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Doubling U.S. Exports Under the President's National Export Initiative: Is it Realistic? Is it Desirable?

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Abstract

President Obama's National Export Initiative is targeted at doubling U.S. exports between 2010 and 2015. We apply USAGE to quantify what the NEI would need to do to foreign import-demand curves and domestic export-supply curves to achieve this target. USAGE is a dynamic economy-wide model of the U.S. incorporating recession-relevant factor market specifications including excess capacity and wage/labor-demand elasticities that vary with the level of employment. In our central simulation, export-promotion policies compatible with the President's target reduce the cost of the current recession from about 70 million one-year jobs for the period 2008-2020 to 45 million jobs.

Key words: Export promotion; National Export Initiative; U.S. recession; Factor-market specification; Excess capacity

JEL codes: E17; C68; E62; E65; F16

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1. Introduction

In his State of the Union address in January 2010, President Obama set the goal of doubling U.S. exports in 5 years. Subsequently he announced a group of export promotion policies titled the National Export Initiative (NEI). To administer and pursue the NEI he formed the Export Promotion Cabinet (EPC). In September 2010 the EPC reported on export-promotion policies adopted under the NEI and under other initiatives of the Administration.[1] These policies can be grouped in four categories:

- ***(C1) Shifting foreign demand curves for U.S. exports*** These are policies designed to induce foreigners to buy more U.S. goods and services at any given purchasers' price. NEI and other Administration policies in this category include: U.S. sponsorship of both trade missions to foreign countries and visits to U.S. trade shows by potential foreign buyers; and streamlining of visa regulations to facilitate visits to the U.S. by foreign tourists, students and business people.
- ***(C2) Shifting U.S. export supply curves*** These are policies that reduce the cost of exporting. NEI and other policies in this category include: the granting through the Export-Import Bank of low-cost credit to small businesses in the U.S. to facilitate their export activity; provision by the government of foreign-market information to U.S. businesses together with training in dealing with foreign trade regulations; and improvement of infrastructure required for moving U.S. goods to and through ports.
- ***(C3) Pursuing trade-expanding policies in international forums*** The NEI includes reinforced efforts to remove trade barriers through new bilateral and multilateral trade agreements and through cases in the WTO designed to force compliance by foreign countries with existing agreements.
- ***(C4) Improving the macro competitiveness of the U.S. economy through cuts in public expenditure*** The EPC report is principally about micro policies. Nevertheless, it emphasizes the importance for U.S. exports of "strong, sustainable, and balanced growth". We interpret at least part of this as referring to the need to improve U.S. competitiveness (lowering the real exchange rate) through fiscal restraint.

We assume that the President's goal is in real terms: the *quantity* of U.S. exports in 2015 should be twice that in 2010. This is an ambitious target. There is no five year period after 1950 in which exports have doubled. The fastest 5-year growth was 68 per cent between 1985 and 1990.[2] Thus, it is reasonable to ask whether the President's target is realistic.

In this paper we give a partial answer. Using an economic model we quantify the extent to which policies in categories (C1) to (C4) would need to be successful to double exports in approximately five years. That is, we quantify a combination of foreign-

[1] See Export Promotion Cabinet (2010).
[2] See National Income and Product Accounts (NIPA) Table 1.1.6 available at http://www.bea.gov/national/nipaweb/SelectTable.asp?Popular=Y .

demand shift, export-supply shift, trade expansion and expenditure reduction that would deliver the President's target. We do not make a judgment on the likelihood of achieving these levels of success.

Two key points emerge from our analysis. First, export stimulation through policies in (C1) to (C3) could make a major contribution to bringing the U.S. economy rapidly to normal levels of employment. This justifies giving export promotion a prominent position in U.S. economic policy. Second, policies in (C4) implemented in the recessionary conditions prevailing in the U.S. would contribute relatively little to the aim of stimulating exports while at the same time they would delay the return to normal levels of employment.

The paper is organized as follows. Section 2 describes our model, particularly the idea of baseline and perturbation runs. The Appendix gives technical details on our treatment of factor markets. We assume that prices for labor and capital (wage and rental rates) respond sluggishly to increases in demand when there are high levels of unemployment and excess capacity. At normal levels, factor prices in our model respond relatively strongly to increases in demand. This is critical to understanding how responses generated by our model to policies in (C1) through (C4) differ between recessed and normal conditions. Our model behaves in a Keynesian manner under recessed conditions but is neo-classical under normal conditions. Section 3 describes our results. Concluding remarks are in section 4.

2. The USAGE model

2.1. Background

In conducting our simulations we use the USAGE model[3]. This is a detailed, dynamic, CGE model of the U.S. developed at the Centre of Policy Studies, Monash University, in collaboration with the U.S. International Trade Commission.[4] The theoretical structure of USAGE is similar to that of the MONASH model of Australia (Dixon and Rimmer, 2002). USAGE can be run at various levels of disaggregation. In the application reported in this paper we use a version in which there are 38 industries.

USAGE includes three types of dynamic mechanisms: capital accumulation; liability accumulation; and lagged adjustment processes. Capital accumulation is specified separately for each industry. An industry's capital stock at the start of period t+1 is its capital at the start of period t plus its investment during period t minus depreciation. Investment during period t is determined as an increasing function of the expected rate of return on the industry's capital.[5] Liability accumulation is specified for the public and foreign sectors. Public sector liability at the start of period t+1 is public sector liability at the start of period t plus the public sector deficit incurred during period t. Net foreign liabilities at the start of period t+1 are specified as net foreign liabilities at the start of period t plus the current account deficit in period t plus the effects of revaluations of assets and liabilities caused by changes in price levels and the exchange rate. As discussed in the Appendix, lagged adjustment processes are specified for the responses of

[3] U.S. Applied General Equilibrium.
[4] Prominent applications of USAGE by the Commission include USITC (2004, 2007 and 2009).
[5] The investment specification for the MONASH model, adopted in USAGE, is discussed in detail in Dixon *et al.* (2005).

wage rates and rental rates to gaps between the demand for and the supply of labor and capital.

2.2. USAGE simulations and closures: baseline and perturbation runs

In a USAGE simulation of the effects of policy and other shocks, we need two runs of the model: a baseline or business-as-usual run and a perturbation run. The two runs usually have different closures (division of variables between exogenous and endogenous). If the exogenous variables in the perturbation run are set at the same values that they had either endogenously or exogenously in the baseline, then the perturbation run produces the same results as the baseline. However, in perturbation runs we shock some of the exogenous variables away from their baseline values. The effects of these shocks are revealed as differences between the perturbation and baseline values of variables that are endogenous in the perturbation run. In this paper we have a single baseline run and 7 main perturbation runs.

Baseline run B: bland and non-recessionary

The baseline run (B) in all our simulations is a non-recessionary, business-as-usual forecast for 2008 to 2020. It is the sort of bland forecast that was available in 2007, before the financial crisis that precipitated the present U.S. recession. In generating the baseline we set most macroeconomic variables exogenously on almost smooth paths with annual growth rates in accordance with forecasts from the Bureau of Labor Statistics (2007) and the U.S. Department of Agriculture (2007). In the baseline, employment grows at about 1.1 per cent a year, GDP at 3.3 per cent, capital at 4.0 per cent, private consumption at 3.2 per cent, public consumption at 2.0 per cent, exports at 6.0 per cent, and imports at 5.6 per cent. Consumer prices grow by 2.4 per cent a year and the terms of trade move very little.

So that the macroeconomic scenario could be set exogenously, several macroeconomic shift variables were made endogenous in the baseline closure. As indicated in Table 1, these included: the average propensity to consume which adjusted to accommodate the forecast for private consumption; a confidence variable which moved the position of supply-of-funds curves to capital creators to accommodate the forecast for investment; a variable which moved export-demand curves to accommodate the forecast for exports; and an import/domestic twist in preferences which accommodated the forecast for imports.

The most difficult part of the baseline closure concerns factor markets and the price level. In our baseline for 2008 to 2010 we introduce bland forecasts for the aggregate level of employment, the real wage rate and the consumer price level. A useful framework for seeing how these forecasts are accommodated is the following stylized model:

$$Y = \left(\frac{1}{A_{prim}}\right) * F\left(K, \frac{L}{A_{lab}}\right) \qquad \text{Aggregate production function} \qquad (1)$$

$$\frac{W}{P} = \left(\frac{1}{A_{prim} * A_{lab}}\right) * F_2\left(K, \frac{L}{A_{lab}}\right) \qquad \text{Real wage equals marginal product of L} \qquad (2)$$

$$\frac{Q}{P} = \left(\frac{1}{A_{prim}}\right) * F_1\left(K, \frac{L}{A_{lab}}\right) \qquad \text{Real rental equals marginal product of K} \quad (3)$$

In this stylized model (1) relates output (Y) to capital (K) and labor (L) inputs via a constant-returns-to-scale production function, F. Movements in A_{prim} and A_{lab} can be used to introduce primary-factor-saving and labor-saving technical change. In (2) and (3) the real wage rate (W/P) and the real rental on capital (Q/P) are equated to the marginal products of labor and capital.

In the baseline Y is determined by the expenditure aggregates and K in each year is pre-determined. Exogenous values for L and W/P are then accommodated via (1) and (2) with A_{prim} and A_{lab} endogenous.[6] Given that P is exogenous in the baseline, we can then deduce W. Q can be determined from (4).

