t}^{Debt} Debt_{z,t} \quad [008]$$

where,

$RDebt_{z,t}$ is income paid by region *z* on its international financial liabilities

And $RR_{z,t}^{Debt}$ could have been calibrated as $RDebt_{z,t} / Debt_{z,t}$. However, that straightforward calibration caused the model to crash. The technical reason for this is that, with those calibrated rates, some regions tended to reduce their supply of debt securities (i.e. to borrow less and less), so that the scarcity pushed rates of return towards negative values. Now, in the 2004 balance of payments and IIP data, the ratio of income paid abroad ($RDebt_{z,t}$) over international liabilities ($Debt_{z,t}$) varies greatly from one region to the other. This reflects the international credit ratings of borrowers from different regions, notably governments, but it is also greatly influenced by the mix of financial vehicles which make up the stock of international liabilities. Since the model does not detail international liabilities, it was decided to apply the same specification to income paid as to income received :

$$RDebt_{z,t} = rde0_z + RR_{z,t}^{Debt} Debt_{z,t} \quad [009]$$

where $RR_{z,t}^{Debt}$ is arbitrarily set at 3%, and the intercept $rde0_z$ is calibrated.

When the capital and financial account data are balanced,

$$\sum_z RDebt_{z,t} = \sum_z RFass_{z,t} \quad [010]$$

Given [001], [003] and [006], this implies

$$\sum_z rfa0_z = \sum_z rde0_z \quad [011]$$

International interest payments are taken into account in the current account balance, and net international financial income is distributed between households and government in fixed proportions. The proportion

going to households is equal to the ratio of household savings over the sum of household and government savings in the base period (a feature that will be refined in the future).

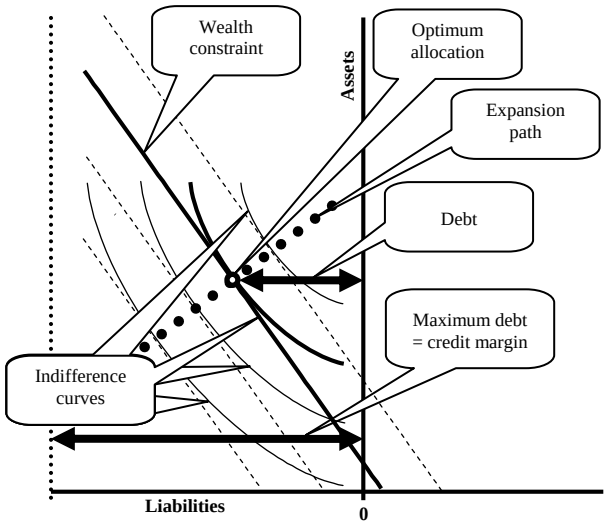
A2. Country credit margins and the structure of regions' external financial wealth

A2.1 CREDIT MARGINS

Some countries have negative net international financial wealth (they are net international debtors). This can happen even if a country has positive savings : for example, if investment expenditures have been in excess of savings. But the portfolio model cannot represent the allocation of a negative amount of net financial wealth.

Moreover, a region's net financial position (assets, minus liabilities) is obviously far more volatile than the underlying stocks of assets and liabilities, making a net position variable often unstable, and therefore difficult to model. So it would seem desirable to model assets and liabilities as distinct variables. But, once again, how can the Decaluwé-Souissi model accommodate negative asset values (liabilities)? A geometric solution is illustrated in Figure A2 below, which is similar to Figure A1, but for the presence of liabilities.

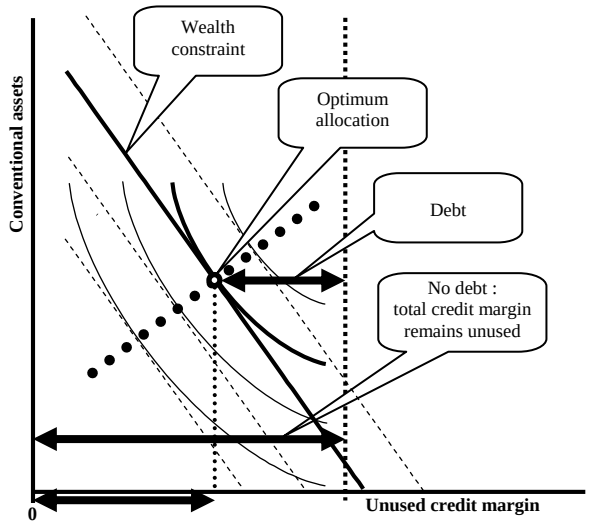
Figure A2 – Asset-liability structure



The credit margin is a device to adapt the portfolio model to handle liabilities. Negative liability variables are converted to positive variables by a simple shift of origin : rather than choosing the positive amount of assets and the negative amount of liabilities, subject to net financial wealth, the country portfolio manager chooses the positive amount of assets, and the – also positive – amount of his/her unused credit margin,

subject to a constraint on the positive total of net financial-wealth-cum-credit-margin. This is represented in Figure A3.

Figure A3 – Unused credit margin as an asset



Net financial-wealth-cum-credit-marginis defined as assets, plus the difference between the maximum amount the region is capable of borrowing, and the actual amount of its liabilities.

$$FinW_{z,t} = Fasset_{z,t} + CrdtMg_{z,t} - Debt_{z,t} \qquad [012]$$

where

$FinW_{z,t}$ is the value of region z's net financial wealth, including its credit margin

$CrdtMg_{z,t}$ is region z's international credit margin

The credit margin has been arbitrarily set in the first period to equal the sum of assets and liabilities (in other words, each country is allowed to increase its debt by the amount of its assets).

$$CrdtMg_z^O = Fasset_z^O + Debt_z^O \qquad [013]$$

The credit margin is then assumed to grow at a rate proportional to the rate of growth of the world sum of equity wealth (see 6 below). In spite of its simplicity, we believe that this formulation is not totally out of line with the reality of international financial markets : countries do have a total borrowing capacity, which usually exceeds their current level of debt. It is nonetheless recognized that, contrary to our specification, real total borrowing capacity is a fuzzy number, not an exact value. Moreover, the level of credit margins influences the values of the calibrated portfolio parameters, and consequently agents' behavior in the model. Therefore, setting credit margins at arbitrary levels as is done here can be

acceptable only in the context of a prototype model : in the future, therefore, efforts should be dedicated to a more careful determination of these credit margins.

A2.2 ASSET-LIABILITY STRUCTURE OF FINANCIAL WEALTH

Financial wealth is allocated between (1) a composite asset, and (2) the surplus of the credit margin over liabilities, i.e. remaining borrowing capacity : debt reduction increases the maximum amount of new loans that could be contracted, and further borrowing reduces it. The rate of return on the composite asset is an aggregate of the interest rates on country debt securities (see below), while the rate of return on debt reduction is the opportunity cost of debt, i.e. the interest rate on a country's own debt. The asset-liability structure of each country's external financial wealth is determined by applying a Decaluwé-Souissi portfolio allocation model.

$$\text{Target} = \left\{ \begin{array}{l} \beta_z^{FinW} \left[\left(1 + RR_{z,t}^{Fasset}\right) Fasset_{z,t} \right]^{-\rho_z^{FinW}} \\ + \left(1 - \beta_z^{FinW}\right) \left[\left(1 + RR_{z,t}^{Debt}\right) Debt_{z,t} \right]^{-\rho_z^{FinW}} \end{array} \right\}^{-\frac{1}{\rho_z^{FinW}}} \qquad [014]$$

subject to

$$FinW_{z,t} = Fasset_{z,t} + CrdtMg_{z,t} - Debt_{z,t} \qquad [015]$$

with elasticity of substitution

$$\sigma_z^{FinW} = \frac{1}{\rho_z^{FinW} + 1},\ 0 < \sigma_z^{FinW} < \infty \text{, which implies } \rho_z^{FinW} = \frac{1 - \sigma_z^{FinW}}{\sigma_z^{FinW}} \text{ and } -1 < \rho_z^{FinW} < \infty$$

The solution is

$$Fasset_{z,t} = \frac{\left(\beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1 + RR_{z,t}^{Fasset}\right)^{\sigma_z^{FinW} - 1}}{\left(\beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1 + RR_{z,t}^{Fasset}\right)^{\sigma_z^{FinW} - 1} + \left(1 - \beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1 + RR_{z,t}^{Debt}\right)^{\sigma_z^{FinW} - 1}} FinW_{z,t} \qquad [016]$$

$$CrdtMg_{z,t} - Debt_{z,t} = \frac{\left(1 - \beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1 + RR_{z,t}^{Debt}\right)^{\sigma_z^{FinW} - 1}}{\left(\beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1 + RR_{z,t}^{Fasset}\right)^{\sigma_z^{FinW} - 1} + \left(1 - \beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1 + RR_{z,t}^{Debt}\right)^{\sigma_z^{FinW} - 1}} FinW_{z,t} \qquad [017]$$

A2.3 AGGREGATE RATE OF RETURN ON INTERNATIONAL FINANCIAL WEALTH

It follows from [012], given [006], that the aggregate rate or return on region *z*'s international financial wealth is defined by

$$RR^{FinW}_{z,t} FinW_{z,t} = RR^{Fasset}_{z,t} Fasset_{z,t} + RR^{Debt}_{z,t} \left(CrdtMg_{z,t} - Debt_{z,t} \right) \quad [018]$$

The return to region *z* of $\left(CrdtMg_{z,t} - Debt_{z,t} \right)$ is the amount of interest payments avoided by not increasing its debt to the limit.

