June 2011
IMF Country Report No. 11/143

Kingdom of The Netherlands—Netherlands: Selected Issues and Analytical Notes

This paper on the Kingdom of The Netherlands—Netherlands was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on May 24, 2011. The views expressed in this document are those of the staff team and do not necessarily reflect the views of the government of the Kingdom of The Netherlands—Netherlands or the Executive Board of the IMF.

The policy of publication of staff reports and other documents by the IMF allows for the deletion of market-sensitive information.

Copies of this report are available to the public from

International Monetary Fund • Publication Services
700 19th Street, N.W. • Washington, D.C. 20431
Telephone: (202) 623-7430 • Telefax: (202) 623-7201
E-mail: publications@imf.org Internet: http://www.imf.org

International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

KINGDOM OF THE NETHERLANDS—NETHERLANDS

Selected Issues and Analytical Notes

Prepared by Daniel Kanda, Alasdair Scott, and Sebastian Weber

Approved by the European Department

May 24, 2011

Contents Page

Figures

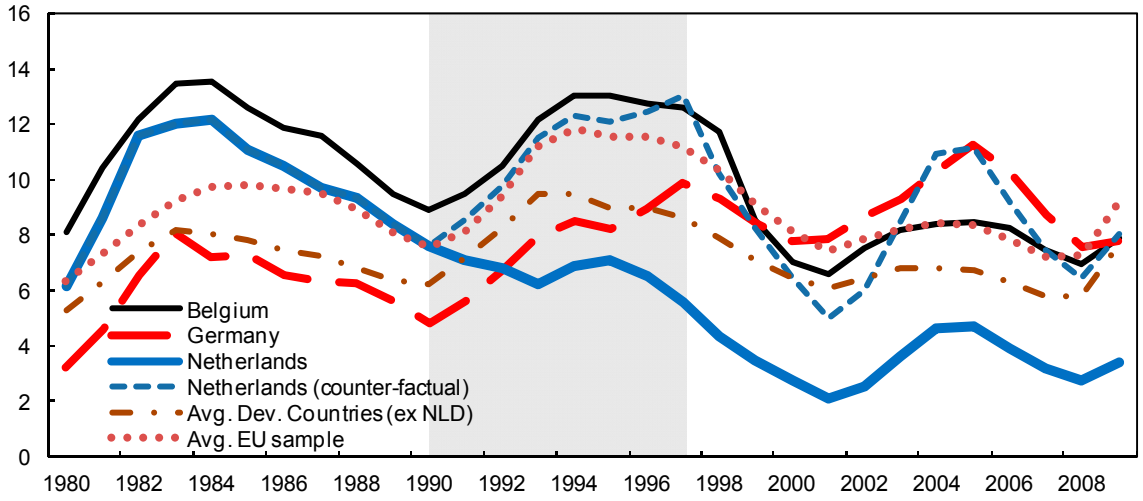
ANALYTICAL NOTE 1: UNEMPLOYMENT IN THE NETHERLANDS: A UNIQUE EXPERIENCE OR A MODEL THAT CAN BE IMITATED?[1]

1. **The Netherlands has emerged from the financial crisis as the EU member with the lowest unemployment rate**. The apparent success in maintaining such a low level of unemployment raises the question about the factors that stand behind the low unemployment rate and the relatively limited increase in response to the crisis. Can the Dutch model be copied or are unique elements at play, which are not easily transferable to other countries by altering the labor market structures?

A. Developments in Unemployment

2. **The current low unemployment level is to a large extent explained by the low unemployment level already preceding the crisis**. Starting from a relatively high unemployment in the early 1980s, the Netherlands has experienced a nearly uninterrupted decline in unemployment since the mid-1980s. While Dutch unemployment generally evolves strongly in line with the average unemployment of other European countries, this co-movement is interrupted during the notable period from 1990 to 1997.

Figure 1-1. Unemployment Developments in Selected Developed Countries



Source: OECD, IMF staff calculations, the counter-factual is counstructed by applying the average growth rate of Germany and Belgium to the Netherlands in the period from 1991 to 1997.

3. **Explaining unemployment today thus requires explaining the unemployment developments in the early 1990s**. Had the Netherlands not succeeded in reducing the unemployment rate in the 1990s, when nearly all OECD countries registered an increase in unemployment rates, the Netherlands would most likely not stand out today as the first of

[1] Prepared by Sebastian Weber

class. This is a direct implication of constructing a counter-factual analysis in which Dutch unemployment grows at the average unemployment rate of Germany and Belgium from 1990 to 1997, the period in which the Netherlands, unlike most other EU countries, experienced a fall in the unemployment rate and, after 1997, grows again at its own observed rate. Under this scenario, today's unemployment rate would be comparable to the unemployment rate in other developed countries.

B. Measures to Reduce Unemployment

4. **The Netherlands has experienced a drastic decline in structural unemployment in the 1990s, which has remained broadly stable in the last 10 years**. Earlier work has already looked at the "miracle" in the Netherlands (See for instance IMF (1997), Bekker et al (1999), Annett (2006), and Nickell and van Ours (2000)). The authors have identified various aspects which have contributed to the reduction, including tax reform, and the benefit system.

5. **The initial conditions were paving the way for a far reaching reform program which helped reduce structural unemployment**. The government footprint was very large and the labor share in income relatively high (Bekker et al. 1999). The government embarked on a fiscal consolidation pattern, however, primarily driven by changing tax composition rather than reducing overall tax intake, and reduced government involvement and distortions.

Wages

6. **Wage moderation has been an essential element of the reform agenda**. In the late 1980s and early 1990s nominal and real wage growth (in the manufacturing sector) in the Netherlands has been one of the lowest in the developed countries. In particular, relative to Germany, real wages grew annually on average by 1.2 percent and 0.7 percent less in the Netherlands, in the 1980s and 1990s respectively.

7. **Wage moderation was sustained also due to an increase in the labor force participation**. Together with an increase in the labor force of skilled young workers and immigrants, this has also prevented a labor shortage which could have put more upward pressure on wages. The increase in the participation rate of women in the Netherlands has also played an important role in preventing labor skill shortage and wage pressure.

8. **Unleashing the potential female labor force appeared particular relevant for reviving the labor market**. Female participation had been one of the lowest in the 1980s with 43 percent. Since then, it has increased continuously to a level well above the OECD and EU average stopping only short of the Scandinavian countries and Switzerland. Policies which facilitated women to join the labor force included the phasing out of tax disincentives (for second earners for instance) and also adequate provision of child care. Women provide a large pool of often highly skilled labor, which can address skill shortages and thus contribute to increased firm profits and higher employment-generating investment. This is facilitated by enhanced productivity due to improved skills, but also by an increase in labor supply which

tends to keep wage pressure relatively low. At the same time larger female participation contributes to a higher combined household income as double earner household prevalence increases (assuming that the larger fraction of inactive females are married).

9. **Competitiveness increased, revitalizing external demand**. Reduced labor costs combined with a de facto peg to the main export destination's currency, the German Mark, allowed for a sustained period of real exchange rate depreciation. This led to a pronounced increase in export demand supporting employment growth further and contributing to the return from a trade deficit to a strong trade surplus.

10. **Increased demand and lower wages lead to rising profits which in turn fuelled firm investment, sustaining further employment growth**. Adjusted for productivity growth real wages have even increased by less allowing firms to increase profits and savings which had been heavily depressed in the early 1980s (Bekker et. al. 1999). The increased savings of firms were to a certain extent reinvested domestically, allowing for a sustained increase in employment.

Table 1-1. Wage Growth in the Manufacturing Sector (In percent)

	Nominal					Real				
	1980s	1990s	2000s	1976-2009	2009	1980s	1990s	2000s	1976-2009	2009
Australia	7.0	3.6	4.4	5.0	1.0	-0.3	1.4	1.3	0.8	-0.8
Austria	5.1	3.8	2.8	4.4		1.5	1.4	0.9	1.4	
Belgium	4.5	2.8	2.4	4.1	2.6	-0.1	0.7	0.3	0.7	2.6
Canada	5.7	2.6	1.4	4.2	-5.1	-0.3	0.6	-0.6	0.1	-5.3
Denmark	6.5	3.7	3.7	5.6	2.9	0.6	1.5	1.7	1.2	1.6
Finland	8.3	3.9	3.9	6.2	3.4	1.6	2.0	2.2	1.7	3.4
France	7.2	2.9	3.0	5.7	2.1	0.8	1.1	1.2	1.3	2.1
Germany	4.1	3.6	1.8	3.6	1.7	1.5	1.2	0.2	1.1	1.4
Ireland	9.0	4.4	5.1	7.7	4.7	1.2	1.8	2.3	2.0	9.6
Italy	11.4	3.9	2.8	8.1	3.2	1.4	0.1	0.6	1.1	2.4
Japan	3.9	1.6	-0.4	2.6	-7.1	1.8	0.8	-0.2	0.9	-5.8
Netherlands	2.7	2.9	2.5	3.2	2.8	0.3	0.5	0.5	0.4	1.6
Norway	9.0	3.9	4.8	6.5	4.3	1.3	1.5	2.8	1.8	2.1
Spain	10.6	5.3	4.5	6.8	5.0	1.4	1.3	1.6	1.4	5.3
Sweden	8.4	4.3	3.1	5.9	1.9	0.7	1.9	1.5	1.1	2.4
United Kingdom	9.3	5.0	3.5	7.2	1.8	3.2	2.3	1.5	2.1	-0.4
United States	4.2	2.9	2.7	4.0	2.8	-0.5	0.1	0.2	-0.1	3.1

Source: OECD, IMF staff calculations

Part-time work and hours

11. **An increase in the part-time to full-time work ratio has facilitated the fall in unemployment**. Comparing the episodes of unemployment reduction in the Netherlands with similar episodes in other countries makes the particular adjustment pattern of the Netherlands visible (See Appendix). With the exception of Belgium and Italy in the 2000s, the reliance on part-time work to reduce the unemployment rate is unique. It explains a significant reduction in unemployment.

Table 1-2. Labor Force Participation, by Gender (In percent of population)

	Females				Males				Total			
	1980s	1990s	2000s	2009	1980s	1990s	2000s	2009	1980	1990s	2000s	200
Australia	55	64	69	71	86	85	85	85	71	74	77	78
Austria		62	66	71		81	81	83		72	74	77
Belgium	45	51	59	61	74	72	74	74	60	62	66	67
Canada	63	69	74	76	86	84	84	84	75	76	79	80
Denmark	76	76	77	78	88	87	86	86	82	82	81	82
Finland	73	71	73	74	80	78	78	78	77	74	76	76
France	56	60	64	66	79	75	75	76	68	67	69	71
Germany	53	61	67	71	82	81	81	84	68	71	74	78
Greece	42	45	54	57	83	79	80	81	62	62	67	69
Ireland	40	48	61	64	83	79	82	82	62	64	71	73
Italy	41	44	50	52	78	75	76	75	60	60	63	63
Japan	57	62	65	68	88	91	92	94	73	77	79	81
Netherlands	43	58	69	74	78	81	85	86	61	70	77	80
New Zealand	64	66	71	74	88	85	87	88	76	75	79	81
Norway	70	74	77	78	89	85	85	84	80	80	81	81
Portugal	58	63	71	73	88	83	84	83	72	73	78	78
Spain	36	47	59	66	85	80	82	83	60	63	71	75
Sweden	80	79	78	78	88	84	84	84	84	82	81	81
Switzerland		72	76	79		93	91	91		82	83	85
United Kingdom	65	68	71	72	90	87	85	85	77	78	78	79
United States	65	71	72	72	88	87	85	84	76	79	79	78
European Union 15	51	58	64	67	82	80	80	81	66	69	72	74
Europe	51	55	59	61	82	80	79	80	66	68	69	70
North America	65	65	65	66	88	88	86	85	76	76	75	75
OECD countries	57	59	62	64	85	84	83	83	71	72	72	73

Source: OECD; IMF staff calculation.

12. **Through lower working hours per worker, the intensive margin of work was reduced while the extensive margin of work was increased**. The Netherlands has always had one of the lowest working times per person and has also relied on this dimension in the reform program of the late 1980s. After a marked initial fall in the working hours per worker between 1985 and 1990, working hours have continued to decline more slowly, in line with the trend in other European countries, to the lowest level of hours per worker in the developed world.

C. The Structure of the Labor Market

13. **Coordination in wage bargaining has facilitated wage moderation**. While it is not necessarily guaranteed that wage coordination ensures better unemployment outcomes, several authors have argued that coordination allows internalizing the adverse effects of wage increases on the overall price level and the competitiveness of the economy (See Belot and van Ours (2001), Nickell (1997) Nickell et al (2001)).[2] The relative small size of the country and a relative homogenous work force may also be helpful in enabling coordination, since a country with large productivity dispersion across regions is unlikely to generate low aggregate unemployment, when applying identical wage rates.

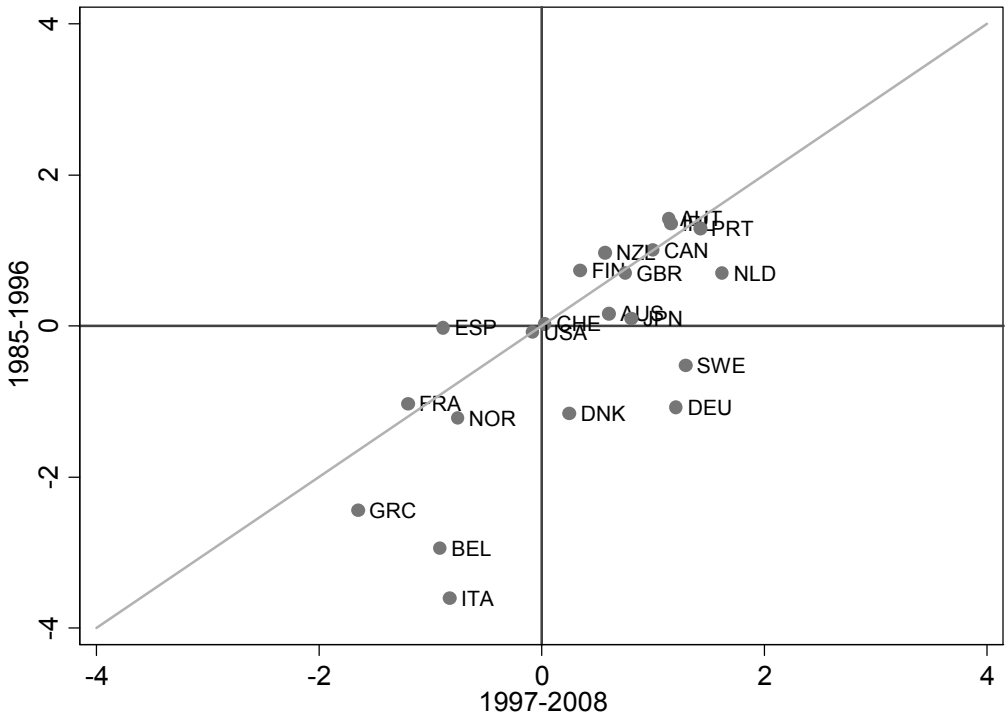
14. **The taxes on labor have been reduced and the overall tax wedge fell, while it increased or remained unchanged in other countries**. The reduction in the employment tax has been a crucial supply side component of the reform in the late 1980s (See Appendix for the evolution of the taxes and the tax wedge across countries). Together with real wage moderation, it allowed labor to become relatively cheaper for firms, facilitating a switch from capital intensive to more labor intensive production (Bakker et al. (1999)). The moderate decrease in the overall tax wedge prevented a drop in labor supply since after tax real wages could grow while pre-tax real wage remained unchanged. Today's tax wedge is relatively low by European standards (though not from a broader international perspective) and is dominated by direct and indirect taxes as opposed to employment taxes.