Perturbation run P1: recession and recovery

Table 2 shows growth rates in macroeconomic expenditure variables for 2008 to 2010. The left hand panel contains pre-recession forecasts, adopted in our baseline. The right hand panel shows outcomes. In our first perturbation run, P1, we set the scenario for the expenditure aggregates for 2008 to 2010 at the outcomes for these years (right hand panel). Consequently, in P1 the macroeconomic shift variables have different values from those in the baseline: the average propensity to consume moves lower in the perturbation run than in the baseline; investor confidence moves lower; export demand curves move inward; and, consistent with the often observed phenomenon of strong growth of import shares in domestic markets in the upswing and decline in the downswing, preferences twist against imports.

Aggregate employment and real wages are treated endogenously in P1 for 2008 to 2010. Correspondingly, primary-factor- and labor-saving technical changes are exogenous, and, as indicated in Table 1, they are set on their baseline paths. The bland baseline reveals developments in technology which we assume take place independently of the state of the macro economy. If we continue to assume that K is predetermined, then in terms of our stylized model L is determined via (1), W/P via (2) and Q/P via (3). However, as explained in Dixon and Rimmer (2011), this approach leads CGE models to generate highly unrealistic results for the effects of recession on factor prices. With Y strongly reduced relative to the bland baseline, if K is assumed to be still on it baseline value, then K/L is sharply increased implying a large increase in W/P and a correspondingly large decrease in Q/P. Such movements in factor prices are not generally descriptive of recessions and are certainly not descriptive of the current U.S. recession.

To achieve realistic recession effects on factor prices, we need to drop the assumption that existing capital is fully used. To this end we added sticky rental adjustment equations to USAGE perturbation computations. We also included sticky wage adjustment equations. Details of these equations are given in the Appendix. In stylized form, they can be written as:

[6] Given values for Y and W/P, (1) and (2) can be solved for A_{prim} and A_{lab} provided the production function is not Cobb-Douglas. In USAGE, the production functions are CES with substitution elasticities significantly less than one.

Table 1. Macroeconomic closure choices

	Baseline	Recession (P1)		Perturbation runs P2 to P7
	2008-2020	2008-10	2011-20	2011-20
Real consumption (C)	X, bland forecast	X, outcome	N	N
Ave. propens. to consume	N	N	X, recovery path	X, recovery path
Real investment (I)	X, bland forecast	X, outcome	N	N
Shift, supply of funds	N	N	X, recovery path	X, recovery path
Public expenditure (G)	X, bland forecast	X, outcome	X, bland forecast	X, bland forecast or shocked path
Real exports (X)	X, bland forecast	X, outcome	N	N
Shift, export demand curves	N	N	X, recovery path	X, recovery or shocked path
Real imports (M)	X, bland forecast	X, outcome	N	N
Twist, import/domestic preferences	N	N	X, recovery path	X, recovery or shocked path
Real GDP	N	N	N	N
Employment (L)	X, bland forecast	N	X, recovery path	N
Primary-factor tech change (A_{prim})	N	X, baseline	X, baseline	X, baseline
Real wage rate (W/P)	X, bland forecast	N	N	N
Labor-saving tech change (A_{lab})	N	X, baseline	X, baseline	X, baseline
Nominal wage rate (W)	N	N, sticky	N	N, sticky
Shifter in sticky wage equation	N	X, baseline	N	X, P1 path
Consumer price index	X, bland forecast	N	N	N
Exchange rate	X, bland forecast	X, Outcome	X, bland forecast	X, bland forecast

N denotes endogenous and X denotes exogenous

Table 2. Percentage growth rates in macroeconomic variables

	Pre-recession forecast			Recession outcomes		
	2008	2009	2010	2008	2009	2010
Private consumption	3.2	3.2	3.2	-0.3	-1.2	1 7
Public consumption	2.0	2.0	2.0	2.5	1.9	1.6
Investment	5.3	5.3	4.8	-7.3	-18.5	16.1
Exports	6.0	6.0	6.0	6.0	-9.5	11.9
Imports	5.6	5.6	5.6	-2.6	-13.8	14.6
GDP	3.3	3.3	3.2	-0.0	-2.5	2.9

$$\frac{W(t)}{W_b(t)} - \frac{W(t-1)}{W_b(t-1)} = \Psi\left(\frac{L(t)}{L_b(t)}\right) + \text{other terms}, \quad \Psi' \geq 0, \Psi(1) = 0$$

Sticky nominal wage, perturbation runs (4)

$$\frac{Q(t)}{Q_b(t)} - \frac{Q(t-1)}{Q_b(t-1)} = \Theta\left(\frac{KE(t)}{K(t)}\right) + \text{other terms}, \quad \Theta' \leq 0, \Theta(1) = 0$$

Sticky capital rental, perturbation runs (5)

Under (4), we specify that the ratio of the perturbation to baseline level of nominal wages (W/W_b) adjusts in a sticky fashion to the gap between the perturbation level of employment (L) and the baseline level (L_b): if the perturbation level for employment in year t is below the baseline level, we assume that the perturbation level for the nominal wage rate relative to its baseline level declines. Under (5), we specify that the ratios of the perturbation to baseline levels of nominal rentals (Q/Q_b) adjust in a sticky fashion to the gap between perturbation levels of capital in existence (KE) and capital in use (K): if the perturbation level for capital in existence in year t is above that of capital in use, we assume that the perturbation level for the nominal rental rate relative to its baseline level declines. Put another way, in (5) we assume that if there is excess capacity [(KE(t) > K(t)], then profit margins, reflected by rentals, adjust down sluggishly.

Equations (4) and (5) allow USAGE to generate recession results with realistic factor-market behavior. In terms of the stylized model, we can visualize the P1 solution for 2008-10 in the following way. With the recession levels of Y given by the expenditure aggregates, we can restrict attention to combinations of capital in use (K) and employment (L) that are compatible with the aggregate production function (1). Given these combinations, we can use the sticky wage and rental equations [(4) and (5)] to trace out a downward sloping curve between K/L and W/Q, and we can use the marginal productivity conditions [(2) and (3)] to trace out an upward sloping curve between K/L and W/Q. The intersection of these two curves determines the factor input and factor price ratios. Knowing K/L and Y is sufficient to tie down K and L. The absolute factor prices (W and Q) can be determined from equations (4) and (5), thereby determining the domestic price level.

Beyond 2010, the expenditure aggregates C, I, X and M are treated endogenously in P1 (see Table 1). The corresponding shift variables are exogenous. For 2011 we assume in

P1 that these shift variables remain at 2010 values. Then over the next five years (2012 to 2016) they return steadily to the values that they had in the baseline, that is, we assume there is a gradual return of the average propensity to consume, investor confidence, export demand curves and import/domestic preferences to normal non-recessionary levels. From 2017 onwards, the shift variables follow their baseline paths.

By 2010 employment in P1 is 9.6 per cent below its baseline forecast value. Because the role of P1 in our analysis is simply to provide the background situation in which to analyse export promotion policies, we want it to portray a typical non-controversial recovery from recession. For this reason we decided to impose on P1 a smooth recovery in employment. We assume that after 2010 employment moves gradually towards the baseline, almost reaching it by 2016. A shifter in the sticky-wage equation was used as the endogenous instrument for getting employment onto its assumed path. This is an effective instrument because with the exchange rate exogenous (Table 1), adjustments in the nominal wage rate affect U.S. competitiveness (the costs of U.S. goods in foreign currency) and thereby influence the simulated outcome for employment by affecting exports and imports.

Perturbation runs P2 to P5: effects of export promotion policies, one at a time

We conduct four perturbation runs (P2 to P5) to show the effects of policies in the four categories outlined in section 1. Each of these runs is identical to P1 for 2008 to 2010.

In P2 we illustrate the effects of (C1) policies by phasing in over five years a 15 per cent outward movement in export demand curves for all U.S. goods and services. The shift is introduced relative to the position of the export demand curves in the recessionary situation depicted in P1. That is, instead of the export-demand shift variable following the path it had in P1, it follows a path that allows exports to be 3 per cent higher at any given foreign-currency price in 2011 than they would be with the export demand curves in P1; 6 per cent higher in 2012; 9 per cent higher in 2013; 12 per cent higher in 2014; and 15 per cent higher in 2015 and beyond. All other exogenous shift variables for expenditure aggregates follow the same paths in P2 as in P1 (Table 1).

Rather than fixing the post-2010 path for employment as in P1, we allow the P2 employment path to move away from the P1 path in response to the increased demand for exports. Technically, we determine the P2 path for employment by fixing the nominal wage-shift variable on its P1 path, thereby allowing wage rates to respond in a sticky fashion to movements in aggregate employment.

In P3 we illustrate the effects of (C2) policies by phasing in over five years a "technological change" that reduces costs per unit of exports for all U.S. goods and services by 5 per cent. We adopt the same approach as in P2. Apart from the export-cost-reducing technological change, all exogenous variables in P3 follow the same paths as in P1.

P4 illustrates the effects of (C3) policies. We phase in over five years export-demand shifts and import-domestic preference twists that would expand both U.S. exports and U.S. imports by 15 per cent at any given set of prices. As with P2 and P3, apart from the relevant policy variables, all exogenous variables in P4 follow the same paths as in P1.

In P5 we illustrate the effects of (C4) policies by phasing in over five years a 10 per cent cut in public consumption and investment. Since we hold tax rates constant, this represents a significant tightening of fiscal policy.

Perturbation runs P6 and P7: effects of export promotion policies, altogether

In P6 we apply all the export-expansion shocks from P2 to P5 and find that in combination they would approximately double exports in 5 years.

As will become apparent from our results for P5, cuts in government spending in recessionary conditions have a strongly negative effect on employment. Thus it seems reasonable to delay the cuts until employment and capital utilization have returned to normal levels. In P7 we illustrate this approach by applying all the shocks from P2 to P5 but we delay the start of the phase in of cuts in public expenditure until 2015.