A3 Investment allocation mechanism

There are several modelling options for investment allocation. Our intention is to introduce a supply and demand interaction mechanism which combines investment demand together with a portfolio allocation model, including foreign direct investment (FDI). This has already been implemented in Lemelin (2008, 2009), but for lack of time in view of the complexity of that modelling approach, the version of the model we use here is without FDI, and total investment expenditures in each region are determined by the equilibrating mechanism between investment demand and the supply of investment funds resulting from portfolio allocation.

A3.1 EXPECTED RETURN ON INVESTMENT

The investment accounting constraint is

$$IT_{z,t} = PK_{z,t} \sum_{k,j} IND_{k,j,z,t} \quad [019]$$

And depreciation is

$$DEP_{z,t} = PK_{z,t} \sum_{k,j} \delta_{k,j,z} \; KS_{k,j,z,t} \quad [020]$$

With myopic expectations, an investment of $IT_{z,t}$ is expected to generate a perpetual income of $\sum_{k,j} \left(R_{k,j,z,t} - PK_{z,t} \delta_{k,j,z} \right) IND_{k,j,z,t}$ beginning in *t*+1. Let

$$\rho_{k,j,z,t} = \frac{R_{k,j,z,t}}{PK_{z,t}} \quad [021]$$

be the rate of return on type *k* capital in industry *j* of region *z*, and the expected income can be written as

$$PK_{z,t} \sum_{k,j} \left(\rho_{k,j,z,t} - \delta_{k,j,z} \right) IND_{k,j,z,t} \quad [022]$$

The present value of the future stream of income, at a discount rate of $ir_{z,t}$, is

$$\sum_{\tau=1}^{\infty}\frac{1}{\left(1+ir_{z,t}\right)^{\tau}}PK_{z,t}\sum_{k,j}\left(\rho_{k,j,z,t}-\delta_{k,j,z}\right)IND_{k,j,z,t}=\frac{1}{ir_{z,t}}PK_{z,t}\sum_{k,j}\left(\rho_{k,j,z,t}-\delta_{k,j,z}\right)IND_{k,j,z,t} \quad [023]$$

In order for the investor to be persuaded to invest, the present value of the income stream expected from the investment must be equal to its cost :

$$IT_{z,t}=\frac{1}{ir_{z,t}}PK_{z,t}\sum_{k,j}\left(\rho_{k,j,z,t}-\delta_{k,j,z}\right)IND_{k,j,z,t} \quad [024]$$

A3.2 MARKET VALUE OF INHERITED CAPITAL

With myopic expectations, the stock of inherited capital, is expected to generate a perpetual flow of income equal to

$$YHK_{z,t}=\sum_{k,j}R_{k,j,z,t}KD_{k,j,z,t}\ -DEP_{z,t}=\sum_{k,j}R_{k,j,z,t}KD_{k,j,z,t}-\sum_{k,j}PK_{z,t}\delta_{k,j,z}KS_{k,j,z,t} \quad [025]$$

where it is possible that $KD_{k,j,z,t} < KS_{k,j,z,t}$ if the rate of capacity utilization is less than 100%. Denote the rate of capacity utilization as $cu_{z,t}^{K}$, and

$$YHK_{z,t}=\sum_{k,j}R_{k,j,z,t}KD_{k,j,z,t}\ -DEP_{z,t}=PK_{z,t}\sum_{k,j}\left(\rho_{k,j,z,t}cu_{z,t}^{K}-\delta_{k,j,z}\right)KS_{k,j,z,t} \quad [026]$$

The present value of a perpetual income of $YHK_{z,t}$ per period beginning in the current period, at a discount rate of $ir_{z,t}$ is

$$YHK_{z,t}\sum_{\tau=0}^{\infty}\frac{1}{\left(1+ir_{z,t}\right)^{\tau}}=YHK_{z,t}\frac{1+ir_{z,t}}{ir_{z,t}} \quad [027]$$

A3.3 MARKET VALUE OF EQUITY

In view of [024] and [027], the total value of equity in region *z* in period *t* is

$$Eqty_{z,t}=IT_{z,t}+YHK_{z,t}\frac{1+ir_{z,t}}{ir_{z,t}} \quad [029]$$

where

$Eqty_{z,t}$ is the value of equity owned by region *z*

A3.4 RATE OF RETURN ON EQUITY

Consistent with the portfolio model of capitalized value, the rate of return on any asset is defined as

$$\frac{\text{Value of asset at the beginning of the following period}}{\text{Value of asset at the beginning of the current period}} - 1$$

Now, at the beginning of period t+1, owners of equity in period t will have received an income of $YHK_{z,t}$, and will be owning equity worth

$$\begin{aligned} &PK_{z,t}\sum_{k,j}\left(\rho_{k,j,z,t}-\delta_{k,j,z}\right)IND_{k,j,z,t}\sum_{\tau=0}^{\infty}\frac{1}{\left(1+ir_{z,t}\right)^{\tau}}+YHK_{z,t}\sum_{\tau=0}^{\infty}\frac{1}{\left(1+ir_{z,t}\right)^{\tau}} \\ &\qquad=\frac{1+ir_{z,t}}{ir_{z,t}}PK_{z,t}\sum_{k,j}\left(\rho_{k,j,z,t}-\delta_{k,j,z}\right)IND_{k,j,z,t}+\frac{1+ir_{z,t}}{ir_{z,t}}YHK_{z,t} \end{aligned} \qquad [030]$$

That is, given [024]

$$\begin{aligned} &PK_{z,t}\sum_{k,j}\left(\rho_{k,j,z,t}-\delta_{k,j,z}\right)IND_{k,j,z,t}\sum_{\tau=0}^{\infty}\frac{1}{\left(1+ir_{z,t}\right)^{\tau}}+YHK_{z,t}\sum_{\tau=0}^{\infty}\frac{1}{\left(1+ir_{z,t}\right)^{\tau}} \\ &\qquad=\left(1+ir_{z,t}\right)IT_{z,t}+\frac{1+ir_{z,t}}{ir_{z,t}}YHK_{z,t} \end{aligned} \qquad [031]$$

where the income stream from new capital has been moved down one period, as it is becoming productive in t+1. To be consistent with the time structure, at the beginning of period t+1, the income of $YHK_{z,t}$ received during period t must also be capitalized at $(1+ ir_{z,t})\ YHK_{z,t}$. So, at the beginning of period t+1, the capitalized value of equity owned in period t is

$$\left(1+ir_{z,t}\right)IT_{z,t}+\frac{1+ir_{z,t}}{ir_{z,t}}YHK_{z,t}+\left(1+ir_{z,t}\right)YHK_{z,t} \qquad [032]$$

Using [029], the rate of return on equity is

$$RR_{z,t}^{Eqty}=\frac{\left(1+ir_{z,t}\right)IT_{z,t}+\frac{1+ir_{z,t}}{ir_{z,t}}YHK_{z,t}+\left(1+ir_{z,t}\right)YHK_{z,t}}{Eqty_{z,t}}-1 \qquad [033]$$

$$RR_{z,t}^{Eqty} = \frac{\left(1+ir_{z,t}\right)IT_{z,t} + \left(1+ir_{z,t}\right)\dfrac{1+ir_{z,t}}{ir_{z,t}}YHK_{z,t}}{IT_{z,t} + \dfrac{1+ir_{z,t}}{ir_{z,t}}YHK_{z,t}} - 1 \qquad [034]$$

$$RR_{z,t}^{Eqty} = \frac{\left(1+ir_{z,t}\right)\left[IT_{z,t} + \dfrac{1+ir_{z,t}}{ir_{z,t}}YHK_{z,t}\right]}{IT_{z,t} + \dfrac{1+ir_{z,t}}{ir_{z,t}}YHK_{z,t}} - 1 = ir_{z,t} \qquad [035]$$

Therefore, the rate of return on equity is equal to the discount rate applied to the expected income stream to be generated by capital.