15. **Albeit unemployment benefits remained high, the structure of support may have incentivized search effort and work**. Although benefit replacement rates in the first two years are among the highest in the world, the drop in support as unemployment length increases beyond two years is also relatively high, different to the trend in most other economies, notably Ireland, Spain, and Portugal—but also Denmark (See Appendix). Too generous unemployment benefits could delay matches to new jobs implying that skills are lost through extended unemployment duration, which in turn tends to increase the stock of long-term unemployed. Adverse unemployment benefit structures and too generous systems have frequently been cited as leading to higher unemployment in response to adverse

[2] For the alternative hypothesis of a hump shaped relationship between unemployment and the level of bargaining see Calmfors and Driffill (1988) and Elmeskov et al (1997).

negative shocks (See for instance Abbritti and Weber 2010). The Netherlands has also implemented reforms which tighten the eligibility criteria for unemployment benefits to increase incentives for search efforts.

Figure 1-2. Change in the Relative Strictness of Regular to Temporary Employment Protection Legislation, (EPL regular – EPL temporary)



16. **Employment protection legislation (EPL) favors flexibility in temporary work and working time, while being stringent on permanent employment relationships**. The reduction in EPL for temporary work relative to EPL for permanent work can to some extent explain the observed rise in the part-time to full-time employment ratio. This design appears particularly helpful in times of crises without the potential negative impact of strict EPL for boom periods (See also Gamberoni et al 2010, I Kadek and de Haan 2011). Notably, Spain, Greece, Italy, France and Belgium belong to the group of countries with relatively stringent temporary EPL compared to permanent EPL and Spain has even changed legislation to heighten the difference (See Figure 1-2).[3] Sweden, Denmark, and Germany have made temporary work more flexible relative to permanent work in the recent decade. The Netherlands is the country which, while having a more stringent EPL on permanent compared to temporary work in the entire sample period, has become in the 1990s the

[3] While Italy and Belgium have reduced EPL on temporary work significantly in the last decade, temporary work EPL is still rather stringent when compared to the respective legislation for permanent work, due to the rather flexible legislation on permanent work in both countries.

country with the largest difference between legislation on permanent work relative to flexible work. While high severance pay in the case of dismissals may dampen the impact of a crisis on unemployment, flexibility of employment relationships with respect to working time is crucial to smooth the adjustment and facilitate new employment creation. However, a good design of the overall framework is warranted to avoid a dual labor market. The Netherlands has witnessed an increase in temporary work contracts in recent years. It is however unclear to which extent this is supply- or demand-driven.

D. The Structure of the Economy

Economic base

17. **There has been a move away from industrial production toward a service oriented economy**. In particular the financial service industry has been a driver of employment growth. Employment in the Netherlands is to about 60 percent generated in the service industry, while construction and agriculture contribute only a minor part to total employment (See Appendix). The contribution of manufacturing employment to total employment is one of the lowest in the sample of EU countries and has declined steadily.

Table 1-3. Average Employment Growth by Sector

	Agriculture, Forestry, and Fishing	Industry	Construction	Wholesal and Retail Trade, etc.	Financial, Real Estate, Rentin	Other Service Activities	Absolute Growth
Australia	-0.7	0.0	3.3	2.0	3.4	2.6	2.0
Austria	-1.9	-0.4	-0.3	0.7	3.9	1.5	1.4
Belgium	-1.8	-1.5	0.2	0.3	3.9	1.1	1.5
Canada	-1.4	0.1	1.7	1.9	4.2	1.5	1.8
Denmark	-2.9	-1.1	0.0	0.6	2.5	0.9	1.3
Finland	-3.1	-1.3	0.2	0.3	3.0	1.3	1.5
France	-2.9	-1.6	-0.3	0.8	2.6	1.6	1.6
Germany	-3.0	-2.0	-1.3	0.4	3.5	1.2	1.9
Greece	-2.5	-0.1	2.2	1.3	4.6	2.2	2.2
Ireland	-1.9	-0.3	5.1	3.8	6.1	4.0	3.5
Italy	-3.6	-0.9	0.4	0.9	4.4	1.6	2.0
Japan	-3.0	-0.7	-0.4	0.1	0.7	2.2	1.2
Netherlands	-0.5	-0.8	0.0	1.5	3.6	1.6	1.3
New Zealand	-0.5	-0.7	3.0	1.8	3.2	2.6	2.0
Norway	-2.8	-0.6	1.2	0.7	3.8	1.9	1.8
Portugal	-1.0	-1.2	1.1	1.9	2.3	1.5	1.5
Spain	-3.0	-0.3	2.1	2.2	4.2	3.2	2.5
Sweden	-3.0	-1.5	0.1	0.2	3.2	0.6	1.4
Switzerland	0.1	-1.0	-0.7	0.0	2.2	1.9	1.0
United Kingdom	-0.6	-3.0	0.3	0.6	2.8	1.4	1.5
United States	-1.7	-3.0	-0.1	0.1	0.6	1.8	1.2

Source: OECD; IMF staff calculation.

18. **Restructuring has been relatively smooth, which may have helped limit the effect on unemployment**. The shift in employment across sectors has been relatively slow but continuous. Measured by the absolute average growth rate across the different sectors, the

Netherlands together with Switzerland, Japan, the United States, and Denmark have one of the lowest levels.

Productivity

19. **Labor productivity is one of the highest in the world**. While being lower than U.S. productivity, productivity in the Netherlands is higher than in most other European countries. The higher productivity relative to other nations, allows the Netherlands to have higher wages per hours. The higher hourly wage in turn contributes to the willingness of workers to substitute out of full time work into part-time work, consistent with evidence that as income increases the working time decreases.

20. **However, in recent years productivity has declined relative to the United States**. Following a pickup process in the late 1980s and early 1990s, labor productivity in the Netherlands was close to identical to productivity in the U.S. in 2000. However, the slower growth of GDP in the early 2000s has reversed part of the earlier gains in productivity ranks, though, as mentioned, still leaving the Netherlands today ahead of most European countries.

E. Social Underpinnings

(In)equality in Access

21. **Public investment in education is relatively high**. In terms of spending per student, the Netherlands has one of the highest levels of public spending on education in the EU. The high spending is reflected in well above average scores in the PISA ranking and a relatively high skilled labor force. According to some measures of gender inequality, the Netherlands take an exemplary role, scoring higher than the Scandinavians (UNDP).

(In)equality in Outcomes

22. **Inequality is of minor concern in the Netherlands and poverty is contained**. The median household income is around 29,000 euro (CBS). Two-thirds of all households have a spendable income above 22,000 euro. The average household income is 33,400 euro. About 5 ½ percent of the households live on less than 10,000 euro (of which more than 80 percent are single households, including students), however only 1½ percent of multi-person households have less than 10,000 euro at their disposal. 16 percent have a disposable income of more than 50,000 euro of which 96 percent are multi-person households.

23. **The social security system ensures a comfortable buffer for those who are not employed**. While students have (naturally) the lowest income, pensioners have an income about 1/3 lower than employees at their disposal while persons living on unemployment benefits garner an income equivalent to about 44 percent of an employee's average income. Over the last several years, real income has increased for all socio-economic groups.

Table 1-4. Gini Coefficient

	After Taxes and Transfers			Before Taxes and Transfers		
	Mid-1980s	Mid-1990s	Mid-2000s	Mid-1980s	Mid-1990s	Mid-2000s
Australia		0.3	0.3		0.4	0.4
Austria	0.2	0.2	0.2			0.4
Belgium	0.2	0.2	0.2	0.4	0.4	0.4
Canada	0.2	0.2	0.3	0.4	0.4	0.4
Denmark	0.2	0.2	0.2	0.3	0.4	0.4
Finland	0.2	0.2	0.2	0.3	0.3	0.3
France	0.3	0.2	0.2	0.5	0.4	0.4
Germany	0.2	0.2	0.3	0.4	0.4	0.5
Greece	0.3	0.3	0.3			
Ireland	0.3	0.3	0.3			0.4
Italy	0.3	0.3	0.3	0.4	0.5	0.5
Japan	0.3	0.3	0.3	0.3	0.	0.4
Netherland	0.2	0.2	0.2	0.4	0.4	0.4
New Zealand	0.2	0.3	0.3	0.4	0.4	0.4
Norway	0.2	0.2	0.2	0.3	0.4	0.4
Portugal	0.3	0.3	0.3	0.4	0.4	0.5
Spain	0.3	0.3	0.3			
Sweden	0.2	0.2	0.2	0.4	0.4	0.4
United	0.3	0.3	0.3	0.4	0.4	0.4
United States	0.3	0.3	0.3	0.4	0.4	0.4

Source: OECD.

24. **Inequality has been low and relatively unchanged**. Measured in income after taxes and transfers, the Netherlands ranks third (together with Finland) after Denmark and Sweden. When measured before taxes and benefits the Netherlands has even improved its relative rank against a close to universal trend of an increase in inequality. Thus, the policies of wage moderation have had no negative repercussions on income dispersion, which is probably attributable to an increase in high-skilled labor supply.

F. The Labor Market in the Context of the Crisis

25. **Flexible working time arrangements have been vital in buffering the impact of the crisis, while stringent employment protection for regular workers may have prevented some dismissals.** Cahuc and Carcillo (2011) provide evidence that short-time compensation programs were able to stabilize employment in recent downturns and thus are also likely to have contributed in the Netherlands to a milder rise in unemployment. However, the program in the Netherlands was relatively small and take up rates modest, thus limiting the potential beneficial effect. There is also more general evidence that higher employment protection on permanent work has contributed to a more stable employment relationship in times of crises (Gamberoni et al 2010).

26. **However, structural aspects not related to the labor market are likely to play a more prominent role in the relatively mild increase in unemployment.** The labor market prior to the crisis was very tight. Thus labor hording due to potential skill shortages and an

expected recovery have been cited frequently as reasons for firms' reluctance to dismiss workers. Retaining workers despite lower production was feasible since firms entered the crisis with large profits from previous years. Countries which are relatively open and competitive additionally benefit from a quick rebound in export demand. The absence of a burst of a domestic bubble in the housing market can also explain a large part of the difference in unemployment trends compared to other countries such as Spain, the U.K. and the U.S. (Gamberoni et al 2010). Thus, despite the significant contraction of output in the Netherlands, the source of the shock has primarily been external. More significant contagion to the domestic economy has also been addressed by guaranteeing the functioning of the major banks as well as the operation of automatic stabilizers and discretionary stimulus, which in turn reduced the size of the shock compared to other countries.

27. **Self-employment biases the unemployment figures to some extent downward.** The Netherlands has witnessed an increase of self-employed in the last ten years, the latter having attained 14 percent of civilian employment by 2009 (Coervers et al 2011). The reduction in contracts and working hours by the self employed is not reflected in the unemployment statistics but is deemed to explain the largest part of the "missing" unemployment response in the crisis. However, both the exact number of self-employed and the exact effect on them are subject to large uncertainty.

G. Which Lessons for Whom?

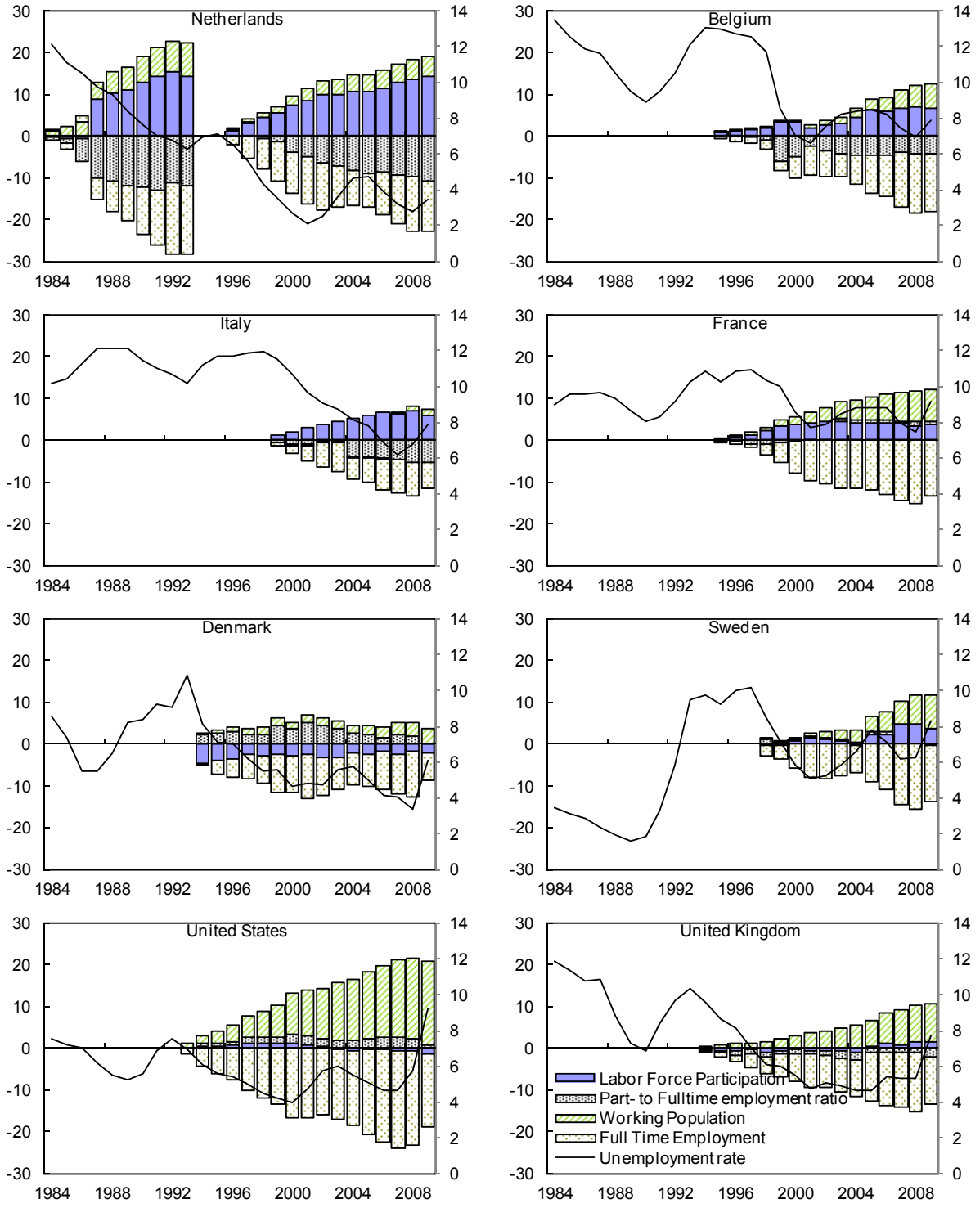
28. **Various policy mixes can lead to a similar outcome.** Countries will have to adopt the choice which is consistent with their preconditions and overall framework. For instance countries with already low tax rates will not be able to follow the Dutch policy of the 1980s since they have no room for maneuver. Similarly countries, which have low overall benefits and flexible employment arrangements for part time work, will also need to look into other aspects for reducing unemployment.