3. Results

3.1. Baseline and recession

Charts 1 to 6 give results for the baseline and recession runs (B and P1). For each variable we plot an index number with the 2010 value in P1 at 1.0.[7] The depth of the current recession is measured by the gaps in 2008 to 2010 between the B and P1 lines. For example, Chart 1 shows that employment measured in hours was reduced by the recession in 2010 by about 10 per cent [=100*(1/1.11-1)]. Similarly, Charts 2 and 4 show that the recessionary levels of exports and GDP in 2010 were about 10 and 9 per cent lower than the levels they would have had under non-recessionary conditions. In the case of imports and investment, the recession caused reductions in 2010 of about 18 and 24 per cent (Charts 5 and 6). Despite the sharp recession-induced reduction in investment, capital in existence in 2010 was only about 3 per cent below its non-recessionary baseline level (Chart 3). Capital in existence is a stock variable and shows a muted response to changes in investment, its flow variable. As explained in the Appendix, USAGE allows for the emergence of excess capacity in response to sharp reductions in demand for capital. While there is no excess capacity in the baseline, P1 implies that excess capacity in 2010 was about 3 per cent. This can be seen in Chart 3 where the P1 level of capital in use in 2010 is about 3 per cent below the P1 level of capital in existence.

Beyond 2010, all the variables shown in Charts 1 to 6 for the recession run move back towards their baseline paths. By 2017, the gaps between the P1 and B paths for employment and for GDP are substantially eliminated. The P1 paths for exports and capital are still below their B paths by 2020 but the gaps are small. The P1 paths for investment and imports overshoot the baseline paths. The overshoot for investment is explained by post-recession shortage of capital and the overshoot for imports is associated with strong post-recession investment and consequent real appreciation.

As can be seen from the charts, the P1 paths imply strong growth rates after 2010, consistent with catch up. Under usual definitions, this means that the recession is over by 2011. However, the charts show that the recession has been costly and will continue to be costly. Integrating the gap between the B and P1 paths in Chart 4 over the period

[7] An exception is capital in use. In Chart 3 it is capital in existence that is given a 2010 value in P1 of 1.0.

2008 to 2020 puts the cost of the recession at about 45 per cent of one year's GDP. A similar calculation applied to Chart 1 puts the cost at about 44 per cent of one year's employment, that is about 70 million one-year jobs.

A final noteworthy feature of the P1 run is the export increases to 2015 and 2016. Chart 2 shows export growth on the P1 line of 29 per cent between 2010 and 2015 and 46 per cent between 2010 and 2016. These increases are generated with no new export policies. They imply that to achieve the President's target in 2015, new export policies would need to boost exports by about 55 per cent beyond where they otherwise would have been [55 = 100*(2/1.29 -1)]. If we are prepared to tolerate a bit of slippage and wait until 2016 for exports to double, then the required boost from new policies is about 37 per cent [37= 100*(2/1.46-1)].

3.2. Effects of export-promotion policies

Charts 7 to 16 contain results for employment and exports in policy runs P2 to P6. The charts also contain baseline paths and paths from the recession run, P1. The headline results are in Charts 15 and 16. Chart 16 implies that in combination the four sets of shocks (run P6) that we have adopted to represent the impacts of policies in (C1) to (C4) would allow exports to expand by 106 per cent between 2010 and 2016, approximately meeting the President's target. Chart 15 implies that meeting the President's target in this way would make a positive but minor contribution to returning U.S. employment to non-recessionary levels over the period up to 2013. After 2013 the employment contribution of the combined policies is more substantial (the gap between the P1 and P6 paths in Chart 15 widens).

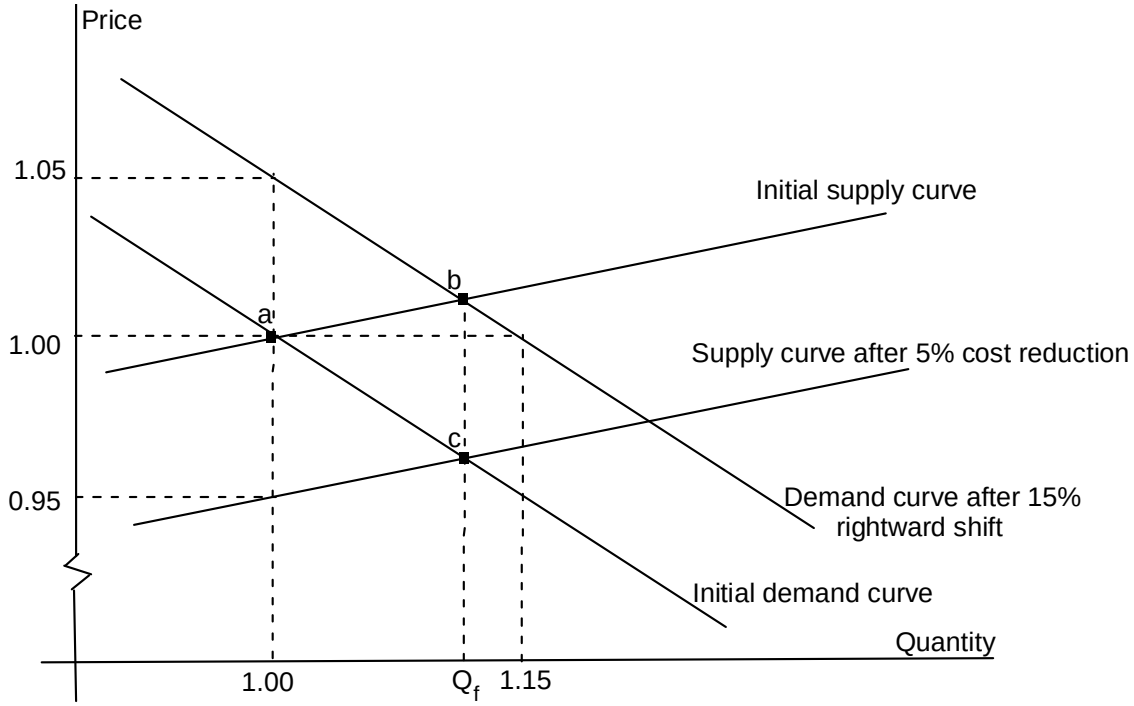
Contributions of each of the four policies to the President's export target

Charts 8, 10, 12 and 14 show that policies in each of the four categories would help achieve the President's target.

Concentrating on 2016, we see that the 15 per cent export demand shift adopted to illustrate (C1) policies elevates exports by 6.8 per cent [= 100*(1.56/1.46-1), Chart 8]. Why not 15 per cent? A little over half the effect of the horizontal demand shift is dissipated in price increases: the outward movement in export demand induces both upward movements *of* export supply curves (caused by, for example, wage increases) and upward movements *along* export supply curves (reflecting capital scarcity leading to higher rental rates).

Because export demand elasticities in USAGE are set at -3, we expected on the basis of partial equilibrium reasoning that export stimulation via a 15 per cent rightward movement in foreign demand curves (P2) would have approximately the same impact on export volumes as a 5 per cent downward movement in export supply curves (P3). This is the result suggested by a demand and supply diagram (see Figure 1). However, as shown in Chart 10, the P3 run generates a noticeably larger export expansion than P2. Whereas the demand shift induced a 6.8 per cent expansion in exports in 2016, the cost reduction induces a 12.3 per cent expansion [= 100*(1.64/1.46-1), Chart 10]. The explanation involves general equilibrium effects. In P3, less labor and capital are

Figure 1. Export demand and supply



The initial price/quantity point is at a. A 15 per cent rightward shift in the demand curve moves the price quantity point to b. A 5 per cent downward shift in the supply curve moves the price/quantity point to c. With the demand elasticity at -3, the quantity at points b and c is the same, Q_f.

required to produce any given level of exports than in P2. Extra resources available to the economy in P3 relative to P2 mean that factor costs are lowered in P3 relative to P2.[8] This is an extra downward force on the supply curve (beyond the 5 per cent assumed in P3) that operates in P3 but not in P2.

Chart 12 shows that the trade-expanding policies assumed in P4 generate an increase in exports in 2016 of 11.6 per cent [= 100*(1.63/1.46-1)]. In view of the P2 results, we can attribute approximately 6.8 percentage points of this to the 15 per cent rightward shift in export demand curves assumed in P4. The rest of the P4 expansion in exports can be attributed to the import-creating effects of the assumed twist in import-domestic preferences. Extra demand for imports in P4 lowers the U.S. real exchange rate and thereby stimulates exports.

In Chart 14, the 10 per cent cut in public expenditure assumed in P5 causes an increase in exports in 2016 of 5 per cent [= 100*(1.53/1.46-1)]. This export response may seem rather weak to people used to looking at CGE results generated under the assumption of full capacity utilization. However, we do not adopt this assumption for the recessionary conditions currently prevailing in the U.S. With excess capacity and unemployment

[8] In this context we should think of the exchange rate as the numeraire. Thus we are saying that factor costs relative to the international price level are lower in P3 than P2.

allowed for in our simulations, changes in demand for capital and labor cause muted responses in factor prices. This limits the extent of real devaluation, and the consequent increase in exports, associated with cuts in public expenditure.

Contributions of each of the four policies to employment recovery

Charts 7 and 9 indicate that (C1) and (C2) policies would help the U.S. to return speedily to baseline levels of employment. In both charts, our assumed policies raise employment strongly in the recessionary period, by 2 percentage points in 2013 for example. These employment effects reflect the Keynesian nature of our underlying assumptions. When employment is well below its baseline path, our model implies that output and employment respond strongly to increases in aggregate demand, including export demand.