A4. Portfolio wealth

A4.1 Amount of wealth to be allocated

Portfolio wealth consists of net financial wealth, including the credit margin, and equity (ownership of capital, or physical wealth). The amount of wealth to be allocated in each period is the sum of wealth inherited from the preceding period, plus current savings : it is equal to the current value of inherited capital, plus the value of inherited financial assets minus liabilities, plus current domestic savings, and plus the ***current*** value of the credit margin :

$$\begin{aligned} Wealth_{z,t} = {} & YHK_{z,t}\frac{1+ir_{z,t}}{ir_{z,t}} + Fasset_{z,t-1} - Debt_{z,t-1} + CrdtMg_{z,t} \\ & + SH_{z,t} + SG_{z,t} + DEP_{z,t} \end{aligned} \qquad [036]$$

A4.2 Allocation of wealth between equity and debt assets

The portfolio manager maximizes a CES aggregate of the capitalized values of assets :

$$\text{Target} = \left\{ \begin{array}{l} \beta_z^{PTF}\left[\left(1+RR_{z,t}^{FinW}\right)FinW_{z,t}\right]^{-\rho_z^{PTF}} \\ +\left(1-\beta_z^{PTF}\right)\left[\left(1+RR_{z,t}^{Eqty}\right)Eqty_{z,t}\right]^{-\rho_z^{PTF}} \end{array} \right\}^{-\frac{1}{\rho_z^{PTF}}} \qquad [037]$$

with elasticity of substitution

$$\sigma_z^{PTF} = \frac{1}{\rho_z^{PTF} + 1},\ 0 < \sigma_z^{PTF} < \infty, \text{ which implies } \rho_z^{PTF} = \frac{1 - \sigma_z^{PTF}}{\sigma_z^{PTF}} \text{ and } -1 < \rho_z^{PTF} < \infty$$

subject to wealth constraint

$$FinW_{z,t} + Eqty_{z,t} = Wealth_{z,t} \quad [038]$$

The solution is

$$FinW_{z,t} = \frac{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1}}{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1} + \left(1 - \beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}} Wealth_{z,t} \quad [039]$$

$$Eqty_{z,t} = \frac{\left(1 - \beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}}{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1} + \left(1 - \beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}} Wealth_{z,t} \quad [040]$$

A5. Balance of payments identity and savings-investment equilibrium

A5.1 Endogenous balance of payments

The balance of payments identity states that the current account surplus/deficit must be equal to the financial and capital account deficit/surplus. So net new (financial and capital account) lending/borrowing in each period must be equal to the current account surplus/deficit.

$$CAB_{z,t} = \left(Fasset_{z,t} - Debt_{z,t}\right) - \left(Fasset_{z,t-1} - Debt_{z,t-1}\right) \quad [041]$$

With this constraint, the current account becomes endogenous. It is regulated by regional agents' willingness to lend and borrow.

A5.2 Savings-investment equilibrium

Together, wealth constraint [038], financial wealth definition [015], and equity definition [029] imply

$$Wealth_{z,t} = Fasset_{z,t} + CrdtMg_{z,t} - Debt_{z,t} + IT_{z,t} + YHK_{z,t}\frac{1 + ir_{z,t}}{ir_{z,t}} \quad [042]$$

This is the composition of wealth *ex post*, after the portfolio allocation mechanism has come into play. Wealth is also defined *ex ante* in equation [036]. Subtracting [042] from [036] yields

$$0 = Fasset_{z,t-1} + CrdtMg_{z,t} - Debt_{z,t-1} + SH_{z,t} + SG_{z,t} + DEP_{z,t} - \left(Fasset_{z,t} + CrdtMg_{z,t} - Debt_{z,t} + IT_{z,t}\right) \quad [043]$$

Given the balance of payments identity [041], this amounts to

$$IT_{z,t} = SH_{z,t} + SG_{z,t} + DEP_{z,t} - CAB_{z,t} \quad [044]$$

which is the traditional savings-investment equilibrium constraint.

A6. Evolution of credit margins

In view of equations [001], [003] and [015],

$$PTF\_W_t = \sum_z Fasset_{z,t} \quad [001]$$

$$PTF\_W_t = \sum_z Debt_{z,t} \quad [003]$$

$$FinW_{z,t} = Fasset_{z,t} + CrdtMg_{z,t} - Debt_{z,t} \quad [015]$$

we have

$$\sum_z \left(FinW_{z,t} - CrdtMg_{z,t}\right) = \sum_z Fasset_{z,t} - \sum_z Debt_{z,t} = 0 \quad [045]$$

Consider equation [039] :

$$FinW_{z,t} = \frac{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1}}{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1} + \left(1 - \beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}} Wealth_{z,t} \quad [039]$$

Subtract $CrdtMg_{z,t}$ from both sides and take the sum over z. There follows

$$\sum_z \left(FinW_{z,t} - CrdtMg_{z,t}\right) = \sum_z \left(\frac{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1}}{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1} + \left(1 - \beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1 + RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}} Wealth_{z,t} \right) - \sum_z CrdtMg_{z,t} \quad [046]$$

$$0 = \sum_z \left(\frac{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1}}{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1} + \left(1-\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}} Wealth_{z,t} \right) - \sum_z CrdtMg_{z,t} \quad [047]$$

and

$$\sum_z \left(\frac{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1}}{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1} + \left(1-\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}} Wealth_{z,t} \right) = \sum_z CrdtMg_{z,t} \quad [048]$$

Therefore, if the world total of credit margins does not grow sufficiently fast relative to world portfolio wealth, the numerators in $\frac{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1}}{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1} + \left(1-\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}}$ must fall, and the only way that can happen is for $RR_{z,t}^{FinW}$ to fall relative to $RR_{z,t}^{Eqty}$. To avoid such distortion, the credit margins are made to grow proportionately to aggregate equity :

$$CrdtMg_{z,t} = 1.006^{t-T1} * CrdtMg_z^O \frac{\sum_{zj} Eqty_{z,t}}{\sum_{zj} Eqty_z^O} \quad [049]$$

where $T1$ is the first year (base year). The 1.006 factor has been chosen for pragmatic reasons, as it results in a value of $RR_{z,t}^{Fasset}$ in the final period (year 2020) that is close to its base year value.

A7. Summary : model financial variables and equations

PTF_W_t is the world portfolio of debt securities	$PTF\_W_t = \sum_z Fasset_{z,t}$	**EQ99 [001]**
$RR^{Debt}_{z,t}$ is the rate of interest paid on international financial liabilities	$Debt_{z,t} = \frac{\left(\beta_z^{PTF\_W}\right)^{\sigma^{PTF\_W}} \left(1+RR^{Debt}_{z,t}\right)^{\sigma^{PTF\_W}-1}}{\sum_{zj}\left(\beta_{zj}^{PTF\_W}\right)^{\sigma^{PTF\_W}} \left(1+RR^{Debt}_{zj,t}\right)^{\sigma^{PTF\_W}-1}} PTF\_W_t$ which, by taking the sum over *z*, implies $PTF\_W_t = \sum_z Debt_{z,t}$	**EQ103 [004]**
$RR^{Fasset}_{z,t}$ is the rate of return on international financial assets	$RR^{Fasset}_{zj,t} = \frac{\sum_z RR^{Debt}_{z,t} Debt_{z,t}}{\sum_z Debt_{z,t}}$	**EQ100 [006]**
$RFass_{z,t}$ is region *z*'s income from international financial assets (shares in the world mutual fund of debt securities)	$RFass_{z,t} = rfa0_z + RR^{Fasset}_{z,t} Fasset_{z,t}$	**EQ101 [007]**
$RDebt_{z,t}$ is income paid by region *z* on its international financial liabilities	$RDebt_{z,t} = rde0_z + RR^{Debt}_{z,t} Debt_{z,t}$	**EQ101b [009]**

New variables	New equations	
$CrdtMg_{z,t}$ is region z's international credit margin	$CrdtMg_z^O = Fasset_z^O + Debt_z^O$ The credit margin is then assumed to grow in proportion to the world sum of equity (equation [zzz046].	**EQ98 [013]**
$Fasset_{z,t}$ is the value of region z's international financial assets	$Fasset_{z,t} = \frac{\left(\beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1+RR_{z,t}^{Fasset}\right)^{\sigma_z^{FinW}-1}}{\left(\beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1+RR_{z,t}^{Fasset}\right)^{\sigma_z^{FinW}-1} + \left(1-\beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1+RR_{z,t}^{Debt}\right)^{\sigma_z^{FinW}-1}} FinW_{z,t}$	**EQ96 [016]**
$Debt_{z,t}$ is the value of region z's international financial liabilities	$CrdtMg_{z,t} - Debt_{z,t} = \frac{\left(1-\beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1+RR_{z,t}^{Debt}\right)^{\sigma_z^{FinW}-1}}{\left(\beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1+RR_{z,t}^{Fasset}\right)^{\sigma_z^{FinW}-1} + \left(1-\beta_z^{FinW}\right)^{\sigma_z^{FinW}} \left(1+RR_{z,t}^{Debt}\right)^{\sigma_z^{FinW}-1}} FinW_{z,t}$ which, together with the $Fasset_{z,t}$ equation, implies $FinW_{z,t} = Fasset_{z,t} + CrdtMg_{z,t} - Debt_{z,t}$	**EQ97 [017]**
$RR_{z,t}^{FinW}$ is the aggregate rate of return on net financial wealth	$RR_{z,t}^{FinW} FinW_{z,t} = RR_{z,t}^{Fasset} Fasset_{z,t} + RR_{z,t}^{Debt}\left(CrdtMg_{z,t} - Debt_{z,t}\right)$	**EQ102 [018]**
$RR_{z,t}^{Eqty}$ is the aggregate rate of return on equity assets	$RR_{z,t}^{Eqty} = ir_{z,t}$	**EQ104 [035]**
$Wealth_{z,t}$ is region z's wealth	$Wealth_{z,t} = YHK_{z,t}\frac{1+ir_{z,t}}{ir_{z,t}} + Fasset_{z,t-1} - Debt_{z,t-1} + CrdtMg_{z,t}$ $+ SH_{z,t} + SG_{z,t} + DEP_{z,t}$	**EQ93 [036]**