29. **Initial conditions and the economic structure should inform the choice among the labor market policy alternatives.** The initial conditions in the Netherlands were very particular but not unique. The Netherlands faced a very high unemployment rate, high taxes, low female participation, high benefits, a high labor share in income, low firm profits, high government debt, a high fiscal deficit, a big state with expenditure to GDP ratio above 60 percent, and maintained a peg to the German Mark. While labor market reform programs can promote a certain economic structure, the transformation toward an economic structure which is more resilient to shocks and provides for more flexible employment opportunities is not easily initiated by government-induced polices, but often only the outcome of very long-term investments of a society into specific education and knowledge.

30. **Some countries are today in a comparable situation as the Netherlands in the 1980s and could implement similar labor market policies.** In particular, the Dutch experience shows that within the context of a currency union orthodox policies can work and

bring about a reversal of the labor market outcome. Wage restraint has helped to reinstall competitiveness and contributed to lower costs for firms which in turn were able to increase employment.

Figure 1-3. Cumulative Contributions to Change in the Employment Rate (LHS) and Unemployment Rate (RHS)



Source: OECD, IMF staff calculation

Figure 1-3. Cumulative Contributions to Change in the Employment Rate (LHS) and Unemployment Rate (RHS) (concluded)

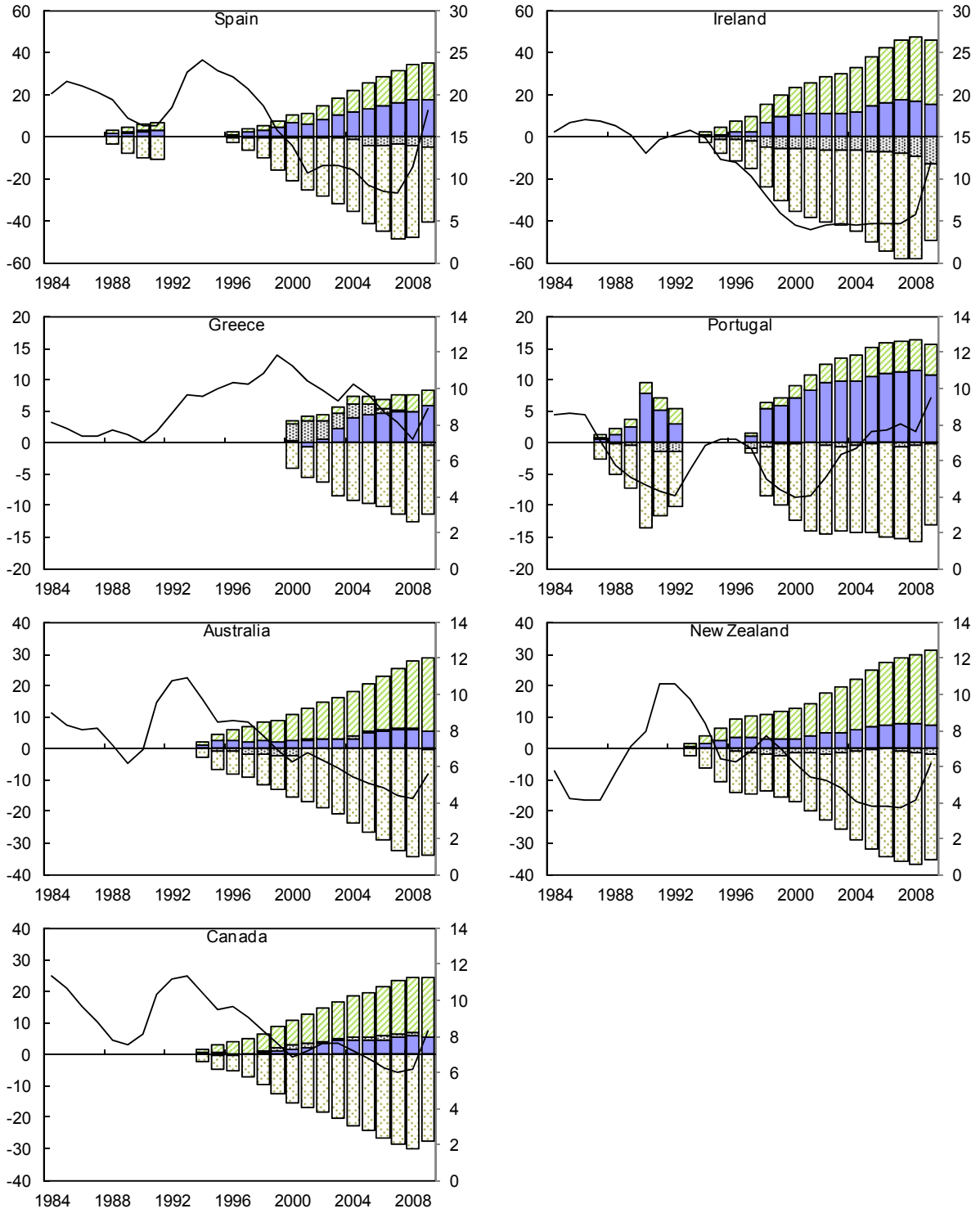
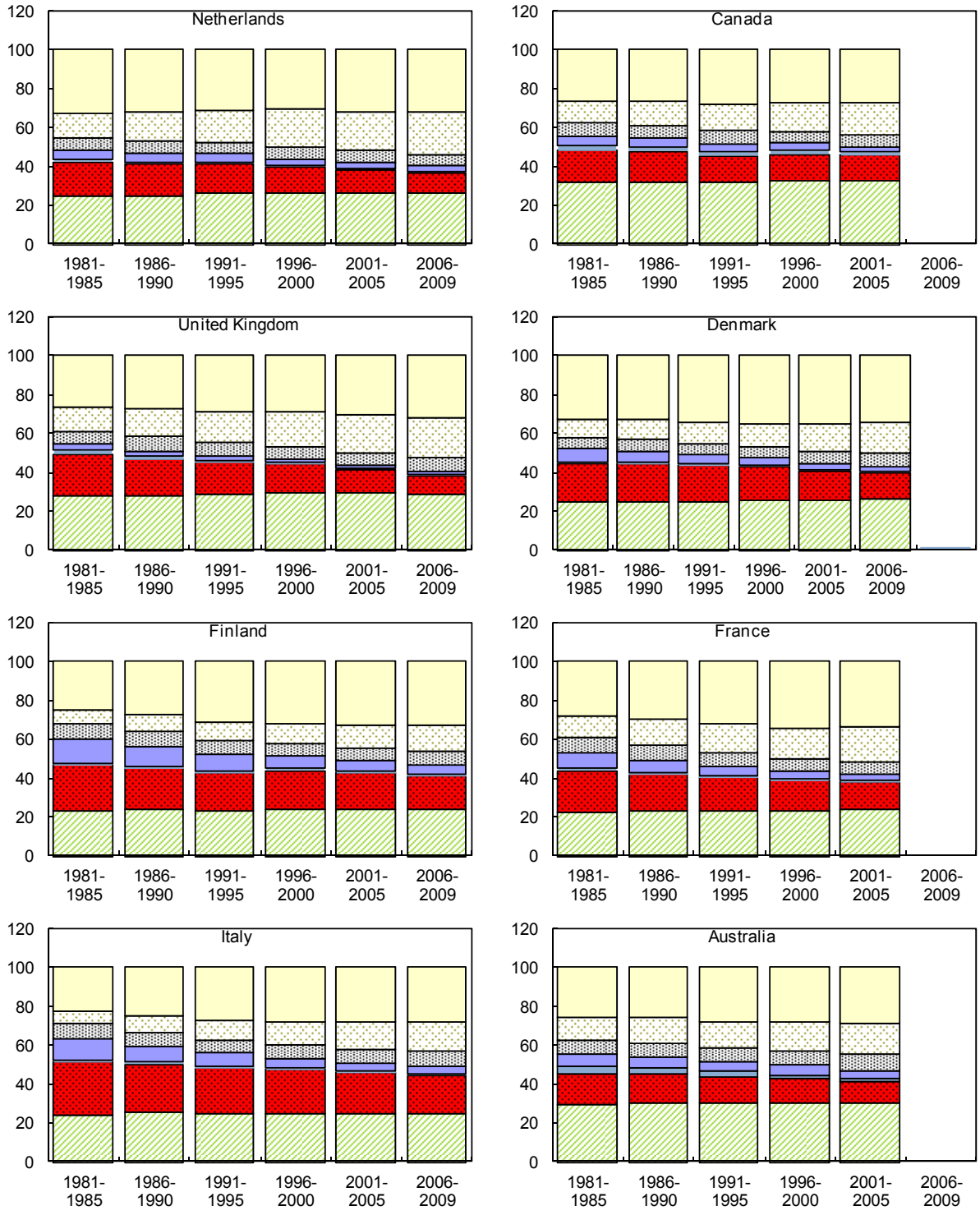
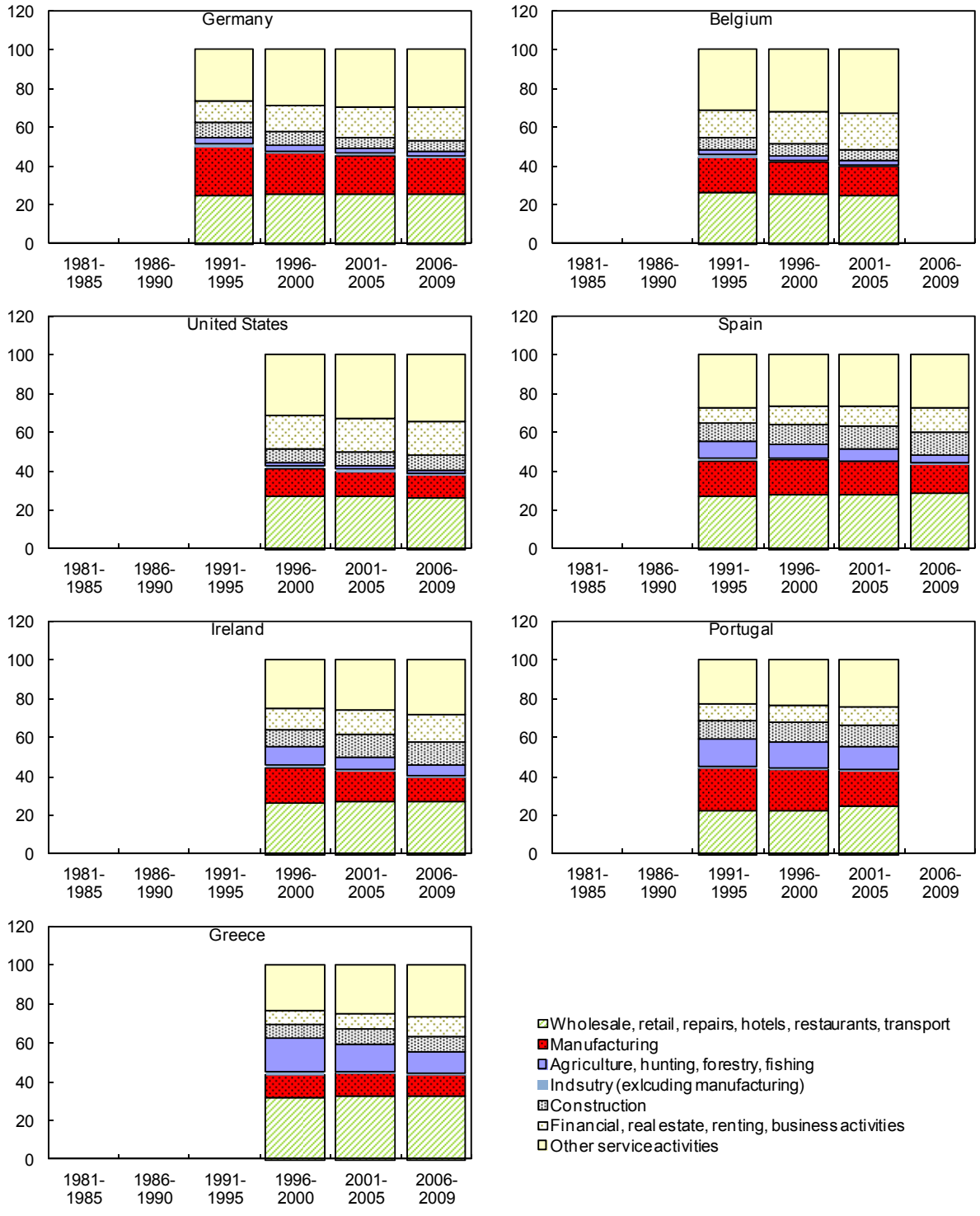


Figure 1-4. Sectoral Contribution to Total Employment
(In percent)