In Chart 11, the employment effects of (C3) policies are quite small. The positive effect of export expansion is offset by the negative effect of import expansion.

Chart 13 again reflects Keynesian mechanisms, showing strongly negative employment effects from cuts in public expenditure. This may seem controversial: there is a considerable literature implying that cuts in public expenditure have only minor effects on employment. This literature is usually framed in terms of *increases* in public expenditure and emphasizes potential crowding-out effects on: consumption [Ricardian equivalence, Barro (1974)]; net exports [real appreciation, Mundell (1963) and Fleming (1962)]; and investment [increased interest rates]. Crowding-out arguments are developed largely in theoretical models that assume business-as-usual or steady-state conditions. Such assumptions are also adopted in the DSGE modelling literature, see for example Ratto *et al.* (2009). However, Chart 13 shows effects under recessionary conditions. In these conditions tighter fiscal policies are likely to have a more deleterious effect on employment than in business-as-usual conditions. This is illustrated in Chart 19. The low path in Chart 19 is an alternative presentation of the P5 results in Chart 13: it shows the gaps between the P5 and P1 lines expressed as percentages of the P1 levels. The other path in Chart 19 was computed by imposing the expenditure cuts as shocks to an economy that would otherwise have been evolving as in the business-as-usual baseline (run B).

With 10 per cent of government expenditure being worth 1.94 per cent of GDP, the recession results in Chart 19 imply an employment multiplier for government expenditure[9] of 1.77 (= 3.44/1.94). On the other hand, the business-as-usual results imply a multiplier of 0.43 (= 0.83/1.94). This lower multiplier is broadly consistent with the recent study by the IMF (2010) which found that a fiscal consolidation worth 1 per cent of GDP increases the unemployment rate by 0.3 percentage points. The IMF multiplier can be considered an average over a large number of consolidation episodes (time periods and countries), the bulk of which reflect non-recessionary conditions.[10] Cuts in public expenditure in non-recessionary conditions restrain wage increases thereby causing the price level to be lower than it otherwise would have been with beneficial

[9] Percentage effect on employment of an increase in government expenditure worth one per cent of GDP.

[10] The IMF study does not deal directly with the effects of recessions on multipliers. However, the study implies that multipliers are inversely related to interest rates. This is supportive of our results because interest rates are typically low in recessionary conditions.

effects for investment, exports and import-competing industries. In recessionary conditions, cuts in government spending have little restraining effect on wages and prices: there is little wage/price pressure to restrain. Consequently, in these conditions there is little to offset the direct loss of jobs generated by expenditure cuts, and much higher multipliers are realistic. As alluded to earlier, a corollary is that tight fiscal policy stimulates exports less strongly in recessed conditions than in normal conditions, see Chart 20.

Improving the employment effects by delaying the cuts in public expenditure

The results in Charts 13, 14, 19 and 20 suggest that the P5 shocks (cuts in public expenditure) could be excluded from the export promotion package (P6) with little cost on the export target and major benefits for employment. This is confirmed by the P7 run in which we delay the commencement of the public expenditure cuts until 2015. As shown in Chart 18, export growth between 2010 and 2016 is reduced from 106 per cent in P6 to 95 per cent in P7. Chart 17 shows the employment compensation allowed by this slippage on the export target. In Chart 17, the employment line for the P7 package lies well above that for the P6 package throughout the period of seriously depressed employment, up to 2014. In the long term, beyond 2016, employment performance under P6 is better than that under P7: in this period employment under P7 is damped by cuts in public expenditure. However, the P7/P6 tradeoff for employment is clearly in favor of P7. Adding up the gaps between the P7 and B lines in Chart 17 gives the cost of the recession under the P7 package at 28 per cent of a year's aggregate employment, down from 44 per cent in P1, without the package. Under P6, the cost of the recession is 32 per cent of a year's aggregate employment. The advantage of P7 over P6 would be accentuated if we weighted jobs created early in the simulation period, when jobs are desperately needed, more highly than jobs created later in the period, when the labor market is tight.

4. Concluding remarks

The U.S. is suffering from its most serious recession since the 1930s. Using the USAGE model we have traced out a picture of the economy, run P1, in which there is a natural recovery starting in 2011, with employment approximately returning to its baseline (no recession) path by 2015. Given this picture, the cost of the recession accumulated for the years 2008 to 2020 is about 44 per cent of a year's aggregate employment or 70 million one-year jobs.

Implementation of policies to achieve the President's target of doubling exports by 2015 could substantially reduce this cost. In our P7 run we found that policies implemented over the period 2011 to 2015 which

- shifted export-demand curves to the right by 15 per cent (C1),
- reduced costs per unit of exports by 5 per cent (C2), and
- generated a 15 per cent impact on exports and imports via trade agreements (C3),

would approximately double exports by 2015. At the same time they would reduce the cost of the recession to 28 per cent of a year's employment or 45 million one-year jobs, a saving of 25 million jobs. In P7, (C4) policies (cuts in public expenditure of 10 per cent) are also undertaken. However, their implementation is delayed until 2015 when employment has returned approximately to its baseline (no recession) path. Our

simulations show that tighter fiscal policies implemented when employment is well below its baseline level contribute relatively little to the goal of expanding exports while at the same time they have strongly negative effects on employment.

The value of export promotion policies in (C1) to (C3) as a means of stimulating employment is sensitive to the state of the economy. The worse the recession and the slower the natural recovery, the more valuable are these policies. In a simulation not reported in this paper we created an alternative no-policy recession scenario (P1alt) in which the start of the recovery is delayed until 2012. In this alternative scenario the cost of the recession for the period 2008 to 2020 is 55 per cent of a year's aggregate employment or 88 million one-year jobs. Implementation of the P7 package in this situation reduces the cost of the recession to 35 per cent of a year's employment or 56 million jobs, a saving of 32 million jobs.

In analyzing the President's export target, we have used a one-country model and looked at the issue purely from the point of view of the U.S. It is worth asking whether export-promotion by the U.S. to speed recovery from recession is really a 1930s beggar-thy-neighbor policy that will provoke self-defeating retaliation.

We think that retaliation is unlikely for two reasons. First, the U.S. intends to abide by bilateral and multilateral trade agreements, and provided it does this, the rest of the world may regard U.S. export promotion as a legitimate contribution to redressing global imbalances. Second, the present global downturn is less internationally pervasive and symmetric than that in the 1930s. If the U.S. and its trade partners were equally recessed then it is difficult to see how U.S. export promotion policies could be of much value even without explicit retaliation. In a symmetrically recessed world, initial increases in U.S. exports would reduce activity in other countries causing reductions in their demands for imports, eventually negating the initial increase in U.S. exports. However, with the current downturn concentrated in the U.S., a switch in demand towards the U.S. and away from the rest of the world (an increase in U.S. exports and a corresponding increase in rest-of-world imports) is likely to have a relatively large positive impact on output in the under-employed U.S. economy and only a small negative impact on output in the more fully employed rest-of-world economy. This will allow U.S. export promotion to benefit the U.S. without significant reductions in output and import demands in other countries. In our simulations, export promotion policies expand U.S. activity sufficiently to generate increases in U.S. imports that almost match the increases in U.S. exports, implying that U.S. export promotion will impose little macroeconomic adjustment on its trading partners.

Appendix: asymmetric treatment of factor markets in the USAGE model

In analyzing demand-stimulating policies such as export promotion, we need to recognize that the their effects depend on the state of the economy on which they are imposed. If there is considerable unemployment and excess capacity then demand stimulation is likely to generate strong quantity movements (increases in employment and output) and weak price movements. On the other hand, if the economy is near full employment then demand stimulation is likely to have little effect on quantities and strong effects on prices. This point is overlooked by modelers who report single number multiplier effects.

In the version of USAGE used in this paper, the responses of wages and rental rates on capital to changes in demand are dependent on the levels of unemployment and excess capacity. Thus our model shows quite different macro responses to a given policy when that policy is imposed in recessionary conditions from the responses when the policy is imposed in business-as-usual conditions.

This Appendix outlines the specifications in USAGE of wage and rental behavior. In section A1 we describe how USAGE allows, in perturbation runs, the responsiveness of wage movements to changes in employment to depend on the level of employment relative to the baseline level. In section A2 we describe how USAGE allows the responsiveness of rental movements to changes in demand for capital to depend on the level of capital utilization. By introducing conditional responsiveness of factor prices, we give USAGE the ability to differentiate between the effects of policies in recessionary conditions compared with normal conditions.

A1. Labor-market specification: asymmetric wage adjustment

In perturbation runs P1 to P7 we assume that the average wage rate for the economy adjusts according to the equation:

$$\left\{\frac{W(t)}{W_b(t)}-1\right\} = \left\{\frac{W(t-1)}{W_b(t-1)}-1\right\} + F\left(\frac{L(t)}{L_b(t)}\right) \quad . \qquad \text{(A1)}$$

In this equation the subscript b indicates a baseline value, that is, a value in the run without the policy or other shock under consideration. $W_b(t)$ and $L_b(t)$ are the wage rate and the level of employment in year t in the baseline. W(t) and L(t) are the wage rate and the level of employment in year t in the perturbation run. F is a function with a positive first derivative and a value of zero when $L(t)/L_b(t) = 1$.

Under (A1), we assume in perturbation runs that the deviation in the wage rate from its baseline level in year t will be the same as that in year t-1 if employment in year t is at its baseline level. If employment in the perturbation run in year t is above (below) its baseline level then the deviation in the wage rate will increase (decrease), driving employment back towards it baseline level.