New variables	New equations	
$FinW_{z,t}$ is the value of region z's net financial wealth	$$FinW_{z,t} = \frac{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1}}{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1} + \left(1-\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}} Wealth_{z,t}$$	**EQ94 [039]**
$Eqty_{z,t}$ is the value of equity owned by region z	$$Eqty_{z,t} = \frac{\left(1-\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}}{\left(\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{FinW}\right)^{\sigma_z^{PTF}-1} + \left(1-\beta_z^{PTF}\right)^{\sigma_z^{PTF}} \left(1+RR_{z,t}^{Eqty}\right)^{\sigma_z^{PTF}-1}} Wealth_{z,t}$$	**EQ95 [040]**

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APPENDIX B: KEYNESIAN CLOSURE AND CRISIS SIMULATION

B1. Keynesian closure in a simple model of a closed economy

Define the following simple aggregate macroeconomic model of a closed economy

$$Y = C + I \tag{01}$$

$$Y = f(K, L) \tag{02}$$

$$P\,Y = wL + rK \tag{03}$$

$$S/P = \alpha + \beta\, Y \tag{04}$$

$$P\; I = S \tag{05}$$

where

Y is the volume of aggregate production;

C is the volume of consumption;

I is the volume of investment;

K is the quantity of capital employed;

L is the quantity of labor employed;

P, w and r are the prices of production, labor and capital, respectively;

S is savings;

α and β are parameters.

This model has 9 variables. With the derived demand for factors, there are 7 equations, but equation (03) is redundant if the production function is first-degree homogenous[14]. That leaves 6 equations for 9 variables.

The usual CGE neoclassical closure consists in fixing $K = \overline{K}$, $L = \overline{L}$ and the numéraire $P = \overline{P}$. Whence

$$I = S/P = \alpha + \beta\, Y = \alpha + \beta\; f(\overline{K}, \overline{L}) \tag{06}$$

$$C = Y - I = Y - S/P \tag{07}$$

The common Keynesian closure, on the other hand, is given by $I = \bar{I}$, $w = \overline{w}$ and the numéraire $P = \overline{P}$. The well-known multiplier solution follows :

$$Y = \frac{\bar{I}}{\beta} - \frac{\alpha}{\beta} \tag{08}$$

---

[14] Factor demand functions are given by the first-order conditions, according to which the value of marginal products must be equal to factor prices. Substituting factor demands in Euler's condition $Y = K\; f'_K + L\; f'_L$, equation (3) follows.

Or to state it in a more familiar form, letting $a = -\alpha$ and $b = 1 - \beta$, we have

$$C = Y - S = -\alpha + (1-\beta)Y = a + bY \tag{09}$$

and

$$Y = \frac{\bar{I}}{1-b} + \frac{a}{1-b} \tag{10}$$

B2. Keynesian closure in a simple model of a closed two-region economy

Let us now extend the above model to a closed two-region economy, which we take as a simplified representation of the world economy.

$$Y_i = C_i + I_i + X_i - M_i \tag{11}$$

$$Y_i = f_i\left(K_i, L_i\right) \tag{12}$$

$$P_i\, Y_i = w_i L_i + r_i K_i \tag{13}$$

$$S_i / P_i = \alpha_i + \beta_i\, Y_i \tag{14}$$

$$P_i I_i = S_i + P_i M_i - \left(P_i / P_j\right) P_j X_i \tag{15}$$

$$M_i = m_i\, Y_i \tag{16}$$

$$M_i = X_j, i \neq j \tag{17}$$

where

subscripts i, j=1, 2 designate the two regions;

X_i is the volume of exports of region i to region j;

M_i is the volume of imports of region i from region j;

P_i / P_j is the real exchange rate, the price of region j's currency in terms of region i's currency.

There are 22 variables in the model. With the derived demand for factors, there are 18 equations, but equations 13 are redundant if the production functions are first-degree homogenous. That leaves us with 16 equations for 22 variables.

The common Keynesian closure is to set $I_i = \bar{I}_i$, $w_i = \overline{w}_i$ and the real exchange rate $P_i / P_j = \bar{e}$ (=1 for simplicity), and numeraire $P_i = \overline{P}$. From (11) and (15), it follows that

$$Y_i = C_i + I_i + X_i - M_i = C_i + S_i \tag{18}$$

$$C_i = Y_i - S_i \tag{19}$$

$$C_i = Y_i - \alpha_i - \beta_i Y_i \tag{20}$$

$$C_i = (1-\beta_i)Y_i - \alpha_i \tag{21}$$

$$Y_i = (1-\beta_i)Y_i - \alpha_i + \bar{I}_i + m_j Y_j - m_i Y_i \tag{22}$$

$$(\beta_i + m_i)Y_i = -\alpha_i + \bar{I}_i + m_j Y_j \tag{23}$$

$$Y_i = \frac{\bar{I}_i - \alpha_i}{\beta_i + m_i} + \frac{m_j}{\beta_i + m_i} Y_j \tag{24}$$

From there, it is easy to solve the rest of the model. Let us first solve the two-equation, two-unknown system (24). Substitute for Y_j :

$$Y_i = \frac{\bar{I}_i - \alpha_i}{\beta_i + m_i} + \frac{m_j}{\beta_i + m_i}\left(\frac{\bar{I}_j - \alpha_j}{\beta_j + m_j} + \frac{m_i}{\beta_i + m_i} Y_i\right) \tag{25}$$

$$Y_i = \frac{\bar{I}_i - \alpha_i}{\beta_i + m_i} + \frac{m_j}{\beta_i + m_i}\frac{\bar{I}_j - \alpha_j}{\beta_j + m_j} + \frac{m_j}{\beta_i + m_i}\frac{m_i}{\beta_i + m_i} Y_i \tag{26}$$

$$\left(1 - \frac{m_j}{\beta_i + m_i}\frac{m_i}{\beta_i + m_i}\right)Y_i = \frac{\bar{I}_i - \alpha_i}{\beta_i + m_i} + \frac{m_j}{\beta_i + m_i}\frac{\bar{I}_j - \alpha_j}{\beta_j + m_j} \tag{27}$$

$$Y_i = \frac{\left(\frac{\bar{I}_i - \alpha_i}{\beta_i + m_i} + \frac{m_j}{\beta_i + m_i}\frac{\bar{I}_j - \alpha_j}{\beta_j + m_j}\right)}{\left(1 - \frac{m_j}{\beta_i + m_i}\frac{m_i}{\beta_i + m_i}\right)} \tag{28}$$

It is easily verified that

$$\frac{dY_i}{d\alpha_i} < 0 \text{ and } \frac{dY_i}{d\alpha_j} < 0$$

An exogenous shift in the savings function of a region reduces GDP in both. Moreover, if $\frac{\bar{I}_i - \alpha_i}{\beta_i + m_i}$ and $\frac{\bar{I}_j - \alpha_j}{\beta_j + m_j}$ are of similar magnitudes, an exogenous shift in the savings function of one region reduces that region's GDP more than the GDP of the other region.

B3. Implementation

The reference scenario (BAU) is based on a neoclassical closure, with savings-driven investments, full employment of labor and capital, fixed exchange rates. Labor supply and nominal government expenditures are exogenous, and supposed to grow at a rate which is defined as:

$$\left(1 + g_{z,t}^{pop}\right)\left(1 + g_{z}^{GDP.p.c}\right) - 1$$

where

$g_{z,t}^{pop}$ is the population growth rate of region *z* in period *t*[15]

$g_{z}^{GDP.p.c}$ is the average compound growth rate of GDP per capita computed from GDP and population growth rates.

The speculative bubble-burst scenario is based on the Keynesian closure described above. It is made up of three elements:

- As explained in the main text, household reaction to the burst of the real estate bubble is represented by an exogenous rise in savings. There is a 20% exogenous shift in the intercept of household savings functions of the U.S., EU15 and Japan, for years 2008-2010.
- Nominal investment expenditures are capped at 95% of their BAU value for 2008, and at 90% for 2009-2010[16], while the rate of capacity utilization is made endogenous (capital unemployment is permitted). This restriction on investment is applied to the U.S., the EU15 and Japan.
- Finally, the labor market closure for the same three regions shifts from neoclassical to Keynesian in 2008: for the years 2008-2010, nominal wages are strictly rigid, constrained not to fall below their

15 The authors thank David Laborde for having shared GDP forecast and population data from the MIRAGE model.

16 Except for Japan, where it is set at 95% for 2010, because a more restrictive constraint made the model infeasible for that year. In view of the fact that the GTAP database contains no information on transfers, the calibrated distribution of domestic savings between the government and households is different from known national accounts figures. For that reason, it would probably be preferable to define the shift in savings in terms of total domestic savings.

preceding year level; afterwards, the wage floor is set at 0.1% (one tenth of one percent) below the preceding year level.