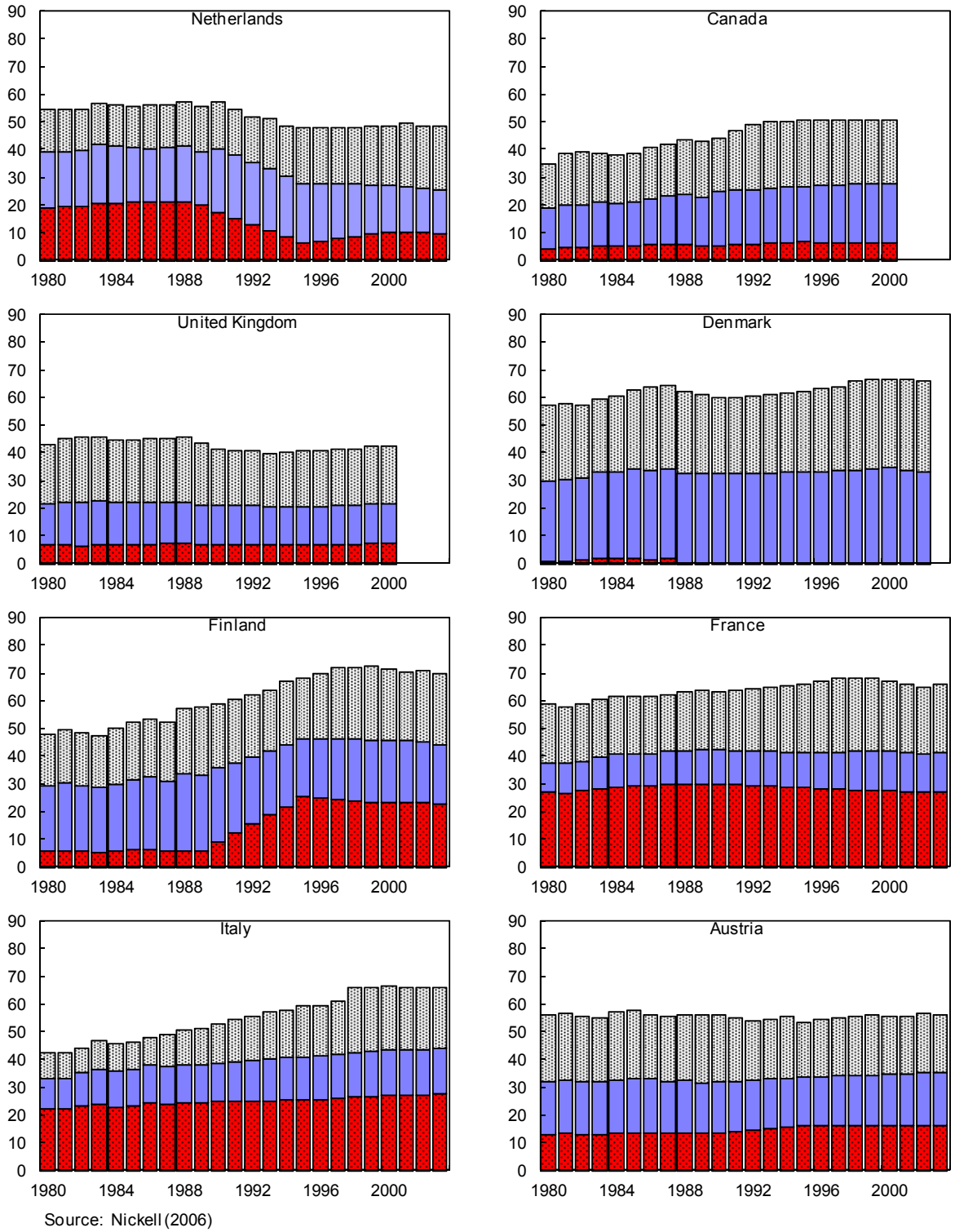
Source: OECD, IMF staff caclulation

Figure 1-4. Sectoral Contribution to Total Employment (concluded)
(In percent)



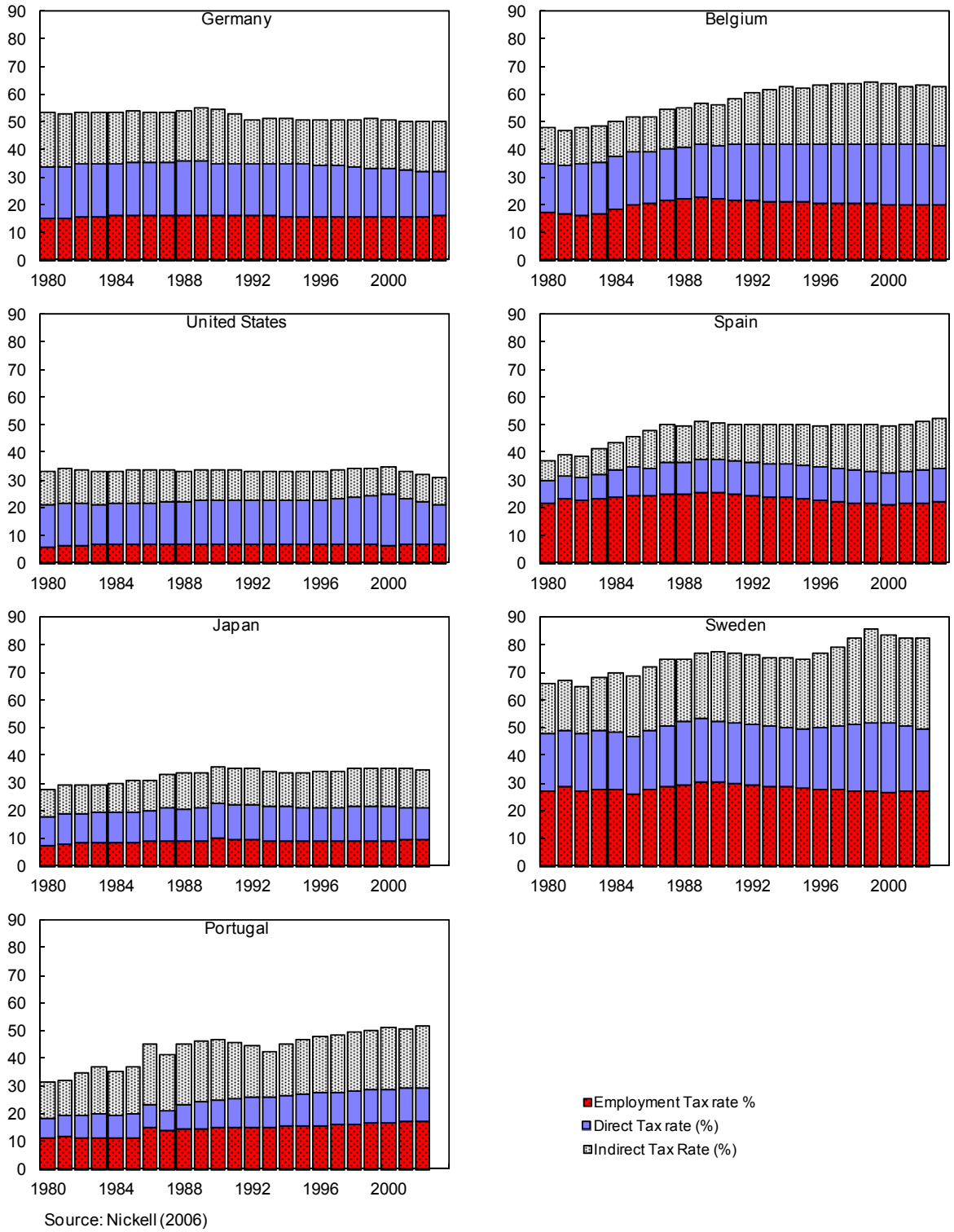
Source: OECD, IMF staff caclulation

Figure 1-5. Evolution of the Tax Wedge and its Components
(In percent)



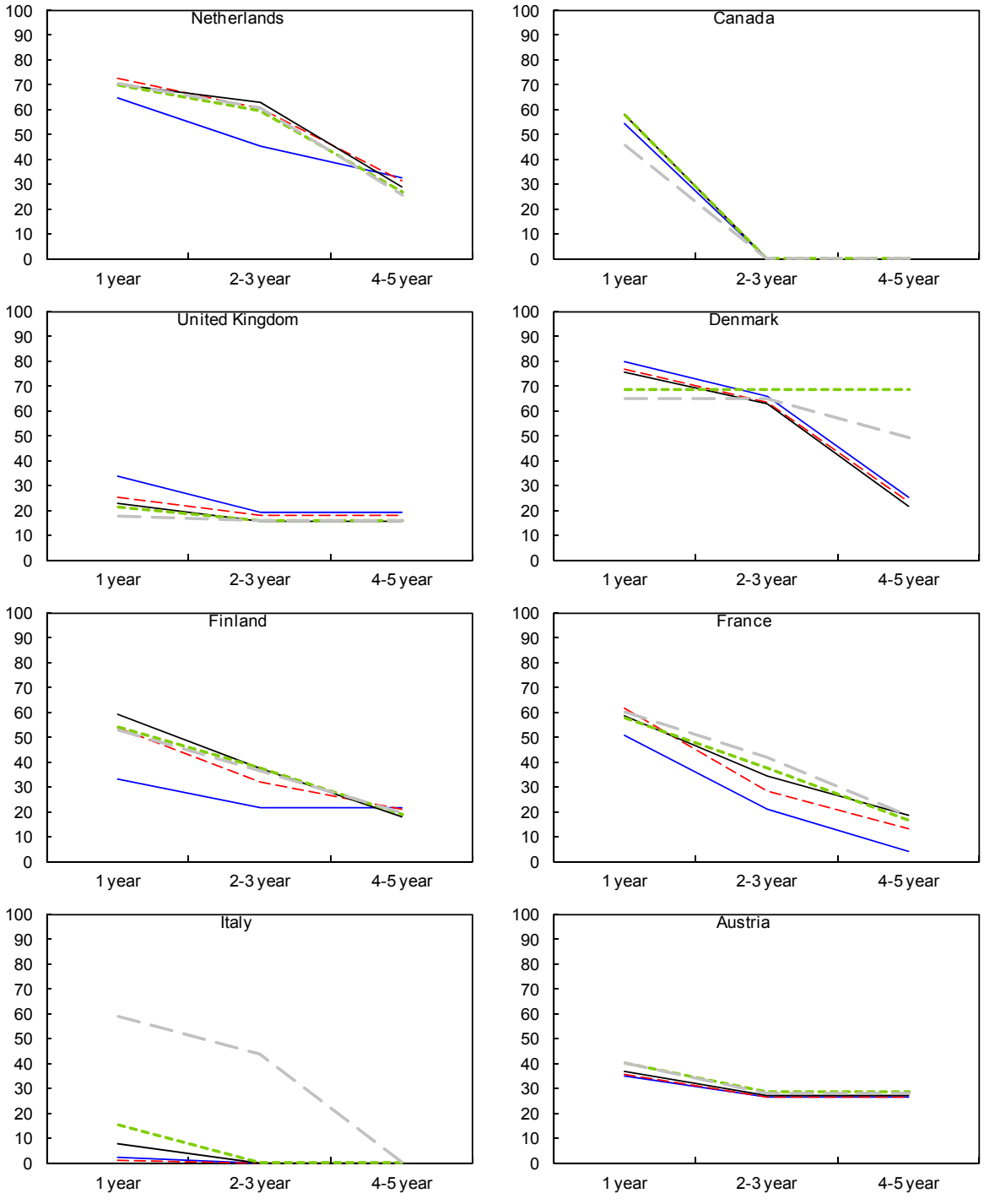
Source: Nickell (2006)

Figure 1-5. Evolution of the Tax Wedge and its Components (concluded)
(In percent)



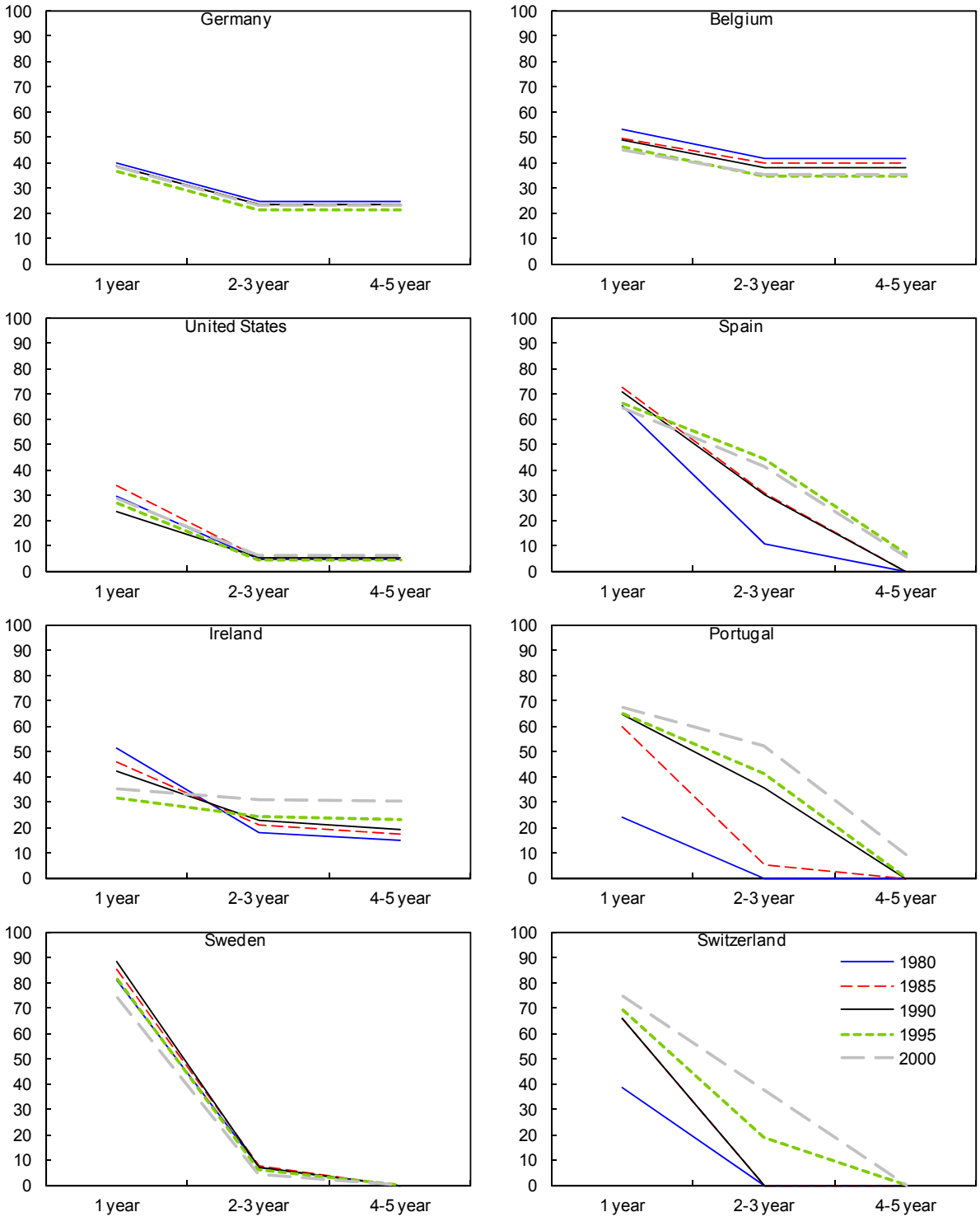
Source: Nickell (2006)

Figure 1-6. Benefit Replacement Rate by Length of Unemployment
(In percent)



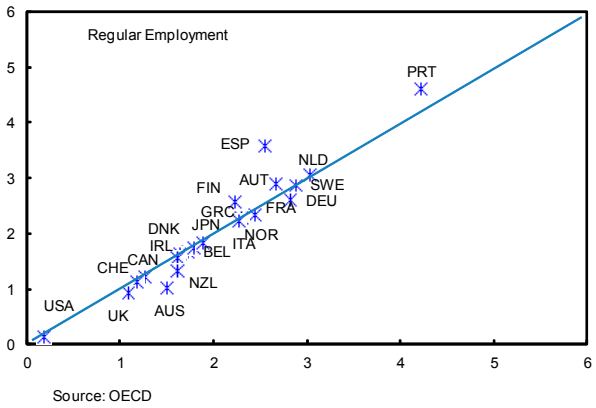
Source: Nickell (2006)

Figure 1-6. Benefit Replacement Rate by Length of Unemployment (concluded)
(In percent)

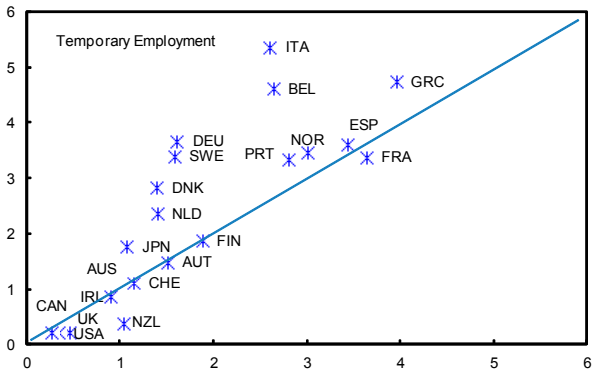


Source: Nickell (2006)

Figure 1-7. Employement Protection Legislation (Index 0-6)



Source: OECD



Reference

Abbritti , Mirko, and Sebastian Weber, 2010,"Labor market institutions and the business cycle: Unemployment rigidities vs. real wage rigidities," Working Paper Series 1183, European Central Bank.