The simplest example of an F function is

$$F\left(\frac{L(t)}{L_b(t)}\right) = \alpha * \left(\frac{L(t)}{L_b(t)}-1\right) \ , \qquad \text{(A2)}$$

where α is a positive parameter. However, for this paper we have found that (A2) leads to an unrealistically favorable picture for employment as the economy comes out of a recession. In some preliminary perturbation runs, employment during the recovery phase (2011 to 2016) moved above its baseline path by nearly as much as it had earlier (2008 to 2010) moved below its baseline path. This unrealistic result reflects the symmetric nature of (A2). For example, if α is one then wages will rise by 2 per cent when employment is 2 per cent above its baseline level and fall by 2 per cent when employment is 2 per cent below its baseline level. With the bland, close-to-NAIRU-employment baseline adopted for this paper we would expect wages to rise more than 2 per cent relative to baseline if employment were 2 per cent above baseline, which would be a very tight labor market.

On the other hand, with downward stickiness, we would expect wage rates to fall by less than two per cent relative to baseline when employment is two per cent below baseline.

To capture these asymmetric responses, we specified F according to

$$F\left(\frac{L(t)}{L_b(t)}\right)=\frac{\alpha}{\exp\left[\left(\Gamma-\frac{L(t)}{L_b(t)}\right)^{\gamma}\right]-1} \quad - \quad 1 \qquad \text{(A3)}$$

We calibrate (A3) by setting

$$\Gamma = 1.02 \qquad \text{(A4)}$$

$$F(1) = 0.00 \text{ and} \qquad \text{(A5)}$$

$$F(0.9) = -0.02. \qquad \text{(A6)}$$

These last two conditions give $\gamma = 0.007192$ and $\alpha = 1.643908$.

Figure A1 shows the F function with these parameter values. Condition (A4) imposes an upper bound on the employment deviation in the positive direction of 2 per cent. Condition (A5) ensures that the wage deviation is constant if employment is at its baseline value. Condition (A6) limits the fall in wages relative to baseline to 2 per cent when employment is 10 per cent below its baseline value.

A2. Capital-market specification: asymmetric rental adjustment and excess capacity

Most CGE calculations are conducted under the assumption of full capacity utilization. It is assumed that the rental rate on capital in each industry adjusts in each year to ensure that demand for capital equals the supply of capital. The supply of capital is predetermined, and depends on investment in previous years. Dixon and Rimmer (2011) demonstrate that this approach is unsuitable for perturbation runs designed to simulate the onset of a serious recession or the effects of policy changes in recessionary conditions. They show that the full capacity assumption leads to unrealistically large simulated reductions in rental rates in response to reductions in demands for capital of the magnitude that are evident in the current U.S. recession. Unrealistic reductions in rentals generate unrealistic reductions in the real exchange rate which in turn lead to unrealistic simulated responses for exports and imports.

To solve this problem, Dixon and Rimmer introduced a sticky adjustment specification for rental rates in perturbation runs. Under this specification, full capacity utilization is maintained in an industry when there is a sharp fall in demand for capital only if this is possible with no more than a limited fall in the rental rate. If an unrealistically large fall in the rental rate would be required to maintain full capacity utilization then capital in use (KU) drops below capital in existence (KE). Figure A2 is an illustration of the Dixon/Rimmer specification.

In mathematical terms, the sticky rental specification adopted for the current paper is as follows:

Figure A1. Asymmetric wage adjustment function, $F[L(t)/L_b(t)]$

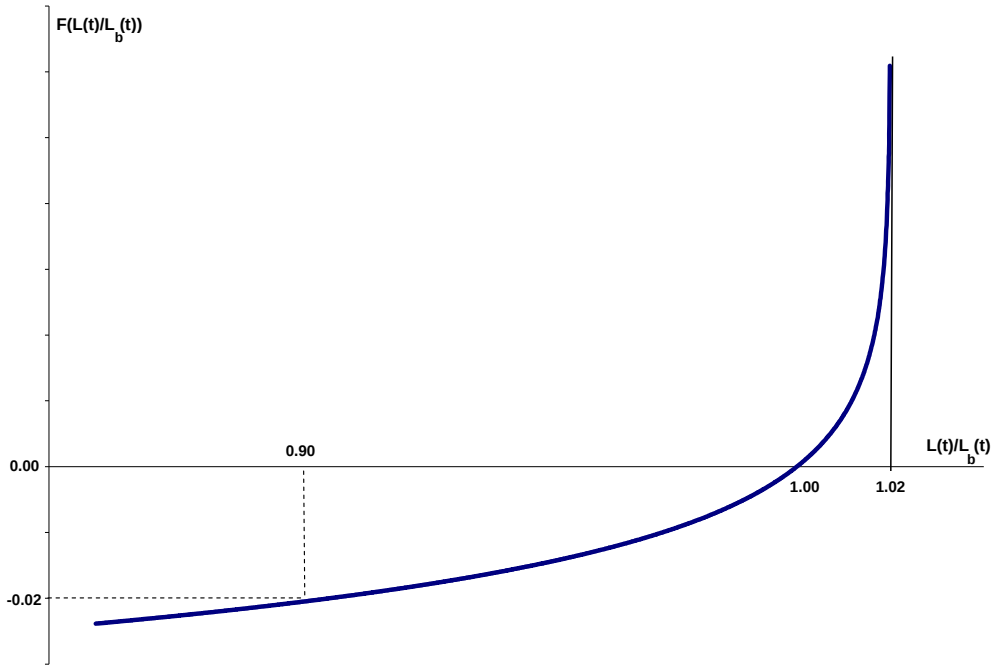
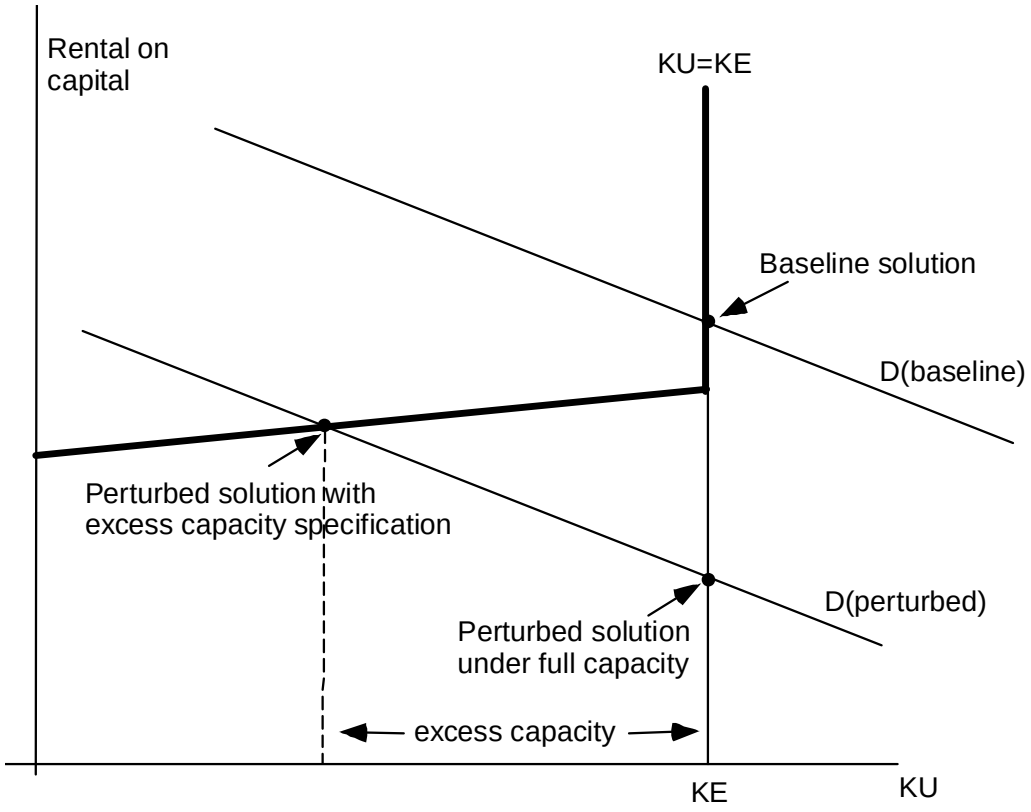


Figure A2. Demand and supply curves for capital: effects of a reduction in demand



$$\left\{\frac{Q(j,t)}{Q_b(j,t)}-1\right\}=\left\{\frac{Q(j,t-1)}{Q_b(j,t-1)}-1\right\}-\beta*EXC(j,t)-MF(j,t)+S(j,t)\quad \text{for all t,} \qquad (A7)$$

$$EXC(j,t)=\frac{KE(j,t)}{KU(j,t)}-1 \qquad \text{for all t,} \qquad (A8)$$

$$MF(j,t)=500*\left(\frac{RQ(j,t)}{RQ_b(j,t)}-1\right)+FMF(j,t) \qquad \text{for all t,} \qquad (A9)$$

$$Q(j,t)=n_j\left(KU(j,t),...\right) \qquad \text{for all t} \qquad (A10)$$

$$EXC(j,t)\geq 0,\quad S(j,t)\geq 0,\quad EXC(j,t)*S(j,t)=0 \qquad \text{for all t,} \qquad (A11)$$

$$MF(j,t)-0.05\geq 0,\quad FMF(j,t)\geq 0,\quad \left(MF(j,t)-0.05\right)*FMF(j,t)=0 \quad \text{for all t,} \qquad (A12)$$

where

$Q(j,t)$ and $Q_b(j,t)$ are the rental rate on capital in industry j in year t in the perturbation and baseline runs;

$EXC(j,t)$ is excess capacity in industry j in year t;

$MF(j,t)$ is a variable that limits the fall between years t-1 and t in rental in the perturbation run relative to baseline;

$RQ(j,t)$ and $RQ_b(j,t)$ are the perturbation and baseline values of the real rental on capital in industry j and year t, defined as rental rate deflated by the price of a unit of capital;

n_j is the demand function for capital inverted to express the rental as a decreasing function of capital in use;

β is a positive parameter; and

$S(j,t)$ and $FMF(j,t)$ are complementary slack variables whose role will be defined shortly.