The introduction of a wage floor and an investment ceiling (inequality constraints) changes the model from a constrained nonlinear system (CNS) to a nonlinear programming (NLP) problem. That is because each inequality constraint may or may not be binding (the model solution may be a boundary solution or an interior solution with respect to the corresponding constraint); if a constraint is not binding, then the corresponding neoclassical full-employment condition must be verified, and, reciprocally, if the full-employment condition is not verified, then the constraint must be binding. In the model, these conditions translate as orthogonality constraints.

We have simulated several recovery plan scenarios. In all cases, a recovery plan is implemented in the USA, UE15, Japan and China, in the years 2009 and 2010. The nominal amount of the Chinese government intervention in all scenarios is equal to 3.5% of the 2008 BAU GDP at basic prices, while it is equal to 1,5% of the 2008 BAU GDP in the other regions. The scenarios vary according to the form of government intervention: increase in government current expenditures; taxable transfers to households; and household income tax rebates. In the paper, we report only on the first scenario, which has the strongest impact.

APPENDIX C: MACROECONOMIC INDICATORS

Table C1 – Domestic consumption and investment – Crisis without recovery plan

(2007 = 100 for positive values; 2007 = -100 for negative values)

		AfriSS	AsPaDev	ChinaHK	EU15	EUplus	India	Japan	LAmDev	MENA	RoAsia	RoLAm	RoW	Transit	USA
Household consumption expenditures	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	101.1	102.7	104.2	89.8	101.0	103.2	95.6	100.8	101.5	102.6	101.0	100.1	102.8	92.5
	2009	101.6	104.0	107.2	89.5	100.2	105.3	92.9	100.9	102.9	103.4	101.3	99.5	104.3	90.5
	2010	110.5	112.8	117.3	92.9	107.3	115.0	99.1	108.6	112.1	110.7	107.8	105.1	113.2	94.6
	2011	121.9	124.1	130.9	110.1	116.5	127.7	110.7	119.3	123.8	120.6	117.1	113.3	124.5	109.2
Consumer price index	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	97.3	97.6	97.5	99.5	98.3	96.6	98.4	97.0	98.0	98.7	97.7	98.1	98.2	99.5
	2009	93.4	93.9	93.7	94.1	93.6	92.4	95.9	93.1	94.2	95.4	94.5	94.6	94.3	99.0
	2010	97.2	96.9	96.0	98.3	97.0	95.4	97.8	96.0	97.7	97.9	96.9	97.1	97.5	99.2
	2011	101.6	100.9	99.4	100.9	100.5	99.6	102.4	100.4	101.5	101.3	101.0	100.7	101.2	99.8
Real household consumption	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	103.8	105.2	106.9	90.2	102.8	106.8	97.1	103.9	103.6	104.0	103.4	102.1	104.7	93.0
	2009	108.7	110.8	114.5	95.1	107.0	113.9	96.9	108.4	109.3	108.4	107.2	105.1	110.6	91.4
	2010	113.7	116.4	122.2	94.5	110.6	120.5	101.4	113.1	114.8	113.0	111.2	108.3	116.1	95.4
	2011	120.0	123.1	131.7	109.1	115.9	128.2	108.0	118.8	122.0	119.0	116.0	112.6	123.0	109.5
Government spending	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	105.2	106.1	109.0	102.2	104.6	107.8	101.8	105.0	105.7	104.7	103.9	103.1	105.7	102.6
	2009	110.7	112.6	118.8	104.4	109.4	116.1	103.7	110.1	111.7	109.5	108.0	106.3	111.8	105.3
	2010	116.5	119.5	129.5	106.6	114.3	125.1	105.5	115.6	118.0	114.6	112.2	109.5	118.2	108.1
	2011	122.6	126.7	141.2	108.9	119.5	134.8	107.4	121.2	124.7	119.9	116.5	112.8	125.0	110.9
Government expenditures price index	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	97.7	97.8	97.5	100.7	97.8	96.8	99.6	97.2	98.8	98.8	98.0	98.0	98.5	100.1
	2009	94.2	94.1	93.6	97.8	93.8	92.5	98.5	93.6	96.7	95.8	95.3	94.9	95.3	100.3
	2010	96.3	95.7	95.0	100.0	95.6	93.8	99.2	95.1	98.0	97.7	96.7	96.8	97.1	100.1
	2011	99.6	99.0	97.9	100.8	98.5	96.9	102.4	98.5	100.0	100.9	100.1	100.3	99.9	99.8
Real government spending	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	107.7	108.5	111.8	101.5	106.9	111.4	102.3	108.0	106.9	106.0	106.0	105.2	107.3	102.5
	2009	117.6	119.7	126.9	106.7	116.6	125.5	105.3	117.7	115.5	114.4	113.4	111.9	117.3	105.1
	2010	121.0	124.8	136.3	106.6	119.6	133.3	106.4	121.5	120.4	117.3	116.0	113.1	121.8	108.0
	2011	123.1	128.0	144.3	108.0	121.3	139.0	104.9	123.0	124.6	118.7	116.4	112.5	125.1	111.1
Total investment expenditures	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	97.1	99.1	103.1	98.4	93.0	97.1	99.1	95.5	100.4	102.6	97.7	97.6	100.9	97.5
	2009	95.4	98.4	106.0	90.4	86.4	94.5	96.0	92.0	101.2	104.0	95.9	95.2	101.6	94.8
	2010	105.8	108.0	117.2	100.1	90.8	103.0	103.1	99.6	112.6	112.6	104.4	101.7	111.9	97.3
	2011	122.8	124.3	133.6	113.6	104.9	119.0	115.9	116.1	128.8	126.5	121.8	115.5	128.3	107.9
Investment price index	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	97.6	97.8	97.6	99.8	98.2	96.7	98.5	97.0	98.1	98.8	97.7	98.0	98.3	99.4
	2009	93.6	93.9	93.7	94.0	93.5	92.3	96.0	93.0	94.3	95.5	94.5	94.6	94.4	98.8
	2010	96.8	96.5	95.9	98.4	96.7	94.7	97.8	95.6	97.3	97.9	97.0	96.9	97.1	99.0
	2011	100.9	100.5	99.4	100.8	100.4	98.9	102.5	100.1	100.9	101.3	101.1	100.6	100.6	99.7
Real investment	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	99.4	101.3	105.6	98.6	94.8	100.5	100.6	98.5	102.4	103.8	100.0	99.5	102.6	98.1
	2009	102.0	104.8	113.0	96.2	92.4	102.4	100.0	98.9	107.3	108.8	101.5	100.7	107.6	95.9
	2010	109.4	112.0	122.2	101.7	93.9	108.8	105.5	104.3	115.7	115.0	107.6	104.9	115.3	98.3
	2011	121.8	123.7	134.5	112.6	104.5	120.3	113.0	115.9	127.7	124.9	120.5	114.8	127.6	108.2

Table C2 – Domestic income and savings – Crisis without recovery plan

(2007 = 100 for positive values; 2007 = -100 for negative values)

		AfriSS	AsPaDev	ChinaHK	EU15	EUplus	India	Japan	LAmDev	MENA	RoAsia	RoLAm	RoW	Transit	USA
	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	101.0	102.7	105.3	91.8	101.6	103.3	97.3	100.7	102.2	103.2	100.8	100.1	103.2	94.3
Household income	2009	101.5	104.1	109.6	92.6	102.7	105.3	94.8	100.8	104.1	104.6	101.0	99.4	104.9	92.1
	2010	110.6	112.9	121.3	95.2	109.3	115.3	101.1	108.3	113.8	112.5	107.0	105.0	114.3	97.2
	2011	122.1	124.4	136.4	110.6	118.0	128.2	110.8	118.8	125.7	122.8	116.0	113.3	126.0	111.6
	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	101.2	103.0	105.5	92.8	94.9	102.6	97.8	100.5	102.5	103.6	101.4	100.5	102.6	93.0
Government income	2009	101.5	104.2	109.7	92.6	79.9	104.1	95.7	99.7	104.3	105.5	101.6	99.8	104.0	88.6
	2010	111.0	114.3	121.7	95.7	85.6	113.3	102.0	108.1	114.1	113.9	109.2	105.5	114.6	91.1
	2011	123.2	127.4	137.1	109.5	96.0	125.9	111.6	120.4	126.1	124.7	120.3	113.7	127.7	102.7
	2007	100.0	100.0	100.0	-100.0	100.0	100.0	100.0	-100.0	100.0	100.0	-100.0	-100.0	100.0	-100.0
	2008	100.9	103.4	106.9	-82.7	110.4	103.5	119.7	-102.8	104.4	104.6	-102.5	-103.9	104.8	-81.7
Household savings	2009	100.3	104.6	112.8	-78.3	135.6	105.8	119.7	-103.3	107.5	107.6	-103.1	-103.8	107.6	-81.1
	2010	112.8	116.0	126.7	-84.6	136.2	117.2	126.5	-114.9	118.8	117.0	-111.8	-110.3	119.2	-79.8
	2011	129.2	131.3	143.6	-108.6	138.6	131.4	113.3	-129.4	131.5	128.2	-123.1	-115.3	132.7	-95.6
	2007	100.0	100.0	100.0	100.0	-100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	79.6	97.8	98.2	83.8	-121.8	39.3	90.8	95.1	84.3	101.9	99.6	96.7	96.7	83.4
Government savings	2009	51.9	90.2	90.8	81.2	-161.9	-44.3	82.0	87.2	62.3	98.9	96.9	90.6	89.3	71.8
	2010	81.1	105.6	105.2	85.1	-165.7	-32.2	95.9	99.2	91.7	112.9	107.0	99.9	107.6	74.2
	2011	126.4	128.5	128.5	110.2	-161.6	17.7	119.0	119.5	134.3	132.4	123.1	115.1	132.8	94.4
	2007	100.0	100.0	100.0	100.0	-100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	87.6	99.4	105.6	85.5	-149.8	97.8	99.6	91.6	100.7	103.9	96.8	96.0	101.3	86.8
Domestic savings	2009	70.0	94.2	109.5	85.5	-226.4	92.4	93.5	80.0	99.3	105.2	91.0	89.3	99.7	53.9
	2010	93.0	108.5	123.5	85.8	-237.9	103.8	105.2	92.2	113.9	115.9	102.6	98.8	114.3	63.4
	2011	127.4	129.3	141.4	112.6	-218.0	121.3	117.2	115.1	132.1	129.3	123.2	115.1	132.7	92.2