Annett, Anthony, 2007, "Lessons from Successful Labor Market Reforms in Europe", IMF Policy Discussion Paper 07/1/2007 (Washington: International Monetary Fund).

Bakker, Bas, Ioannis Halikias, Jan Kees Martijn, and Maxwell Watson, 1999, "The Netherlands: Transforming a Market Economy," IMF Occasional Papers 181 (Washington: International Monetary Fund).

Belot, Michele, and van Ours, Jan C., 2001, "Unemployment and Labor Market Institutions: An Empirical Analysis," Journal of the Japanese and International Economies, Elsevier, Vol. 15(4) (December), pp. 403–18.

Cahuc, Pierre, and Stephane Carcillo, 2011, "Is Short-Time Work a Good Method to Keep Unemployment Down?", IZA Discussion Paper No. 5430.

Calmfors, Lars, and John Drifill, 1988, "Bargaining Structure, corporatism and macroeconomic performance", in Economic Policy, Vol. 6, pp.12–61.

Coervers, Frank, Rob Euwals, and Andries de Grip, 2011, "Temporary Workers Earn Less. Labor Market Flexibility in the Netherlands", CPB Netherlands Bureau for Economic Analysis.

Elmeskov, Jörgen, John P Martin, and Stefano Scarpetta, 1998, "Key Lessons For Labour Market Reforms: Evidence From OECD Countries. Experience", in Swedish Economic Policy Review, Vol. 5, No. 2, pp. 205–52.

Gamberoni, Elisa, Erik Von Uexkull, and Sebastian Weber, 2010, "The Roles of Openness and Labor Market Institutions for Employment Dynamics during Economic Crises," World Bank - Economic Premise, The World Bank, Issue 29 (August), pp. 1–5.

IMF (1997) "Selected Issues", in Staff Report on the 1997 Article IV consultations with the Netherlands, IMF Staff Country Report No. 97/69 (Washington: International Monetary Fund).

I Kadek Dian Sutrisna Artha, and Jakob de Haan, 2011, "Labor Market Flexibility and the Impact of the Financial Crisis," DNB Working Papers 280, Netherlands Central Bank, Research Department.

Nickell, Steve, and Jan van Ours, 2000, "Why has Unemployment in the Netherlands and the United Kingdom Fallen so Much?" Canadian Public Policy, University of Toronto Press, vol. 26(s1) (July), pp. 201–20.

Nickell, Stephen; Ochel, Wolfgang, Nunziata, Luca, and Quintini, Glenda 2001 "The Beveridge Curve, Unemployment and Wages in the OECD from the 1960s to the 1990s" CEP Discussion Paper, 0502, Preliminary Version, pp.1–53.

Nickell, Steve, 2006, "Why has Unemployment in the Netherlands and the United Kingdom Fallen so Much?" Canadian Public Policy, University of Toronto Press, Vol. 26(s1) (July), pp. 201–20.

APPENDIX: DECOMPOSING CHANGES IN THE EMPLOYMENT RATE

The change in the employment rate can be decomposed into four main sub components: 1) the growth rate of the participation rate, 2) the change in the ratio of part time to full time employment, 3) the growth rate of the (working age) population, and 4) the growth rate of the full time employment.

$$\frac{EMP_t}{LF_t} = \frac{EMP_t}{POP_t}\left(\frac{LF_t}{POP_t}\right)^{-1} = \left(1+\frac{L^{PT}}{L^{FT}}\right)\frac{L^{FT}}{POP_t}\left(\frac{LF_t}{POP_t}\right)^{-1} \tag{1}$$

Appropriate transformation and taking the first difference yields the approximation:

$$\Delta\log\left(\frac{EMP_t}{LF_t}\right) \approx \Delta\left(\frac{L_t^{PT}}{L_t^{FT}}\right) - \Delta\log\left(\frac{LF_t}{POP_t}\right) - \Delta\log\left(POP_t\right) + \Delta\log\left(L_t^{FT}\right) \tag{2}$$

Policies may have varying effects on the different sub-elements which is why the decomposition may be more insightful than simply contrasting employment rates with labor market policies. Furthermore, it allows constructing counter-factuals for the sub-components to derive the development of the implied counter-factual employment rate.

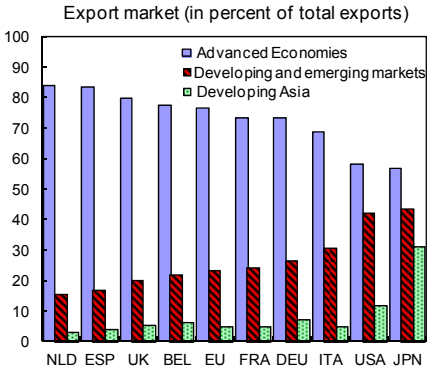
Data are taken from the OECD.

ANALYTICAL NOTE 2: INTERNATIONAL TRADE, FISCAL AND FINANCIAL SPILLOVERS[1]

A. Risks from Regional Export Concentration and Global Fiscal Consolidation

1. **The Netherlands is highly open to trade and maintains a sizeable trade surplus**. Trade to GDP is projected to exceed the pre crisis level and stand well above 145 percent in 2010 while the trade surplus is expected to reach nearly 8 percent of GDP. The goods surplus is generated primarily vis-à-vis EU member countries, while extra-EU trade contributes negatively to the overall surplus, mostly driven by trade with Asia and the U.S.

2. **Regional concentration of exports makes the Netherlands exposed to a correction in deficit countries and highly indebted developed countries**. More than 77 percent of Dutch exports go to other European countries. Only some 15 percent go to emerging markets and developing countries, with less than 3 percent of total exports to Asia.[2] Netherlands' exports are thus more vulnerable to faltering demand in European countries and advanced economies then many other euro area member countries.



Source: IMF Direction of Trade Statistics

Table 2-1. Trade by Regions and Countries – 2009

	Balance	Exports			Imports		
Origin/Destination	Value in mm USD	Value in mm USD	Share (%)	Change (%)	Value in mm USD	Share (%)	Change (%)
Total	54,946	498,495	100.0	-22	443,550	100.0	-24
EU	168,337	385,331	77.3	-23	216,994	48.9	-22
Germany	54,017	128,402	25.8	-21	74,385	16.8	-23
Belgium	24,185	62,852	12.6	-28	38,668	8.7	-23
France	26,465	46,044	9.2	-19	19,579	4.4	-24
United Kingdom	13,775	40,393	8.1	-28	26,618	6.0	-21
Italy	16,271	25,223	5.1	-24	8,952	2.0	-25
Spain	10,262	17,187	3.4	-21	6,925	1.6	-26
Poland	3,913	9,220	1.8	-23	5,307	1.2	-10
America	-28,297	29,085	5.8	-21	57,382	12.9	-25
United States	-14,742	19,642	3.9	-20	34,383	7.8	-21
Developing Asia	-59,513	13,486	2.7	3	72,999	16.5	-14
China,P.R.: Mainland	-45,137	6,626	1.3	13	51,763	11.7	-12
Mid.East & N. Africa	-1,397	12,530	2.5	-6	13,927	3.1	-42

Source: IMF Direction of Trade Statistics.

[1] Prepared by Sebastian Weber.

[2] However, it should be noted that a large fraction of Dutch exports are re-exports, and the latter are more concentrated in Europe, Dutch exports excluding re-exports are thus less European centered, but still exhibit a small exposure to Developing Asia, although exports to China have been growing in recent years.

3. **Fiscal consolidation in the Netherlands and in trading partner countries will be significant**. The structural primary balance position of the Netherlands is projected to improve in 2011 by 1½ percent of GDP and an extra ¾ percent of GDP in 2012. Additionally, several of Netherlands' main trading partners are expected to reduce fiscal spending over the same horizon by a similar order of magnitude. The latter could imply a marked reduction of demand for Dutch exports. Since exports account historically and in the current recovery for a significant part of GDP growth, reduced demand potentially translates into non negligible effects on overall GDP growth.

4. **GDP growth could slow notably due to fiscal consolidation**. We simulate for 2010-12 the domestic effect of Dutch fiscal consolidation and the spillovers from global fiscal consolidation to the Netherlands using a model based on the national accounting framework.[3] The model computes the contribution of fiscal changes in the Netherlands and its main trading partners to output growth, allowing for carry-over effects from fiscal changes in the previous period to current GDP growth. The simulation results indicate that the *domestic* effect of fiscal consolidation in the Netherlands reduces output by -0.5 percent in 2011 and -0.6 percent in 2012 (Table 2-2). While the effect in 2011 is driven by reduced spending in 2011, the effect in 2012 stems more from the carry-over effects from the 2011 consolidation (-0.5 percent) as opposed to the contribution from the additional consolidation in 2012 (-0.1 percent).

Table 2-2. Fiscal Contribution to Growth1/
(In percentage points)

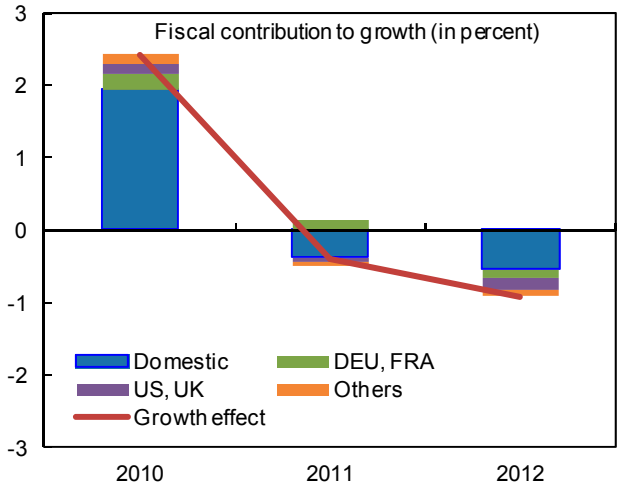
	2011			2012		
	Total Growth Impact	Of which:		Total Growth Impact	Of which:	
		Domestic Effect	Spillover Effect		Domestic Effect	Spillover Effect
Netherlands	**-0.5**	**-0.5**	**0.0**	**-1.0**	**-0.6**	**-0.4**
of which:						
- current year	-0.6	-0.4	-0.2	-0.3	-0.1	-0.2
- carry over prev. year	0.1	-0.1	0.2	-0.7	-0.5	-0.2
PPP weighted average	-0.3	-0.2	-0.1	-1.1	-0.9	-0.2
Simple average	-0.3	-0.2	-0.1	-1.0	-0.7	-0.2

Source: IMF staff estimates.

1/ Financial sector support recorded above-the-line was excluded for the calculation of growth impact for Ireland (2.5 percent of GDP in 2009 and 5.3 percent of GDP in 2010) and the U.S. (2.5 percent of GDP in 2009, 0.4 percent of GDP in 2010, and 0.1 percent of GDP in 2011 and 2012). Financial sector support is not expected to have a significant impact on demand. For Russia only non-oil revenues are assumed to have an impact on growth.

[3] The procedure builds on Ivanova and Weber (forthcoming). A short description is provided in the Appendix.

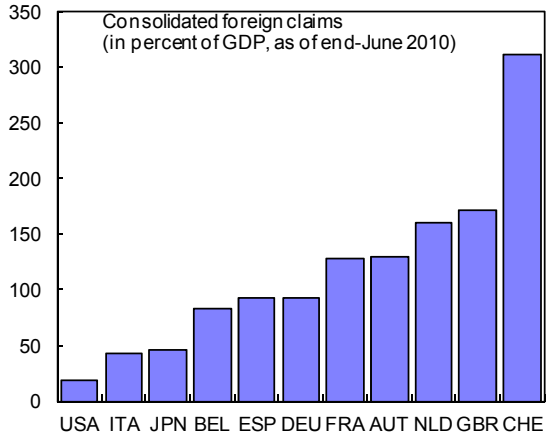
5. **Spillover effects from main trading partners are likely to reduce GDP notably by 2012**. The negative contribution to GDP from trading partners' consolidation efforts is expected to be nil in 2011, due to a still positive impact from Germany, but -0.4 percent in 2012. Thus the negative contribution of spillovers in 2012 accounts for 40 percent of the total negative effect of global fiscal consolidation of -1 percent. The extent of spillover in the Netherlands is well above the PPP weighted average of the 20 countries in the sample for which spillovers account for 18 percent of the overall growth impact of fiscal consolidation. Fiscal consolidation in Germany and France accounts for 33 percent of the spillovers to the Netherlands, the U.S. and the U.K. for 45 percent, Italy for 7 percent, Spain for 4 percent, Greece, Ireland and Portugal for 4 percent, and the remaining 7 percent is attributable to the other countries in the sample.



Source: IMF staff calculations.

B. Financial Sector Linkages

6. **International financial exposures of Dutch banks are also concentrated with respect to advanced economies and some major countries**. While the share of claims on European counterparts reaches 55.1 percent, Belgium, Germany, and, the U.K. account for more than half of these claims (Table 2-3). Exposures to Southern European countries and Ireland are a combined 13.2 percent of total claims abroad. The U.S. constitutes the highest individual exposure with a share of 18.7 percent of total claims abroad. However, the consolidated foreign claims of Dutch banks relative to GDP have fallen from 315 percent in 2007 before the crisis to 160 percent in mid-2010 and the share of loans to non-residents has fallen significantly from slightly above percent in 2007 Q3 to below 50 percent of total loans as of 2010 Q2.[4]



Source: BIS, IMF staff calculations

[4] In line with the high openness to trade, the exposure is also explained by significant trade-related lending.