For understanding (A7) to (A12) a good starting strategy is to ignore (A9) and assume that $MF(j,t)$ is a parameter set at 0.05. Then consider two possibilities. The first possibility is that there is no excess capacity, $KU(j,t) = KE(j,t)$. With $KU(j,t)$ given in this way, the rental rate $Q(j,t)$ can be determined from the demand curve for capital, (A10). Once we know $Q(j,t)$ we can check to see if (A7) is satisfied with a non-negative value for $S(j,t)$. If so, we can conclude that industry j will operate at full capacity in year t. If not, then we must consider the other possibility, that $KU(j,t) < KE(j,t)$. In this case we must set $S(j,t)$ at zero, see (A11). Then starting $KU(j,t)$ at $KE(j,t)$ we can consider successively lower values. As we lower $KU(j,t)$ the left hand side of (A7) rises and the right hand side falls. In this way the $KU(j,t)$ satisfying (A7) can be determined. Notice that (A7) does not limit the extent to which rental rates can increase when capital is fully used. What it does is to limit the extent to which rentals can fall. With β set at a small value (we used 0.2) and $MF(j,t)$ at 0.05, (A7) limits the extent to which the rental rate in industry j can fall relative to its baseline value to a little over 5 per cent.

However, falls of more than 5 per cent are realistic if rentals are high. For example, if t-1 in the perturbation run is a year of capital scarcity in industry j, allowing a temporary elevation in profitability (reflected by a high real rental on capital), then it is realistic to

suppose that profitability can fall sharply in year t in response to an increase in capacity generated by strong investment in year t-1. We allow for this possibility by treating MF(j,t) as a variable. Its lower bound is 0.05 [see (A12)], but it will take higher values (allowing for larger falls in rental rates) if $RQ(j,t)/RQ_b(j,t)$ -1 is greater than 0.0001. In this case FMF(j,t) must be zero [see (A12)] implying that MF(j,t) > 0.05. Thus if RQ(j,t) is significantly higher than $RQ_b(j,t)$, then rentals can fall sharply without necessitating excess capacity.

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Chart 1. Baseline (B) and Recession (P1): employment