Table C3 – Trade and current account balances – Crisis without recovery plan

(2007 = 100 for positive values; 2007 = -100 for negative values)

		AfriSS	AsPaDev	ChinaHK	EU15	EUplus	India	Japan	LAmDev	MENA	RoAsia	RoLAm	RoW	Transit	USA
Fisher index of export prices	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	96.0	97.2	96.8	99.4	97.5	96.8	98.7	96.0	96.0	98.0	96.7	96.9	96.6	99.6
	2009	91.8	93.3	92.5	94.5	93.0	92.6	96.0	92.0	91.7	94.4	93.0	93.1	92.3	97.4
	2010	96.3	96.1	94.3	98.5	96.2	95.2	98.4	95.6	96.2	97.0	96.0	96.3	96.5	99.7
	2011	101.7	100.1	97.6	101.1	100.2	99.1	102.4	100.8	101.3	100.8	100.6	100.9	101.1	101.5
Fisher index of import prices	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	98.7	98.5	99.0	98.1	99.6	98.0	97.2	98.4	99.3	98.9	99.0	99.5	99.2	96.9
	2009	94.7	94.9	95.9	93.2	94.7	94.1	93.0	95.0	95.5	95.6	96.2	95.9	95.2	93.1
	2010	98.4	98.1	99.3	96.8	98.7	98.1	95.8	98.1	99.3	98.5	98.9	98.8	99.2	95.3
	2011	101.7	101.7	103.1	100.4	101.1	102.2	99.5	101.3	102.4	101.7	101.6	100.8	102.4	99.2
Fisher index of export volume	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	104.3	105.5	107.6	91.3	103.0	107.5	99.1	104.3	104.7	103.8	102.9	101.9	104.5	94.8
	2009	107.7	110.7	115.6	97.5	106.3	114.5	98.1	108.0	109.2	108.1	105.6	103.9	108.9	89.0
	2010	111.9	116.3	125.0	95.5	109.9	121.8	103.6	112.0	114.2	113.3	109.0	107.0	114.4	96.4
	2011	117.6	122.4	135.4	108.7	114.4	128.8	107.3	116.5	120.8	119.5	113.4	111.1	121.5	111.8
Fisher index of import volume	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	101.0	103.0	103.8	94.9	99.6	102.6	99.9	99.9	101.4	103.3	99.2	99.2	102.5	98.6
	2009	105.7	107.9	109.7	97.6	103.3	107.8	102.6	102.7	106.7	107.7	101.3	101.8	108.3	103.3
	2010	110.4	113.3	115.8	99.5	105.7	111.9	106.9	107.3	111.9	112.8	105.7	104.8	113.0	104.4
	2011	119.3	121.4	124.8	111.2	113.3	120.1	116.3	116.7	121.1	120.3	116.2	113.1	121.6	112.1
Value of exports	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	100.2	102.5	104.2	90.8	100.4	104.0	97.8	100.2	100.5	101.6	99.5	98.8	101.0	94.4
	2009	98.9	103.3	107.0	92.2	98.9	106.0	94.1	99.4	100.2	102.1	98.2	96.8	100.6	86.7
	2010	107.8	111.7	117.9	94.1	105.7	116.0	101.9	107.0	109.8	109.9	104.7	103.0	110.4	96.1
	2011	119.5	122.4	132.1	110.0	114.7	127.6	109.9	117.4	122.3	120.4	114.1	112.1	122.9	113.5
Value of imports	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	103.0	103.8	106.5	89.5	102.6	105.3	96.3	102.7	103.9	102.6	102.0	101.3	103.6	91.9
	2009	102.0	105.1	110.9	90.9	100.7	107.8	91.2	102.6	104.3	103.3	101.6	99.7	103.7	82.8
	2010	110.1	114.0	124.1	92.5	108.4	119.5	99.3	109.8	113.4	111.7	107.8	105.7	113.5	91.9
	2011	119.6	124.4	139.6	109.2	115.7	131.6	106.8	118.1	123.7	121.6	115.2	112.0	124.4	111.0
Current account balance	2007	-100.0	-100.0	100.0	-100.0	-100.0	-100.0	100.0	-100.0	100.0	100.0	100.0	100.0	100.0	-100.0
	2008	-85.1	-41.6	117.8	-431.1	-92.4	-75.4	105.9	-82.7	105.6	106.4	322.4	188.1	105.6	-101.2
	2009	-136.6	-53.6	126.8	132.9	-96.5	-72.0	100.7	-86.6	101.5	107.7	218.5	39.2	99.2	-124.8
	2010	-120.7	-48.1	151.1	-436.3	-100.3	-68.0	111.6	-87.6	117.5	120.0	279.4	152.5	122.8	-119.6
	2011	-135.7	-100.2	172.1	-375.0	-118.2	-91.6	101.6	-116.0	131.0	129.3	-97.6	-43.3	140.6	-123.7
Total savings	2007	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	2008	97.1	99.1	103.1	98.4	93.0	97.1	99.1	95.5	100.4	102.6	97.7	97.6	100.9	97.5
	2009	95.4	98.4	106.0	90.4	86.4	94.5	96.0	92.0	101.2	104.0	95.9	95.2	101.6	94.8
	2010	105.8	108.0	117.2	100.1	90.8	103.0	103.1	99.6	112.6	112.6	104.4	101.7	111.9	97.3
	2011	122.8	124.3	133.6	113.6	104.9	119.0	115.9	116.1	128.8	126.5	121.8	115.5	128.3	107.9

Table C4 – Fisher quantity index of bilateral trade flows – Crisis without recovery plan

Index (2007 = 100)