7. **Despite a lower overall exposure, losses to Dutch lenders could be sizeable in the event of a defaulting counterpart**. We conduct a network analysis to simulate the direct and indirect effects of a foreign default on Dutch claims abroad.[5] The lower default scenario indicates already sizeable losses to Dutch lenders even if only one of the major financial partners defaults on a fraction of their liabilities. The effect is magnified due to Netherlands' financial openness which increases the sensitivity to indirect effects via third countries. A default on 10 percent of international claims by the U.S., the U.K., Germany or Spain could generate a loss of between 0.9 to 3.1 percent of GDP. The impact on credit availability is particularly high in the case of a default on claims vis-a-vis the U.K. and the U.S. In a more pessimistic scenario of a default on 20 percent of international claims abroad, the impact on the availability of credit rise less than proportionally, while the loss in percent of GDP rises in line with the increase in the default ratio. Since, tier 1 capital is sufficiently high in the Netherlands, deleveraging is only required in the extreme event of a default on 20 percent of international claims by both the U.S., and the U.K. The analysis indicates that the Netherlands has a higher exposure to Spain than to Italy. However, exposure to the U.S. remains the most important source of potential financial disruptions. The decrease in total claims abroad since the onset of the financial crisis has brought the potential loss from a default somewhat down. Nevertheless, exposure relative to GDP remains relatively high by international standards.

Table 2-3. Dutch Bank Claims Abroad
(As of end-June 2010)

	US$ Billion	Share (percent)
All countries	1,239	100
Developed countries	1,042	84.1
Europe	682	55.1
Belgium	109	8.8
France	81	6.5
Germany	150	12.1
United Kingdom	135	10.9
Spain	73	5.9
Italy	43	3.5
Other developed countries	359	29.0
United States	231	18.7
Developing countries	154	12.5
Asia & Pacific	43	3.5
India	11	0.9
China	10	0.8

Source: BIS.

[5] See for a detailed treatment Tressel (2010).

Table 2-4. Spillovers to the Netherlands from International Banking Exposures

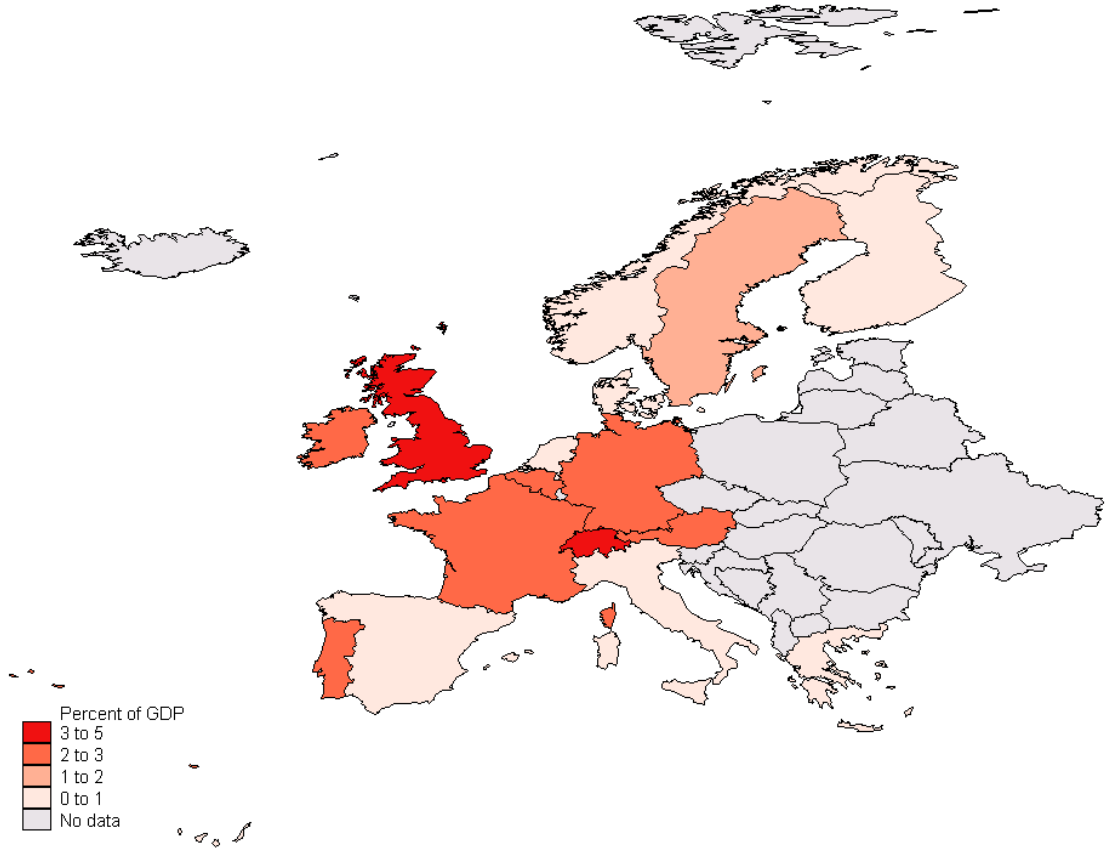
	Shock Originating From Magnitude 1/	Deleveraging Need 2/	Dutch Lenders' Losses (percent GDP)	Impact on Credit Availability (percentage points)
United States	10	0.0	3.1	-5.4
United Kingdom	10	0.0	1.6	-15.3
Germany	10	0.0	1.0	0.0
Italy	10	0.0	0.6	-2.9
Spain	10	0.0	0.9	-2.6
GIP 3/	10	0.0	0.4	-1.9
UK and US	10	0.0	4.7	-25.0
US and DEU	10	0.0	4.2	-5.4
UK, US, and DEU	10	0.0	5.7	-25.2
United States	20	0.0	6.3	-9.3
United Kingdom	20	0.0	3.2	-20.2
Germany	20	0.0	2.0	-0.1
Italy	20	0.0	1.1	-2.9
Spain	20	0.0	1.9	-2.6
GIP 3/	20	0.0	0.8	-3.3
UK and US	20	8.7	9.4	-37.1
US and DEU	20	0.0	8.3	-16.9
UK, US, and DEU	20	32.7	11.5	-45.0

Source: RES/MFU Bank Contagion Module based on BIS, ECB, and IFS data.

1/ Magnitude denotes the percent of on-balance sheet claims that default.
2/ Deleveraging need is the amount (in percent of Tier I capital) that needs to be raised through asset sales in response to the shock in order to meet a Tier I capital asset ratio of 6 percent, expressed in percent of total assets.
3/ Greece, Ireland, and Portugal.

8. **Possible contagion from a shock in the Netherlands is relevant for several European countries.** With the exception of Portugal and Belgium which are exposed to the Netherlands with respectively more than 7 and 6 percent of total assets, Dutch assets generally account for less than 5 percent of any major economies' total claims abroad. This high exposure of Portugal and Belgium explains the relative strong impact on the two countries of a Dutch default amounting to 50 percent of its foreign liabilities. For the United Kingdom and Switzerland it is the indirect exposure driven by the high ratio of claims abroad to GDP in these two countries that makes them more vulnerable.

Figure 2-1. Spillover from the Netherlands Through International Banking Exposures



C. Conclusion

9. **The Netherlands is very open to trade and finance, but trade flows and financial claims are not geographically diversified**. Openness to trade has benefited the Netherlands before the crisis and has supported the recent recovery process. However, both financial openness and trade linkages have also been a transmission channel for the financial crisis. The concentration of trade makes the Netherlands particular susceptible to developments in few developed countries.

10. **Synchronized fiscal tightening across Europe has important spillover effects for GDP growth**. The Netherlands benefited from positive spillovers due to fiscal expansions in most countries in 2009–10. The swing to fiscal tightening in 2011–12 potentially reduces Dutch GDP growth by a fraction similar in size to the reduction caused by the domestic consolidation plans. A more ambitious consolidation path in major trading partners could thus pose a downside risk to GDP growth in the next two years.

Table 2-5. Dutch Bank Liabilities Abroad
(As of end-June 2010)

	US$ Billion	Share (% of all claims on Dutch banks)	Share (% of countries total claims abroad)
All countries	967	100	3.3
Europe	589	60.8	3.3
Germany	149	15.4	4.9
United Kingdom	141	14.6	3.7
France	126	13.1	3.8
Switzerland	38	3.9	2.3
Austria	16	1.6	3.3
Belgium	23	2.4	6.0
Italy	21	2.2	2.4
Spain	21	2.1	1.6
Ireland	12	1.3	2.2
Portugal	11	1.1	7.3
Greece	4	0.4	2.9
Sweden	9	0.9	1.3
Other developed countries			
Japan	48	5.0	1.9
United States	124	12.8	4.5

Source: BIS.

References

IMF, 2010, "Recovery, Risk and Rebalancing," IMF World Economic Outlook, Oct 2010 (Washington: International Monetary Fund).

Ivanova, Anna, and Sebastian Weber, forthcoming, "Do Fiscal Spillovers Matter", IMF Working Paper (Washington: International Monetary Fund).

OECD, 2009, "The effectiveness and scope of fiscal stimulus", OECD Economic Outlook Interim Report (March).

Tressel, Thierry, 2010, "Financial Contagion through Bank Deleveraging: Stylized Facts and Simulations Applied to the Financial Crisis," IMF Working Paper 10/236 (Washington: International Monetary Fund).

APPENDIX: A SIMPLE FRAMEWORK TO MEASURE THE EFFECT OF GLOBAL CONSOLIDATION ON GROWTH

The simulation results are based on the representation of the national accounts and behavioral assumptions for government spending, taxes, consumption, investment, exports and imports. Starting from the national accounting identity we know that:

$$Y_{t,j} = C_{t,j} + I_{t,j} + G_{t,j} + X_{t,j} - M_{t,j} \qquad (1)$$

where $Y_{t,j}$ is the real output, $I_{t,j}$ is real investment, $G_{t,j}$ is the real government spending, $X_{t,j}$ is are real exports and $M_{t,j}$ are real imports of country *j* in time *t* denominated in a common currency. The individual components of output are respectively given by:

$$\begin{aligned} C_{t,j} &= C_0 + c_1\left(Y_{t,j} - T_{t,j}\right) & M_{t,j} &= \mu_j Y_{t,j} \\ I_{t,j} &= I_0 + d_1 Y_{t,j} - d_2 r_{t,j} \quad . & G_{t,j} &= G^0_{t,j} + \rho_G G^0_{t-1,j} + g_1 Y_{t,j} \\ X_{t,j} &= \sum_{\substack{i \neq j \\ i=1}}^{I} \omega_{ij}\mu_i Y_{t,i} & T_{t,j} &= T^0_{t,j} + \rho_T T^0_{t-1,j} + t_1 Y_{t,j} \end{aligned} \qquad (2)$$

where μ_i is the marginal propensity to import of a trading partner *i*,[1] Y_i is the output of a trading partner *i*, and ω_{ij} is the weight of imports from country *j* in total imports of country *i*. Government expenditures and revenues have a cyclical part and a discretionary element. We also allow past fiscal measures to have carry over effects into the current period. Substituting the definitions (1.2) in (1.1) yields

$$Y_{t,j} = ex_{t,j} + m_j G^0_{t,j} + \rho_G m_j G^0_{t-1,j} - m_j c_1 T^0_{t,j} - \rho_T m_j c_1 T^0_{t-1,j} + m_j \sum_{\substack{i \neq j \\ i=1}}^{I} \omega_{ij}\mu_i Y_{t,i} \qquad (3)$$

Where $ex_{t,j} = C_0 + I_0 - d_2 r_{t,j}$ and $m_j = \left(1 - c_1 - d_1 - g_1 + t_1 + \mu_j\right)^{-1}$ is the expenditure multiplier. Taking the first difference and dividing by real output in t-1 yields the growth rate as a function of the fiscal change:

$$\frac{\Delta Y_{t,j}}{Y_{t-1,j}} = m_j\left(\frac{\Delta G^0_{t,j}}{Y_{t-1,j}} + \rho_G \frac{\Delta G^0_{t-1,j}}{Y_{t-1,j}}\right) - m_j c_1\left(\frac{\Delta T^0_{t,j}}{Y_{t-1,j}} - \rho_T \frac{\Delta T^0_{t-1,j}}{Y_{t-1,j}}\right) + m_j \sum_{\substack{i \neq j \\ i=1}}^{I} \omega_{ij}\mu_i \frac{\Delta Y_i}{Y_{t-1,i}} \frac{Y_{t-1,i}}{Y_{t-1,j}} \qquad (4)$$

[1] In the calculations the import elasticity was assumed to be equal to 1 for all countries, which implies that the marginal propensity to import μ_i is equal to the ratio of imports to GDP for each country.

Equation (1.4) is a system of *I* linear equations that can be written in matrix notation and solved for the change in expenditures and revenues according to:

$$\tilde{Y}_t = W\left[A_1\overline{G}_t - A_2\overline{T}_t\right] \qquad (5)$$

Here $W = \left(I - B\right)^{-1}$ is a *I*-by-*I* identity matrix, B is a *I-by-I* matrix, $\tilde{Y}$ is *I-by*-1 vector of real GDP growth rates, A_1 and A_2 are diagonal *I-by-I* matrices and $\overline{G}_t$ and $\overline{T}$ are *I-by*-1 vectors. It is possible to derive country *i*'s contribution to country *j*'s GDP growth by evaluating:

$$\tilde{y}_{t,ji} = w^{ji}\left[a_1^{ji}\overline{g}_t^{\,i} - a_2^{ji}\overline{t}_t^{\,i}\right] \qquad (6)$$

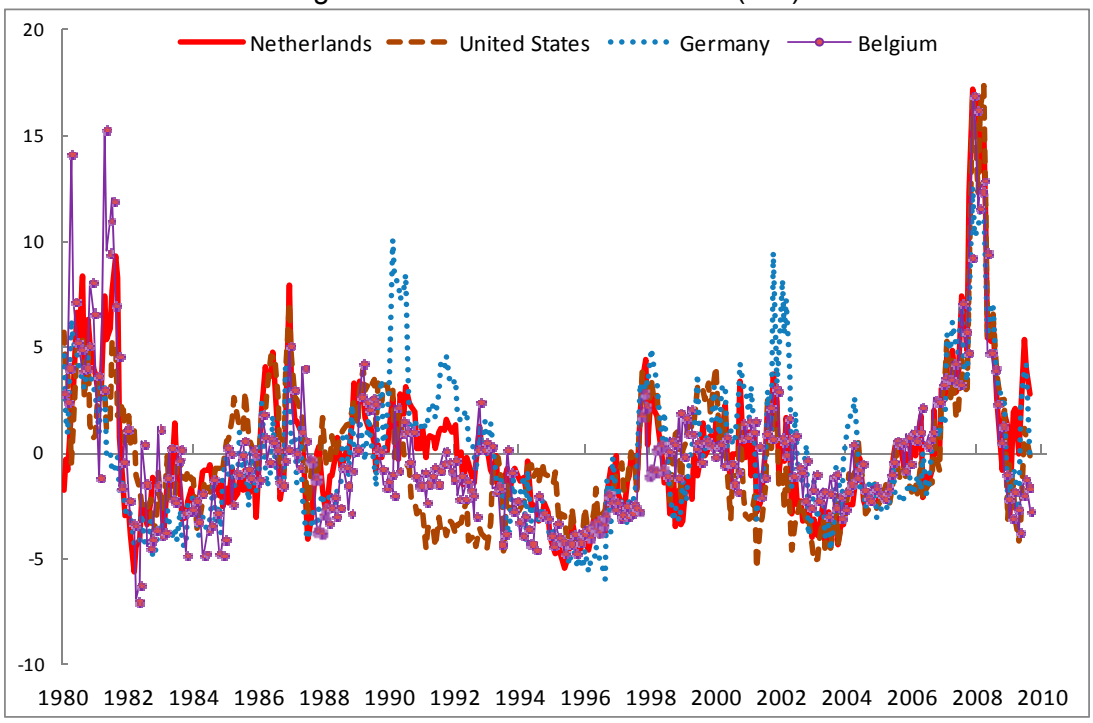
For the purpose of our simulation we set *I*=20 and the sample of countries includes: Austria, Belgium, China, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, Portugal, Russia, Spain, Sweden, Switzerland, United Kingdom, and United States. This sample of countries accounts for 83 percent of Dutch exports. We measure the fiscal impulse by the change in the cyclical adjusted revenues and expenditures relative to GDP. Multipliers are taken from OECD (2009) and generally adjusted upwards by a factor of 20% to reflect the current environment of low interest rates and exchange rate stability for the Netherlands vis-à-vis most of its trading partners.[2]

[2] According to IMF (2010) the multipliers in the current economic environment are potentially up to twice the normal multipliers.