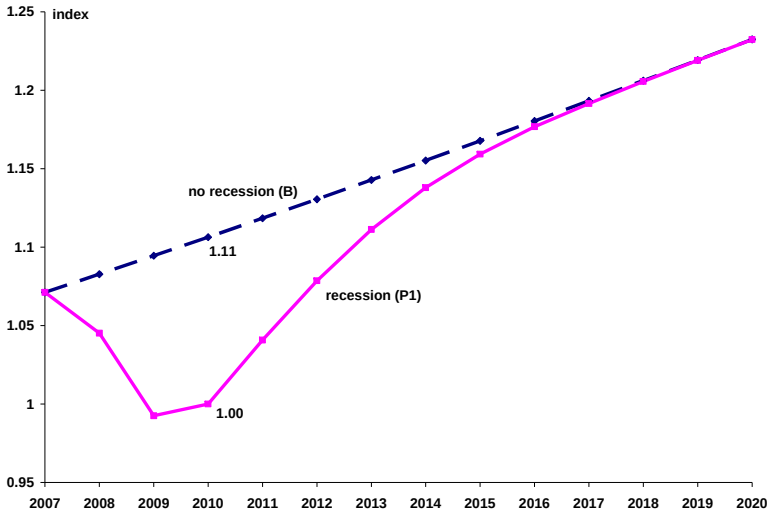

Chart 2. Baseline (B) and Recession (P1): exports

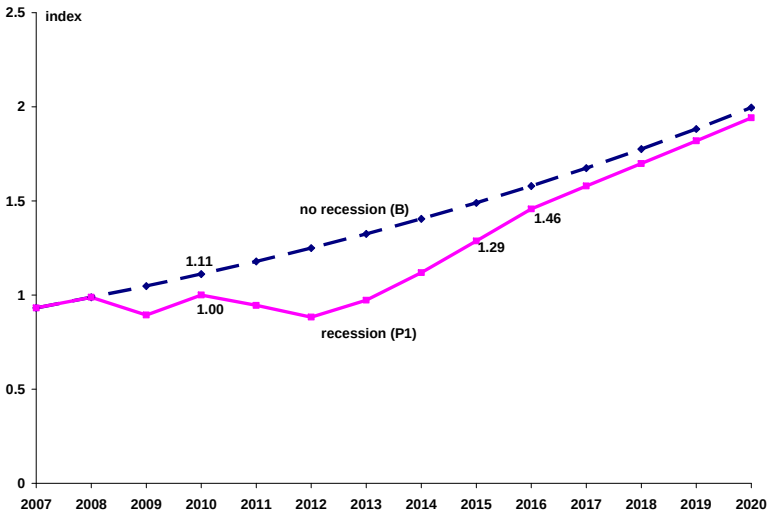

Chart 3. Baseline (B) and Recession (P1): capital

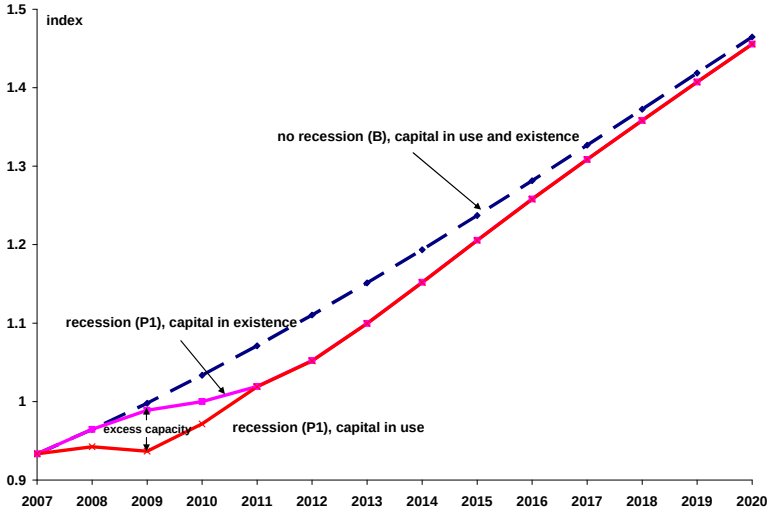

Chart 4. Baseline (B) and Recession (P1): GDP

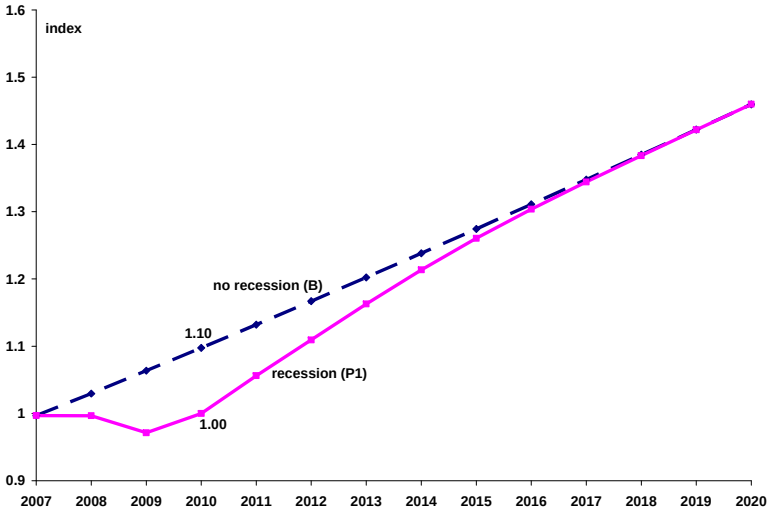

Chart 5. Baseline (B)and Recession (P1): imports

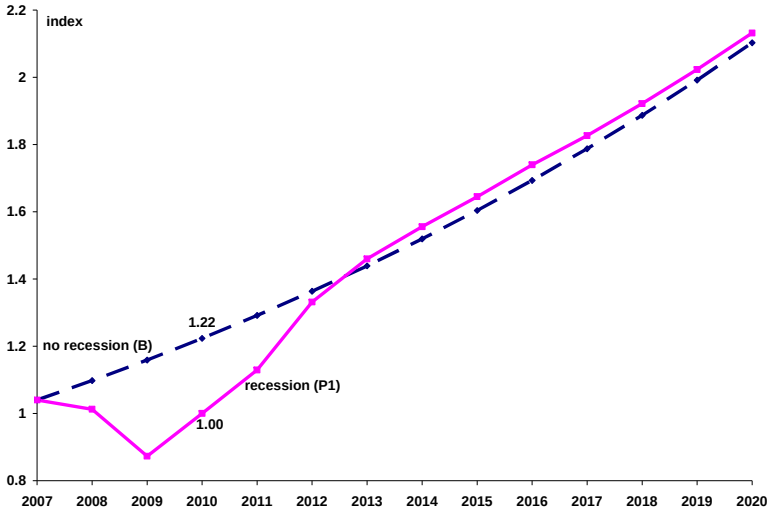

Chart 6. Baseline (B) and Recession (P1): investment

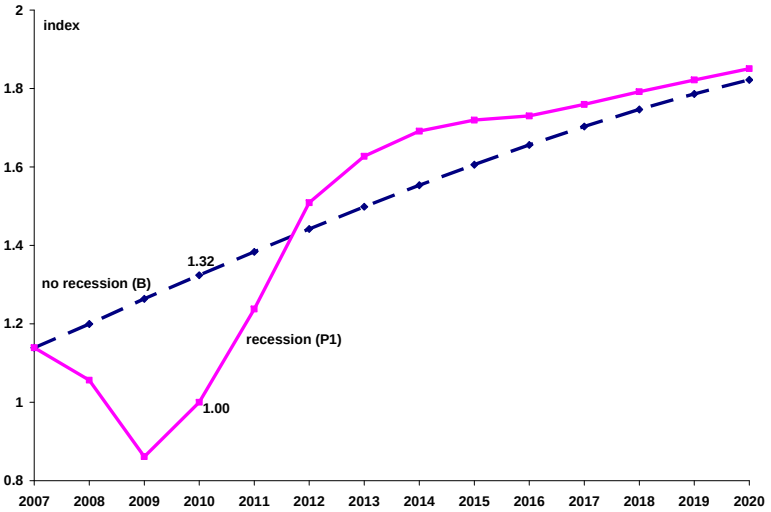

Chart 7. B, P1 & Export demand shift (P2): employment

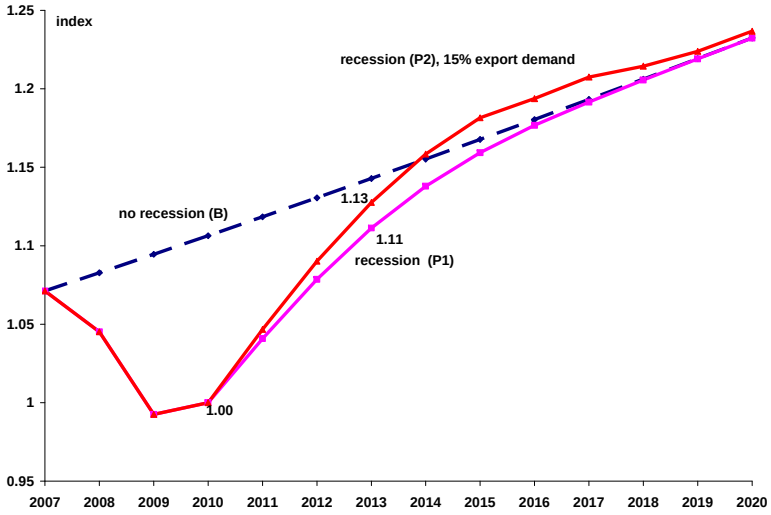

Chart 8. B, P1 & Export demand shift (P2): exports

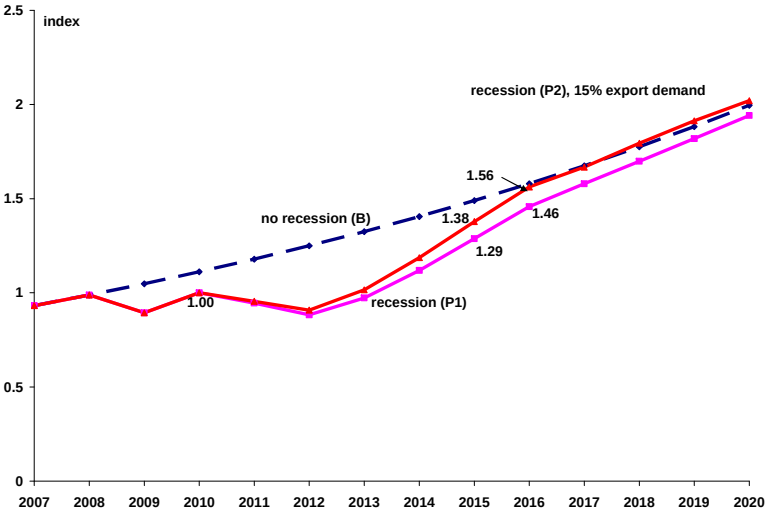

Chart 9. B, P1 & Export supply shift (P3): employment

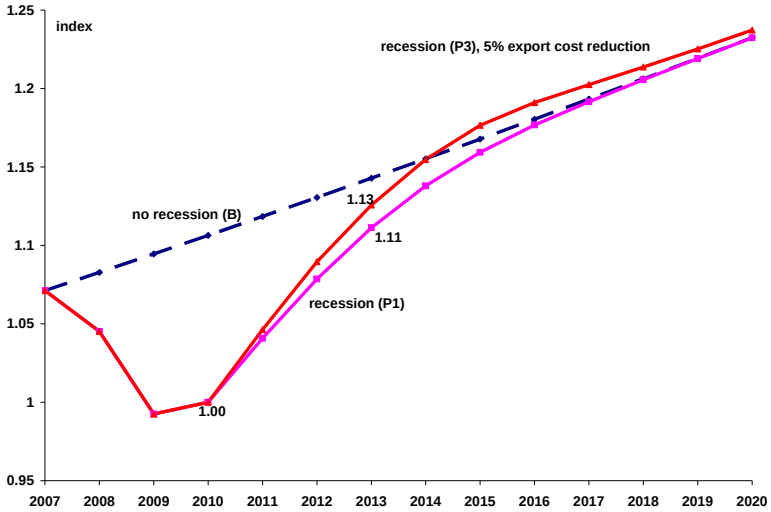

Chart 10. B, P1 & Export supply shift (P3) exports

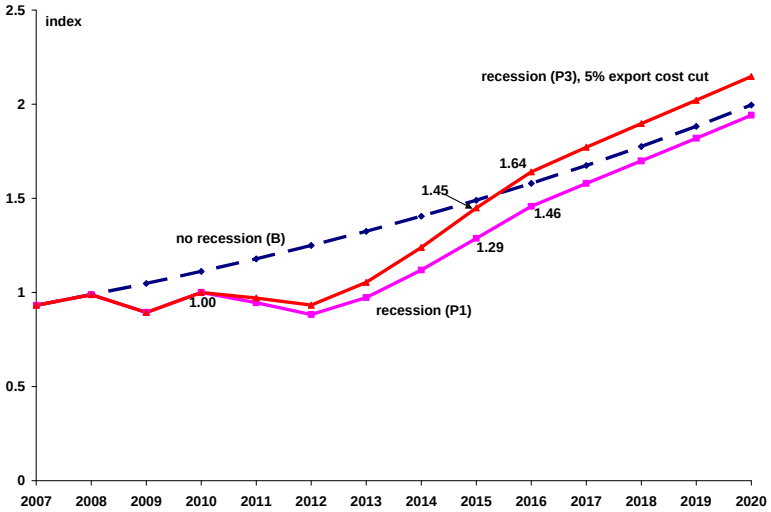