		DESTINATION												
	ORIGIN	AfriSS	AsPaDev	ChinaHK	EU15	EUplus	India	Japan	LAmDev	MENA	RoAsia	RoLAm	RoW	Transit	USA
2008	AfriSS	106.7	106.8	109.7	93.3	105.5	109.1	100.1	107.9	106.9	104.8	105.8	104.9	106.3	95.8
	AsPaDev	107.3	107.0	109.8	93.3	105.6	109.1	100.1	108.1	107.7	104.8	106.1	105.0	106.3	95.5
	ChinaHK	109.5	108.6	111.6	94.1	106.9	110.2	101.2	109.6	109.5	106.2	107.8	106.7	108.1	96.7
	EU15	102.2	103.6	106.3	90.1	101.7	105.7	97.0	103.7	102.6	101.6	101.6	101.2	101.3	92.5
	EUplus	108.3	108.5	111.2	94.4	106.7	111.0	101.1	109.0	108.3	105.9	107.5	106.3	107.3	96.1
	India	107.9	106.3	109.1	92.9	104.6		99.3	107.6	107.6	104.2	106.1	104.2	105.5	94.8
	Japan	102.9	103.2	106.3	90.4	102.4	105.6		104.3	102.5	101.6	102.0	100.9	102.6	92.5
	LAmDev	106.0	106.0	108.6	92.3	104.3	108.4	99.1	106.6	106.1	103.7	104.8	103.8	104.9	94.4
	MENA	107.6	108.2	110.9	94.3	106.3	110.4	101.2	108.7	107.9	105.9	106.8	105.8	107.2	97.1
	RoAsia	107.6	108.1	111.3	94.1	107.0	110.5	101.3	109.0	107.3	106.2	106.9	105.8	107.5	96.2
	RoLAm	106.5	107.3	110.1	93.2	105.6	109.6	100.1	107.6	106.9	105.0	105.9	104.8	106.1	95.3
	RoW	107.7	107.7	110.7	94.0	106.1	110.4	101.1	108.4	107.2	105.6	106.9	105.7	106.9	96.1
	Transit	108.6	108.9	111.5	94.8	106.7	110.9	101.8	109.3	108.7	106.6	107.6	106.6	107.5	97.3
	USA	100.3	102.4	105.1	89.3	101.0	104.8	95.8	101.6	101.0	100.5	101.2	100.0	101.3	
2009	AfriSS	111.5	111.8	117.7	100.7	110.4	116.2	98.2	112.8	112.7	108.2	108.5	107.5	111.7	90.1
	AsPaDev	113.5	113.2	119.2	101.8	111.7	117.6	99.2	114.2	115.1	109.5	110.2	108.9	113.1	90.5
	ChinaHK	116.9	116.8	123.1	104.5	114.9	120.4	101.6	117.4	118.2	112.5	113.6	112.5	116.6	92.8
	EU15	103.1	106.0	111.3	95.2	104.0	109.9	92.7	105.2	104.4	102.3	101.3	101.0	103.1	84.5
	EUplus	111.1	111.5	117.0	99.8	109.4	115.9	96.9	111.6	111.6	107.0	108.1	106.6	111.2	88.0
	India	112.8	111.6	117.6	102.0	110.0		97.7	112.8	113.9	108.1	109.3	107.3	111.4	89.0
	Japan	105.4	106.8	113.5	97.1	106.8	111.6		107.7	104.7	104.3	102.7	102.1	106.6	86.2
	LAmDev	111.7	112.0	117.4	100.2	110.0	116.5	97.9	112.1	112.2	107.9	108.4	107.2	111.4	89.0
	MENA	113.5	114.5	120.0	102.7	112.2	118.5	100.1	115.1	114.2	110.3	110.4	109.3	113.4	92.9
	RoAsia	113.6	115.1	121.8	103.6	114.1	119.8	101.0	115.5	114.1	111.7	111.2	110.2	114.8	91.2
	RoLAm	112.8	114.8	120.6	102.5	112.6	119.2	100.0	114.4	114.6	110.5	110.7	109.5	113.8	90.6
	RoW	113.0	113.3	119.7	102.1	111.9	118.4	99.8	113.6	112.7	109.8	110.1	108.8	112.6	90.2
	Transit	114.0	114.8	120.3	102.9	112.3	118.8	100.4	114.8	114.8	110.7	110.8	109.8	113.5	92.2
	USA	102.3	108.1	113.8	97.0	106.6	112.5	94.6	104.5	104.8	104.6	103.8	102.7	106.7	
2010	AfriSS	117.4	119.3	130.1	100.0	115.4	125.3	105.7	119.6	118.9	115.1	114.9	113.4	118.8	98.9
	AsPaDev	117.4	119.4	130.4	99.8	115.4	125.5	105.6	119.7	119.4	115.3	115.1	113.2	118.5	98.4
	ChinaHK	120.1	124.1	135.5	102.8	119.3	129.4	109.0	123.2	123.0	119.5	118.5	117.2	122.2	101.5
	EU15	107.9	112.3	121.9	93.5	107.6	117.6	99.0	110.6	110.2	108.4	106.5	105.3	109.0	92.3
	EUplus	116.2	119.1	129.2	98.9	114.3	125.0	104.3	117.7	118.2	114.1	113.9	112.2	116.5	96.8
	India	116.4	118.2	129.2	99.2	114.1		104.6	118.5	118.9	114.3	113.9	112.0	117.4	97.5
	Japan	108.7	111.6	122.1	93.8	108.5	117.8		111.3	109.3	108.3	106.2	104.9	110.7	92.3
	LAmDev	116.0	117.9	127.8	98.1	113.1	123.8	103.8	116.7	117.9	113.2	113.2	111.3	116.8	96.5
	MENA	119.9	122.8	133.3	102.3	117.8	128.6	108.2	122.0	121.4	118.1	117.3	115.7	121.0	101.7
	RoAsia	117.2	121.0	132.3	100.7	116.8	127.2	106.7	120.0	118.5	117.0	115.7	113.8	119.8	98.8
	RoLAm	116.7	120.1	130.1	99.3	114.7	125.8	105.1	118.5	119.4	115.1	114.8	112.9	118.4	97.7
	RoW	116.6	118.5	129.2	99.0	114.2	124.9	105.0	117.6	117.3	114.4	114.4	112.1	117.1	97.3
	Transit	119.9	123.0	133.3	102.3	117.8	128.8	108.2	121.5	122.2	118.3	117.9	116.0	120.4	101.2
	USA	105.2	110.3	119.8	92.0	106.2	116.0	97.2	107.0	108.3	106.4	105.8	103.7	108.8	

Table C5 – Fisher price index of bilateral trade flows – Crisis without recovery plan

Index (2007 = 100)

		DESTINATION													
	ORIGIN	AfriSS	AsPaDev	ChinaHK	EU15	EUplus	India	Japan	LAmDev	MENA	RoAsia	RoLAm	RoW	Transit	USA
2008	AfriSS	97.4	97.6	97.5	100.2	98.3	97.3	99.0	97.8	96.9	98.2	97.7	98.1	97.9	99.8
	AsPaDev	96.9	97.5	97.5	100.2	98.3	97.3	99.1	97.9	96.7	98.3	97.5	97.9	97.7	99.7
	ChinaHK	96.9	98.1	98.1	100.5	98.7	97.4	99.5	98.0	97.3	98.8	97.6	98.2	97.8	100.0
	EU15	95.5	96.7	96.5	99.0	97.1	96.4	98.1	96.2	95.6	97.4	96.1	96.7	95.6	98.9
	EUplus	97.7	98.3	98.0	100.6	98.7	98.0	99.5	97.9	98.0	98.7	98.0	98.6	97.1	100.2
	India	96.5	97.2	97.3	99.7	98.1	97.1	98.8	97.5	96.6	98.0	97.2	97.7	97.6	99.7
	Japan	95.8	96.4	96.5	99.2	97.3	96.3	97.1	96.4	94.7	97.2	96.0	96.3	96.5	98.7
	LAmDev	96.7	97.5	97.2	99.9	97.9	97.2	98.7	96.9	97.3	97.9	97.4	97.7	96.7	99.3
	MENA	97.4	98.1	97.8	100.5	98.5	97.8	99.4	97.7	97.8	98.7	97.8	98.4	98.0	100.3
	RoAsia	97.1	98.0	97.9	100.6	98.8	97.8	99.5	97.8	96.3	98.8	97.8	98.1	98.2	100.1
	RoLAm	96.2	97.9	97.7	100.2	98.4	97.6	99.1	97.2	97.0	98.4	97.6	98.0	97.7	99.7
	RoW	97.7	97.8	97.8	100.4	98.5	97.8	99.4	97.6	96.9	98.5	98.1	98.3	97.6	100.0
	Transit	97.7	98.3	98.0	100.7	98.7	97.8	99.7	97.9	98.2	98.9	98.3	98.8	97.5	100.6
	USA	94.4	96.4	96.2	98.7	96.9	96.1	97.6	94.8	95.0	97.0	96.2	96.5	96.2	97.1
2009	AfriSS	93.4	93.6	93.1	95.6	94.2	93.0	96.0	93.9	93.0	94.4	94.0	94.5	93.8	97.7
	AsPaDev	93.5	93.9	93.4	96.0	94.6	93.4	96.3	94.3	93.1	94.8	94.2	94.6	94.0	97.8
	ChinaHK	93.9	94.9	94.5	96.8	95.5	94.0	97.2	94.9	94.1	95.7	94.8	95.3	94.6	98.5
	EU15	90.6	92.0	91.4	93.7	92.4	91.4	94.2	91.5	90.6	92.8	91.6	92.2	90.6	95.9
	EUplus	93.1	93.6	92.9	95.3	93.9	93.0	95.7	93.4	93.4	94.2	93.7	94.3	92.6	97.3
	India	92.8	93.4	93.0	95.1	94.1	93.0	95.9	93.7	92.7	94.2	93.7	94.2	93.7	97.5
	Japan	91.4	92.1	91.9	94.5	93.2	91.8	93.3	92.2	89.9	93.3	91.8	92.2	92.1	96.2
	LAmDev	93.1	93.7	93.0	95.5	94.1	93.2	95.9	93.3	93.5	94.3	94.0	94.2	93.0	97.3
	MENA	93.7	94.3	93.7	96.1	94.7	93.7	96.6	94.1	94.0	95.1	94.3	95.0	94.1	98.6
	RoAsia	93.6	94.5	94.1	96.6	95.3	94.0	96.9	94.4	92.5	95.5	94.6	94.8	94.6	98.3
	RoLAm	92.9	94.5	93.9	96.3	94.9	93.9	96.6	93.9	93.6	95.2	94.5	94.9	94.3	98.0
	RoW	93.8	94.0	93.6	96.1	94.6	93.7	96.5	93.8	92.9	94.9	94.5	94.8	93.7	97.9
	Transit	93.9	94.4	93.7	96.3	94.7	93.7	96.7	94.1	94.3	95.2	94.7	95.3	93.6	98.8
	USA	90.0	92.6	92.1	94.5	93.1	92.1	94.8	90.6	90.6	93.5	92.6	92.9	92.3	99.6
2010	AfriSS	97.4	96.9	95.7	100.0	97.7	96.2	99.0	97.3	97.5	97.6	97.7	98.0	97.2	100.5
	AsPaDev	97.9	97.2	95.8	99.9	97.7	96.4	99.0	97.3	97.8	97.7	97.9	98.1	97.4	100.3
	ChinaHK	99.2	98.3	97.0	100.9	98.8	97.8	100.1	98.5	98.7	98.7	99.2	99.3	98.7	101.4
	EU15	95.1	94.8	93.6	97.8	95.6	94.1	96.9	95.0	94.9	95.5	95.4	95.8	95.0	98.2
	EUplus	97.2	96.7	95.4	99.6	97.5	96.1	98.6	96.9	96.9	97.1	97.5	97.7	97.4	99.8
	India	98.1	97.0	95.5	99.8	97.4	96.6	98.7	97.1	97.6	97.4	97.9	97.8	96.9	100.0
	Japan	95.3	95.0	93.7	97.9	95.7	94.3	96.8	95.2	95.0	95.6	95.5	95.8	95.1	98.2
	LAmDev	97.3	96.4	95.1	99.3	97.0	95.7	98.4	96.8	96.7	97.0	97.2	97.5	97.2	99.7
	MENA	98.2	97.8	96.4	100.8	98.4	97.0	99.8	97.9	97.9	98.4	98.6	98.8	98.0	101.3
	RoAsia	97.8	97.5	96.2	100.2	98.1	96.7	99.4	97.6	97.6	98.0	98.0	98.3	97.6	100.5
	RoLAm	98.1	96.9	95.6	99.8	97.5	96.2	98.9	97.4	97.5	97.5	97.8	98.0	97.2	100.1
	RoW	97.1	96.8	95.4	99.7	97.5	96.0	98.8	97.0	97.0	97.3	97.4	97.7	97.1	100.0
	Transit	98.2	97.8	96.5	100.8	98.5	97.1	99.8	98.0	97.9	98.4	98.5	98.7	98.2	101.2
	USA	94.6	94.3	93.1	97.2	95.0	93.6	96.3	94.4	94.4	94.9	94.9	95.3	94.5	97.8