ANALYTICAL NOTE 3: MACRO-FINANCIAL LINKAGES[1]

1. **The Dutch financial sector has been hit hard by the financial crisis, while the impact on the broader economy has also been pronounced but less severe**. The recent developments in the indicators point toward a gradual improvement of the financial sector situation, but downside risks remain elevated.

Figure 3-1. Financial Stress Index (FSI)



Source: IMF staff calculations

A. Financial Stress Indicator

2. **The financial system has suffered major distress in the crisis and uncertainty remains high**. To measure aggregate vulnerabilities in the financial system, we construct a financial stress index (FSI) based on variables related to the banking sector, securities markets and foreign exchange market.[2] The evolution of the FSI indicates that the financial crisis has had a higher impact on the financial system in the Netherlands than on the average advanced economy or European country. After peaking during the crisis by end-2008, the index dropped rather rapidly to a temporary low by end-2009, but edged up again in mid-

[1] Prepared by Sebastian Weber.

[2] The financial stress index (FSI) is a composite of the spread between commercial papers and sovereign bonds, the beta of the banking sector (from a CAPM), the term structure of interest rates, and volatilities in stock returns and the exchange rate. Large values imply higher distress. A value of zero indicates neutral financial conditions. See Cardarelli et el. (2009) and Balakrishnan et al. (2009)

2010 due to increased volatility in the stock market and an increase in the stress in the banking sector. This indicates that uncertainty remains high and the recovery fragile.

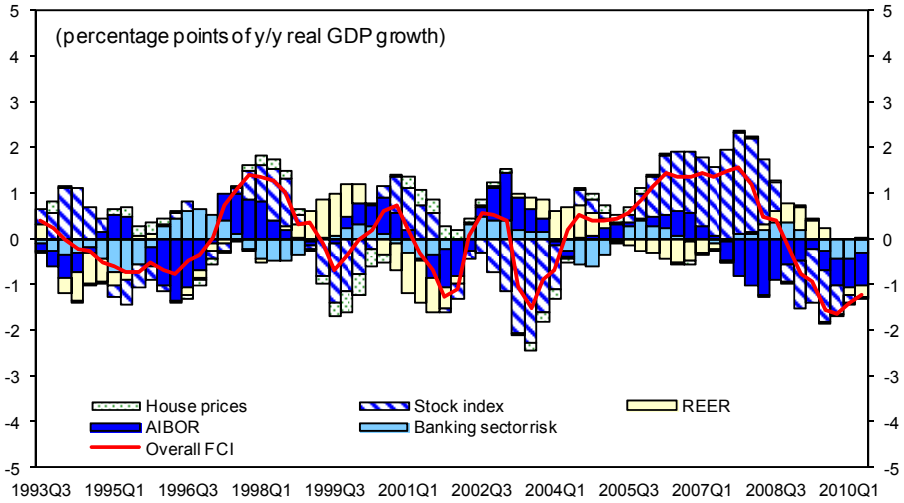
B. Financial Spillovers on the Real Sector

3. **Spillovers from the financial conditions remain a source of concern**. Financial variables have affected the broader economy via multiple channels. Falling housing prices worsened the balance sheet position of households and are a potential factor limiting consumption growth. While credit demand has declined, stress in the banking sector and falling profitability of banks have added to the reduced credit growth via tighter conditions for loans. To analyze these channels in more detail and quantify the effects, we make use of three econometric approaches. First, we construct an index which allows us to evaluate the impact of the change in financial conditions on GDP. Second, we analyze the existence of a potential disequilibrium in the credit market. And, finally, we assess to which extent the output growth is affected by conditions in the credit market.

Financial Conditions and their Effect on Output

4. **We use a VAR analysis to decompose the contribution of various financial indicators to economic activity**. The overall financial condition index (FCI) is the sum of the cumulative impulse responses of real GDP to each of the financial variables. The latter variables include the house price index, the short term interest rate (AIBOR), the stock price index, the banking sector risk (measured by the beta estimated in a CAPM), and the real effective exchange rate. The value of the overall FCI reflects the overall contribution of financial conditions to GDP. Additionally, the impulse responses are standardized such that a change in the index by one unit can be interpreted as an (annualized) change in GDP growth by 1 percentage point.

Figure 3-2. Financial Conditions Index (FCI)



Source: IMF staff calculations.

5. **The evolution of the FCI implies a strong negative impact of financial conditions on GDP in 2009 and 2010**. The FCI's deteriorating trend since 2007Q4 until 2009Q4 suggests a significant cumulative reduction in GDP over the two years due to the deterioration in financial conditions. At the end of 2009 the index stood at -1.6 down from 1.6 in 2007Q4. While the downward trend stopped in 2010, the recovery is moderate and the negative overall contribution of the financial conditions to output is estimated to persist throughout 2010. For the first time in the observed sample range, all financial variables exert a negative impact on GDP. This and the absence of a fast improvement in asset markets, the interbank market and the banking sector indicate that a return to a positive contribution of financial conditions to GDP growth can only be slow.

6. **The main contribution to negative growth in 2009 has come from falling stock market prices which have not recovered fully yet**. The deterioration of equity prices and the temporary drying up of short term funding in the interbank market, have fuelled the stress in the banking sector via lower asset values and increased costs of refinancing.[3] The estimated contribution of house price developments to GDP is negative since end 2009, but remains very low in absolute terms. However, a further deterioration in the housing market or a double dip in the stock market could constitute important sources of downside risk as the continued low levels of interest rates already constrain the profitability of the banking sector.

[3] The Choleski decomposition is obtained by ordering output first followed by the price level, the banking sector risk, the interbank rate, the real exchange rate, the stock market index and the house price index. The conclusions are robust to changes in the ordering.

Credit Market Imbalances

7. **Adverse financial conditions can feed into a mismatch of demand and supply in the credit market**. However, the policy implications are very different depending on whether the mismatch is driven by the supply side (credit crunch) or the demand side (credit contraction) of credit. In the case of a credit crunch banks are constrained in their capacity to provide credit either because of liquidity problems or deleveraging. Thus, there is a case for policy to focus on restoring stability in the financial sector, possibly through direct support to financial institutions. In the event of a credit contraction, households and firms demand for credit is weak due to the economic outlook. In this case, policy should focus on fostering household and firm demand by improving the economic conditions for households and firms.

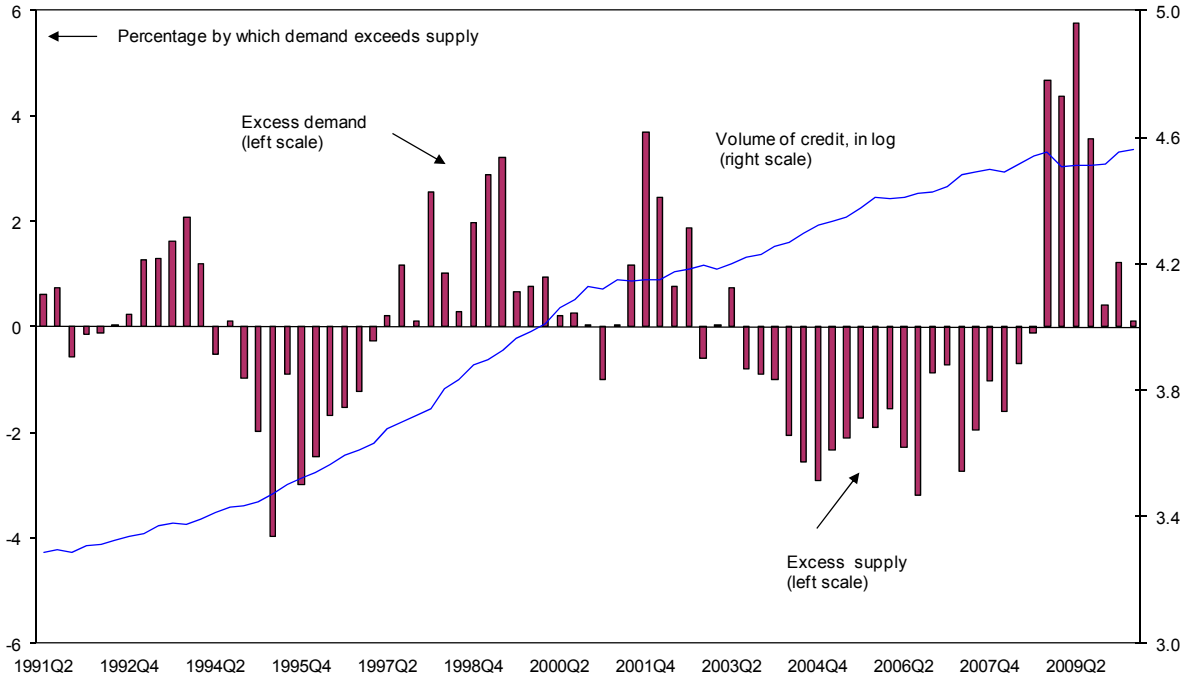
8. **We estimate a system of equations for the demand for and the supply of credit to the private sector for the period from 1990Q1 to 2010Q2**.[4] The demand for credit is assumed to depend on the lending rate, inflation, economic activity, the stock price index, and the annual average of the producer confidence index (as a proxy for the economic outlook). The supply of credit is explained by total deposits (as a measure of available resources), the lending rate, the spread between lending and short term funding rate, inflation, economic activity, the beta of the banking sector to account for stress in the banking sector, the stock price index, and the annual volatility of the stock price index. The difference between the residuals of the supply and the residuals of the demand equation can be interpreted as disequilibrium in the credit market. An excess demand which coincides with a flat or falling volume of credit indicates the presence of a credit crunch.

9. **The analysis suggests that the excess demand in 2008–09 has come to an end in 2010**.[5] The financial crisis was preceded in the Netherlands by an excess supply of credit for a prolonged period. This trend started to reverse in mid 2007 and quickly turned into an excess demand of close to 6 percent in 2009Q2. The excess demand ("credit crunch") was driven by a faster decline in credit supply than in demand for credit, reflecting the adverse conditions in the financial sector and the associated deleveraging of several major banks. While credit demand remained subdued throughout last year, credit supply recovered on the back of improved access to capital and a moderation of the stress in the banking sector.

[4] The analysis is based on Pazarbasioglu (1997) and has and recently been applied again to Finland by Roca (2010). The credit data refers to the loans to the private sector. Using the loan data adjusted for securitization, implies a somewhat weaker excess demand, but does not alter the general conclusion.

[5] The exact timing of the start and end of the credit crunch varies slightly with the choice of the determinants of demand and supply. However, the magnitude of the credit crunch and the general evolution of the mismatch of demand for and supply of credit remain robust to various changes in the choice of the explanatory variables.

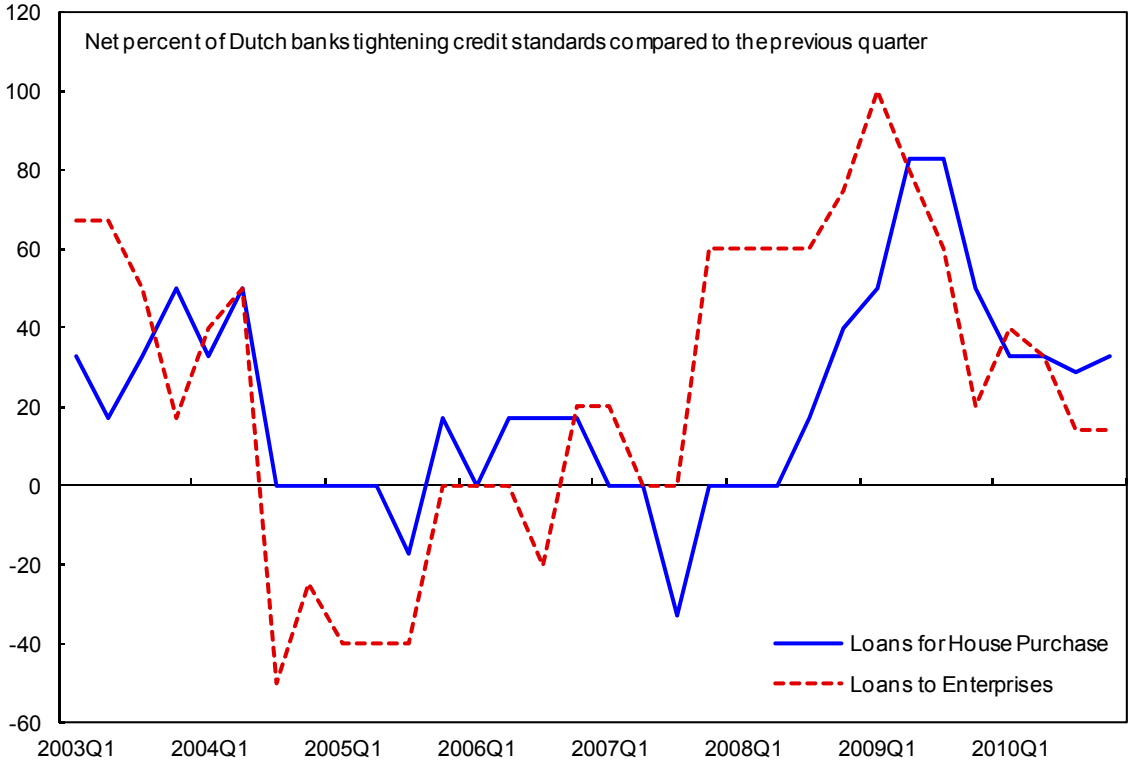
Figure 3-3. Netherlands: Excess Supply of / Demand for Credit



Source: IMF staff estimates.