Chart 11. B, P1 & Trade expansion (P4): employment

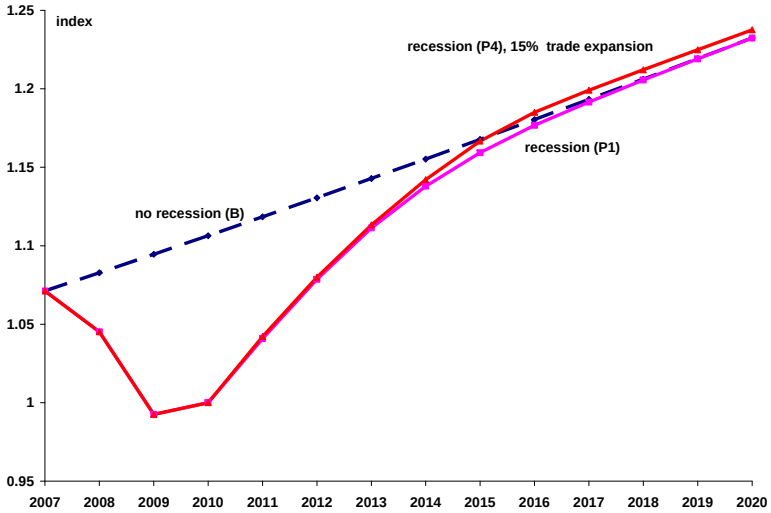

Chart 12. B, P1 & Trade expansion (P4): exports

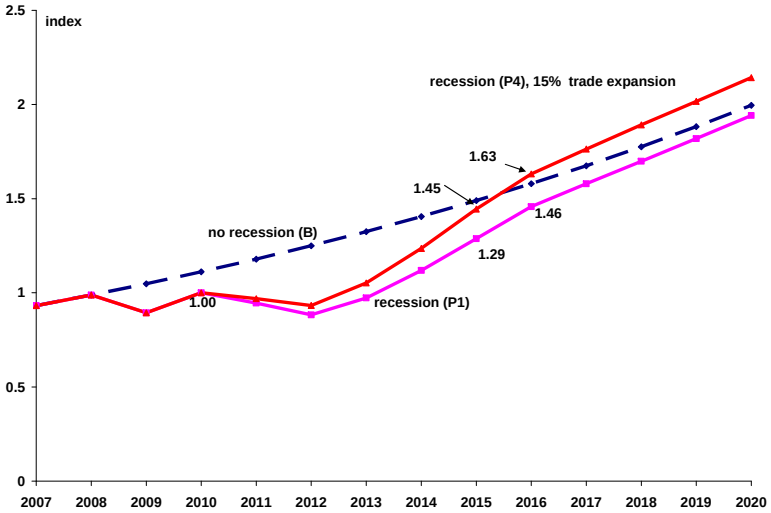

Chart 13. B, P1 & Public expend. cuts (P5): employment

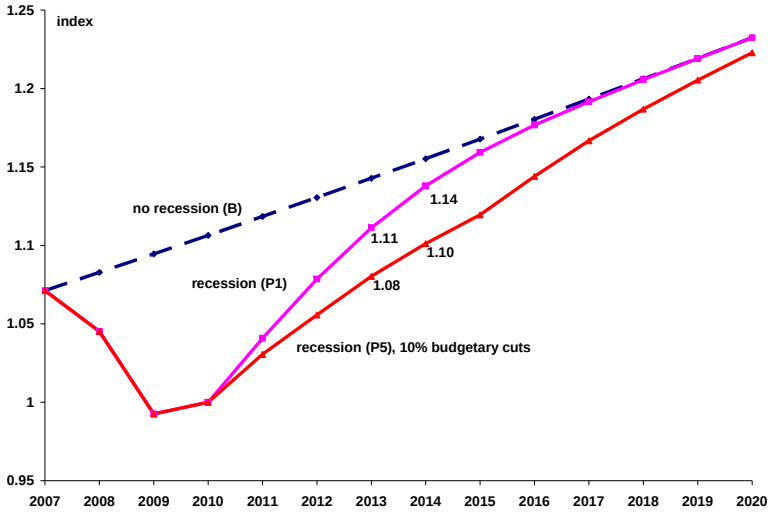

Chart 14. B, P1 & Public expend. cuts (P5) exports

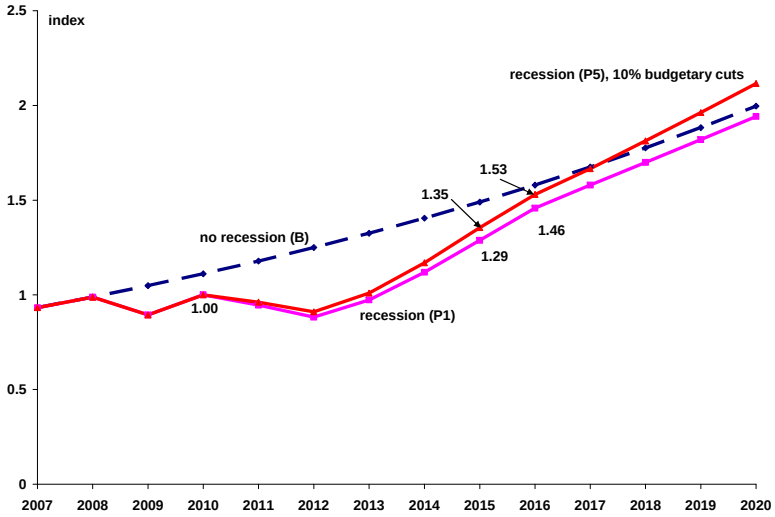

Chart 15. B, P1 & All policies (P6): employment

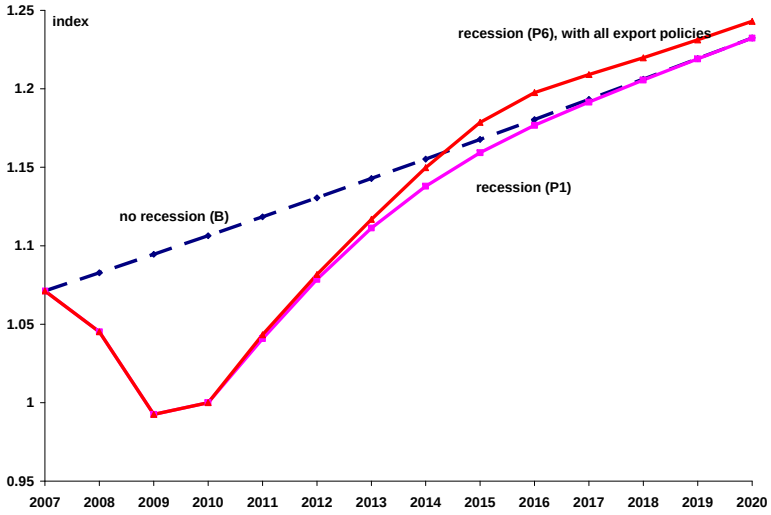

Chart 16. B, P1 & All policies (P6): exports

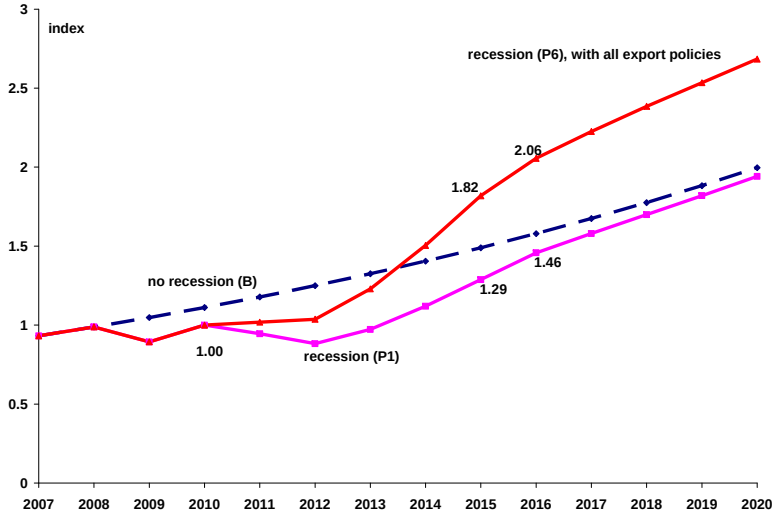

Chart 17. B, P1, P6 & Delayed cuts (P7): employment

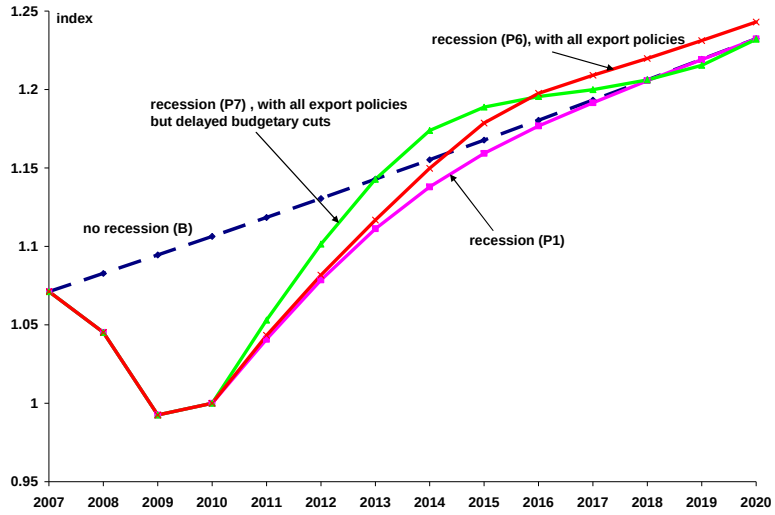

Chart 18. B, P1, P6 & Delayed cuts (P7): exports

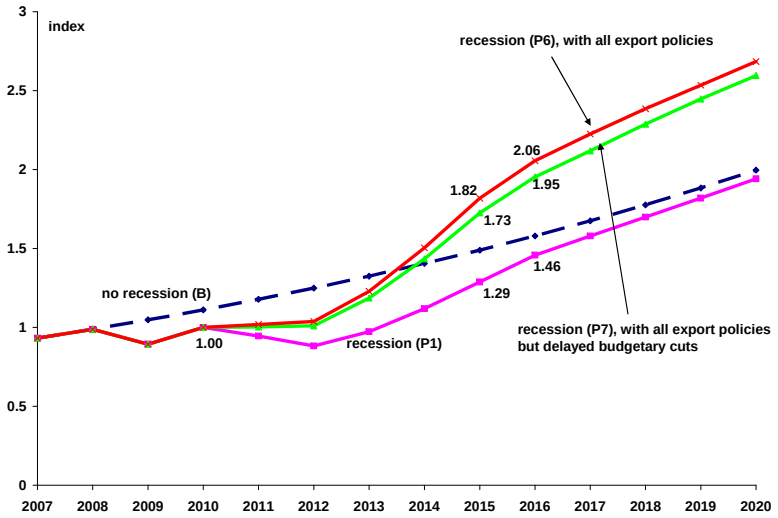

Chart 19. 10% public expenditure cuts: effects on employment (% deviations)

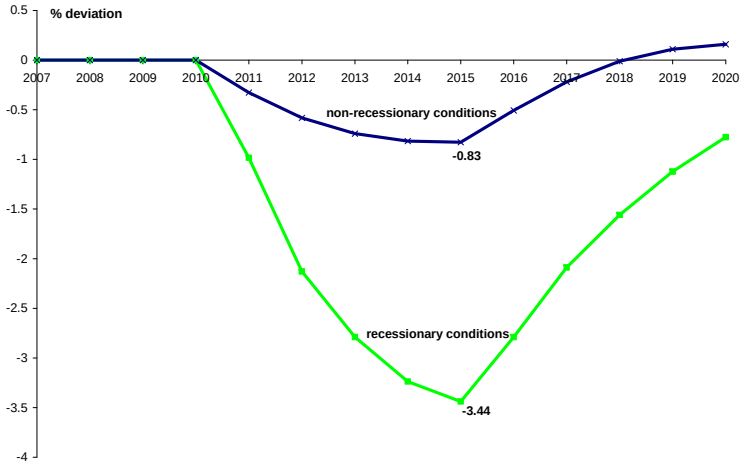

Chart 20. 10% public expenditure cuts: effects on exports (% deviations)