Table C5 – Value index of bilateral trade flows – Crisis without recovery plan

Index (2007 = 100)

		DESTINATION													
	ORIGIN	AfriSS	AsPaDev	ChinaHK	EU15	EUplus	India	Japan	LAmDev	MENA	RoAsia	RoLAm	RoW	Transit	USA
2008	AfriSS	103.9	104.3	107.0	93.5	103.7	106.1	99.1	105.5	103.6	102.9	103.4	102.9	104.1	95.6
	AsPaDev	104.0	104.3	107.0	93.5	103.8	106.1	99.2	105.8	104.1	103.0	103.4	102.8	103.9	95.3
	ChinaHK	106.1	106.6	109.5	94.6	105.6	107.3	100.7	107.4	106.5	104.9	105.2	104.8	105.7	96.7
	EU15	97.5	100.2	102.6	89.2	98.7	101.9	95.1	99.7	98.1	98.9	97.7	97.8	96.8	91.4
	EUplus	105.8	106.7	109.0	95.0	105.3	108.7	100.6	106.8	106.2	104.5	105.4	104.9	104.1	96.3
	India	104.2	103.3	106.1	92.7	102.6		98.2	104.9	103.9	102.1	103.2	101.9	103.0	94.5
	Japan	98.6	99.5	102.5	89.7	99.7	101.7		100.5	97.1	98.8	97.9	97.2	99.0	91.3
	LAmDev	102.5	103.3	105.5	92.2	102.1	105.4	97.8	103.3	103.2	101.6	102.1	101.4	101.4	93.8
	MENA	104.8	106.1	108.5	94.8	104.7	108.0	100.6	106.2	105.6	104.5	104.4	104.1	105.0	97.4
	RoAsia	104.5	105.9	109.0	94.7	105.7	108.0	100.8	106.6	103.3	104.9	104.6	103.7	105.6	96.3
	RoLAm	102.5	105.1	107.5	93.3	103.8	106.9	99.2	104.6	103.7	103.3	103.3	102.7	103.7	95.0
	RoW	105.2	105.4	108.3	94.4	104.5	107.9	100.4	105.9	103.9	104.1	104.8	103.9	104.4	96.2
	Transit	106.1	107.0	109.2	95.5	105.3	108.4	101.5	107.0	106.7	105.4	105.8	105.3	104.9	97.9
	USA	94.7	98.7	101.0	88.2	97.8	100.7	93.6	96.3	95.9	97.4	97.4	96.5	97.4	
2009	AfriSS	104.2	104.7	109.5	96.3	104.0	108.1	94.2	105.9	104.8	102.1	102.0	101.6	104.8	88.0
	AsPaDev	106.1	106.3	111.4	97.8	105.7	109.9	95.5	107.6	107.2	103.7	103.8	103.1	106.3	88.4
	ChinaHK	109.7	110.9	116.3	101.1	109.7	113.2	98.8	111.3	111.2	107.7	107.7	107.2	110.3	91.4
	EU15	93.5	97.5	101.7	89.2	96.1	100.5	87.4	96.2	94.6	94.9	92.8	93.1	93.4	81.1
	EUplus	103.5	104.3	108.6	95.1	102.7	107.8	92.7	104.2	104.2	100.7	101.2	100.5	102.9	85.6
	India	104.7	104.3	109.4	97.0	103.6		93.7	105.7	105.6	101.8	102.4	101.1	104.4	86.8
	Japan	96.3	98.4	104.3	91.8	99.5	102.4		99.3	94.0	97.3	94.3	94.2	98.2	82.9
	LAmDev	104.0	105.0	109.2	95.8	103.5	108.5	93.9	104.6	104.9	101.8	101.8	101.1	103.6	86.6
	MENA	106.4	107.9	112.4	98.7	106.3	111.1	96.7	108.3	107.3	104.9	104.1	103.8	106.7	91.6
	RoAsia	106.3	108.7	114.6	100.1	108.7	112.6	97.9	109.0	105.6	106.6	105.2	104.5	108.6	89.7
	RoLAm	104.8	108.5	113.2	98.7	106.9	112.0	96.6	107.4	107.2	105.1	104.6	103.9	107.3	88.8
	RoW	106.1	106.5	112.1	98.1	105.9	110.9	96.3	106.6	104.7	104.2	104.1	103.2	105.5	88.3
	Transit	107.1	108.4	112.8	99.1	106.4	111.3	97.1	108.0	108.3	105.4	105.0	104.6	106.3	91.0
	USA	92.1	100.1	104.8	91.7	99.3	103.6	89.8	94.7	95.0	97.8	96.2	95.4	98.4	
2010	AfriSS	114.3	115.6	124.4	100.0	112.7	120.5	104.7	116.4	115.9	112.4	112.2	111.2	115.5	99.4
	AsPaDev	114.9	116.1	124.9	99.8	112.8	121.0	104.6	116.5	116.8	112.6	112.7	111.1	115.3	98.7
	ChinaHK	119.1	121.9	131.4	103.8	117.8	126.5	109.0	121.3	121.4	118.0	117.6	116.3	120.6	102.9
	EU15	102.6	106.5	114.1	91.4	102.9	110.7	96.0	105.1	104.6	103.5	101.6	100.9	103.6	90.6
	EUplus	113.0	115.1	123.3	98.6	111.5	120.1	102.8	114.1	114.5	110.9	111.1	109.7	113.5	96.6
	India	114.2	114.7	123.4	99.0	111.1		103.2	115.1	116.1	111.4	111.5	109.5	113.7	97.5
	Japan	103.5	106.0	114.4	91.8	103.8	111.0		105.9	103.8	103.6	101.5	100.5	105.3	90.6
	LAmDev	112.9	113.6	121.5	97.4	109.8	118.4	102.2	113.0	114.0	109.9	110.0	108.5	113.6	96.3
	MENA	117.7	120.0	128.5	103.1	116.0	124.8	108.0	119.5	118.9	116.2	115.6	114.3	118.6	103.1
	RoAsia	114.6	117.9	127.3	100.9	114.5	123.0	106.0	117.1	115.6	114.7	113.4	111.9	116.9	99.3
	RoLAm	114.5	116.3	124.4	99.1	111.9	121.1	104.0	115.4	116.4	112.2	112.3	110.6	115.1	97.8
	RoW	113.3	114.8	123.3	98.7	111.3	119.9	103.7	114.0	113.7	111.3	111.4	109.6	113.7	97.2
	Transit	117.8	120.2	128.6	103.1	116.0	125.1	108.1	119.1	119.7	116.4	116.1	114.5	118.3	102.4
	USA	99.5	104.0	111.5	89.5	100.9	108.6	93.6	101.0	102.3	101.1	100.4	98.8	102.9	