10. **While estimation results should be interpreted with caution, survey data on bank lending standards tends to confirm the conclusion.** Lending conditions have been tightening for households as well as non financial corporations. The worsening coincides to a large extent with the period in which the estimation detects an excess demand for credit, while the neutral or lower credit standards coincide with a situation of excess supply. Tighter credit conditions were, however, mitigated to some extent by an increase in financing via bond markets for (large) non financial corporations. Surveys also indicate that larger corporations in particular have had fewer problems in obtaining credit. The general high level of profits preceding the crisis has provided firms with buffers which allowed absorbing tighter credit conditions without severe consequences (Taskforce Kredietverlening 2010). Additionally, the authorities estimate that extraordinary measures provided liquidity to firms of more than 4 billion euro, in 2009 and 2010, and additional 2.1 billion in 2011. This support, which is not reflected in the regression framework, could lower the estimated excess demand by 0.6–0.9 percentage points.

Figure 3-4. Bank Lending Standards Developments



Source: CBS

Credit Market Conditions and Growth

11. **A higher sensitivity of output to credit growth indicates that disruptions in the credit market can be an important source of risk for growth**. Thus, it is important to assess the strength of the relationship between output and credit growth for the Netherlands. We estimate several VAR models to capture the transmission of credit growth shocks to economic activity. The results are then used to compute short and medium run responses and quantify the contribution of the credit market developments to output fluctuations.

12. **The VAR analysis points to a robust relationship between credit and output growth**. We use quarterly data for the period from 1990Q4 to 2010Q2 to estimate three VAR models. The basic model (1) includes GDP and credit growth. The framework is extended in model (2) to include additionally consumption growth as a relevant transmission channel of credit on GDP growth. Finally model (3) controls for potential external developments by adding export growth. We find credit growth to be a significant explanatory variable in all of the estimation models (Table 3-1).

13. **A potential contraction in credit growth could affect output growth notably**.[6] Shocks to credit growth account for 9–12 percent of the variation in output growth at the one year horizon. A reduction in credit growth reduces private consumption which in turn decelerates output growth. According to the estimates, a 10 percent negative shock to credit growth reduces average (annual) consumption growth by 1.7 percent and average (annual) output growth by 2.1 percent.

C. Conclusion

14. **The financial sector has been an important contributing factor to the negative GDP growth experienced recently**. The Dutch financial sector has been affected particularly strongly by the financial crisis. Besides the sheer size of the banking sector, this was also a result of important macro-financial linkages in the Netherlands. These linkages are apparent in the key role that both the financial system and the credit market play in the transmission of shocks to economic activity. The deterioration of financial conditions during the crisis translated into a credit crunch and a significant reduction in growth.

15. **While there are signs of improvement, the recovery appears fragile**. The situation in the financial sector has had a direct impact on the supply of credit during the crisis and on output growth. The improvement on the supply side of credit has contributed to a normalization of the credit market. Conditional on a continuation of that trend, exit measures should be put in place, and measures to revive the situation of firms and households should take center stage. However, the recent increase in the financial stress index indicates that the situation is still fragile and a relapse, while unlikely, cannot be ruled out entirely.

[6] While the exact magnitudes vary slightly, results are robust to a change in the ordering of the variables. Numbers reflect a lower bound estimate since credit growth is generally ordered last while other variables are allowed to impact GDP growth contemporaneously in the case of model (2) and model (3).

Table 3-1. Impact of Credit Growth on Economic Activity

	Model 1	Model 2		Model 3	
	GDP	GDP	Consumption	GDP	Consumption
Impact of a Drop in Credit by 10%					
- After 2 quarters	-1.03	-0.93	-0.77	-0.80	-0.88
- After 1 year	-2.29	-2.21	-1.64	-2.06	-1.68
- After 2 years	-3.08	-2.72	-2.09	-2.39	-2.16
Contribution to Variance (in % of total variance)					
- After 2 quarters	7.56	6.34	6.68	4.79	8.42
- After 1 year	11.91	11.02	11.76	9.10	13.36
- After 2 years	12.81	11.32	12.31	9.24	14.05
Reduced form Coefficient Estimates					
Credit (t-1)	0.10	0.09	0.08	0.08	0.09
	(2.19)	(2.03)	(1.92)	(1.73)	(2.14)
Credit (t-2)	0.04	0.05	0.07	0.03	0.08
	(0.78)	(0.98)	(1.80)	(0.57)	(2.01)
GDP (t-1)	0.36	0.40	0.15	0.31	0.21
	(2.97)	(3.04)	(1.34)	(2.20)	(1.72)
GDP (t-2)	0.01	0.11	0.04	0.05	0.08
	(0.12)	(0.94)	(0.39)	(0.38)	(0.75)
Consumption (t-1)		0.05	-0.18	0.04	-0.20
		(0.33)	(1.41)	(0.25)	(1.49)
Consumption (t-2)		-0.36	-0.08	-0.31	-0.08
		(2.39)	(0.65)	(.155)	(.137)
Foreign demand (t-1)				0.07	-0.02
				(1.65)	(0.64)
Foreign demand (t-2)				0.03	-0.04
				(0.73)	(1.15)
Number of observation	76	76	76	76	76
Adj. R-squared	0.26	0.30	0.10	0.32	0.10

Note: t-statistics in parenthesis.

Source: IMF staff calculations.

References

Balakrishnan, Ravi, Selim Elekdag, Stephan Danninger, and Irina Tytell, 2009, "The Transmission of Financial Stress from Advanced to Emerging Economies," IMF Working Paper 09/133 (Washington: International Monetary Fund).

Cardarelli, Roberto, Selim Elekdag, and Subir Lall, 2009, "Financial Stress, Downturns, and Recoveries," IMF Working Paper 09/100 (Washington: International Monetary Fund).

Roca, Paulo, 2010, "Macro-Financial Linkages," in Finland: 2010 Article IV Consultation IMF Country Report No. 10/273 (Washington: International Monetary Fund).

Ministerie van Economische Zaken, Landbouw en Innovatie, 2010, "Eindverslag van de Taskforce Kredietverlening" (December).

Pazarbasiouglu, Ceyla, 1997, "A Credit Crunch? Finland in the Aftermath of the Banking Crisis," IMF Staff Papers No. 44, pp. 315–27 (Washington: International Monetary Fund).

ANALYTICAL NOTE 4: RECENT DEVELOPMENTS IN THE DUTCH HOUSING MARKET[1]

1. **Dutch house prices rose steeply up until 2008 but suddenly reversed, raising fears of a collapse**. House prices rose by 6 percent (annualized) in nominal terms on average from 2000 to the third quarter of 2008. This was well in excess of economy-wide inflation: in real terms, house prices rose by 3½ percent over the same period. The rate of decline from the peak in 2008 was severe even by the standard of the house price slump of the late 19s and early 1980s: nominal (real) house prices fell by -5 (4) percent in the four quarters from 2008Q3 (Figure 4-1). Such a sudden reversal and steep decline raised fears that wealth effects would weaken consumption and damage banks' balance sheets, leading to further declines in a self-perpetuating cycle.

2. **Risks to the housing market appear finely balanced**. The Dutch experience of house price rises was less severe than those of other countries (¶3), and a variety of indicators and models of equilibrium housing valuations indicate that the Dutch housing market is not obviously overvalued (¶4–6). Household debt is high and growing as a proportion of disposable income, but the liquidity of household balance sheets has improved following the downturn (¶7). House prices themselves appeared to have stabilized across all types and regions, but may now have resumed a gradual decline, consistent with flat sales (¶8).

3. **House price fluctuations have not been as severe as for other economies**. It is useful to first compare house prices in the Netherlands with those in the euro area, given that those economies have common monetary policy conditions. From 2002Q1 to 2006Q3—the period during which all euro-area house prices were rising—Dutch house prices rose by 22 percent, whereas other euro-area house prices rose by 56 percent on average.[2] The "anglo-saxon" economies (Australia, Canada, New Zealand, U.K., U.S.) saw house price rises of 64 percent during the same period. Declines from recent (idiosyncratic) peaks to most recent observations have been less for Dutch house prices than other euro-area economies over the same period such as Denmark (-17 percent) and Spain (-12 percent).

4. **Indicators of affordability are still elevated**. Often-used indicators of affordability such the ratio of house prices to income and the ratio of house prices to rents have fallen from their peaks in 2008, but still remain high by the standards of the past 40 years (Figure 4-2).[3] However, the rate of change of these indicators was not as steep during the boom period as it was for the price levels themselves. Moreover, there is evidence that supply

---

[1] Prepared by Alasdair Scott.

[2] This value is a simple average across 9 euro area economies (Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, and Spain) and is not weighted (such as by GDP, population, or housing units).

[3] The distortions in the Dutch rental market (see Analytical Note 9) imply that the price-rental ratio might be a less useful indicator than in other economies.

constraints play a significant role in Dutch house prices,[4] which would explain a trend increase in relative house prices.

5. **Macroeconomic indicators of house price busts do not show a strong risk of a house price collapse in the Netherlands**. Previous research indicates that useful indicators of ensuing house price busts include a high growth rate in the credit to GDP ratio and negative and weakening current account balances.[5] Credit growth was strong, relative to nominal GDP. But the current account balance has been resolutely in surplus (Figure 4-3).

6. **Econometric models applied to latest observations do not indicate obvious overvaluation from current levels**. Applying the econometric models in IMF (2009b) to more recent data shows very little evidence of overvaluation at current levels. The models cover a range of single-equation and corresponding VECM reduced-form specifications, and a Probit model. In the former, house prices are regressed on measures of affordability, income, user cost of housing, and/or existing housing stock. The Probit model attempts to model the probability of having reached a peak, implying a forthcoming downturn in prices. The specifications are described in the Appendix. The models imply the same conclusions as in IMF (2009b): there is no obvious evidence of significant overpricing in Dutch house prices.

7. **The vulnerability of Dutch household balance sheets has been a concern**. Mortgage debt as a proportion of disposable income and GDP has steadily increased (Table 3-1), despite an internationally-high saving rate than increased following the crisis. However, the quality of Dutch household balance sheets has improved. One measure of this is a version of the "quick ratio" often applied to corporations—the ratio of liabilities to liquid assets (deposits and currency). In the period leading up to the crisis, the change in the quick ratio was highly correlated with house price growth. The relationship fits the Netherlands particularly well; the increase in the ratio was slightly higher than average, behind Ireland, Spain, Greece, Portugal, Finland and Norway (Figure 4-4). However, since the crisis hit, Dutch households have increased deposits and mortgage growth has slowed dramatically, such that the ratio of mortgages outstanding to liquid deposits has reduced considerably (Figure 4-5).

8. **House prices in the Netherlands appeared to have stabilized during 2010, but may have resumed a downward slide**. Nominal house prices had stayed essentially constant from 2009Q3 to the middle of 2010, although real house prices fell slightly over the same period as positive inflation returned. However, house prices appear to have resumed a downward slide since the middle of 2010, albeit at a slower rate than in 2009 (Table 4-2). This would appear to be consistent with low sales and anecdotal evidence of increased time

[4] See, for example, Vermeulen and Rouwendal (2007) and Kranendonk and Verbruggen (2008).

[5] See International Monetary Fund (2009) and Kannan et al. (2009).

on market (Figure 4-6). However, the price data might be distorted by compositional effects; on a like-for-like basis, prices might actually have increased. In short, the most recent data are sending mixed signals.

Table 4-1: Mortgage Stock to GDP
(percent)

2006	94.6
2007	95.3
2008	98.7
2009	107.3
2010	106.7

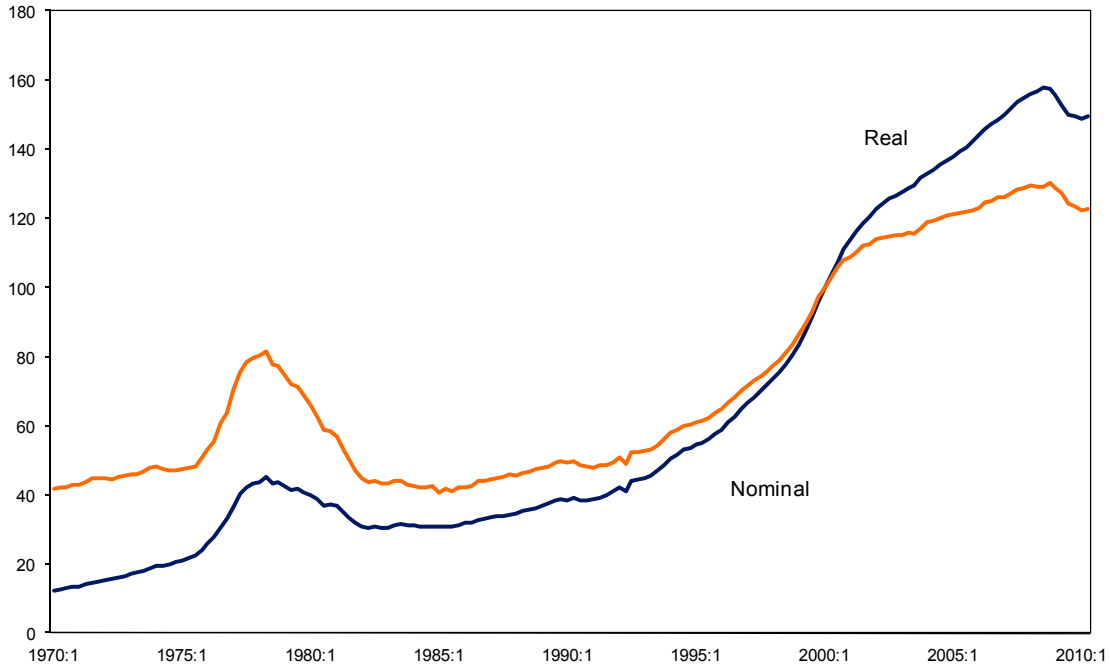
Source: Dutch National Bank; staff calculations

Table 4-2: Prices of Existing Houses

		Index	Monthly change (%)
2010	January	106.3	0.10
	February	106.5	0.20
	March	106.2	-0.30
	April	107.1	0.80
	May	106.3	-0.70
	June	106.3	0.00
	July	107.0	0.70
	August	106.8	-0.20
	September	106.3	-0.50
	October	105.8	-0.50
	November	105.5	-0.30
	December	105.3	-0.20
2011	January	105.1	-0.20
	February	104.9	-0.20

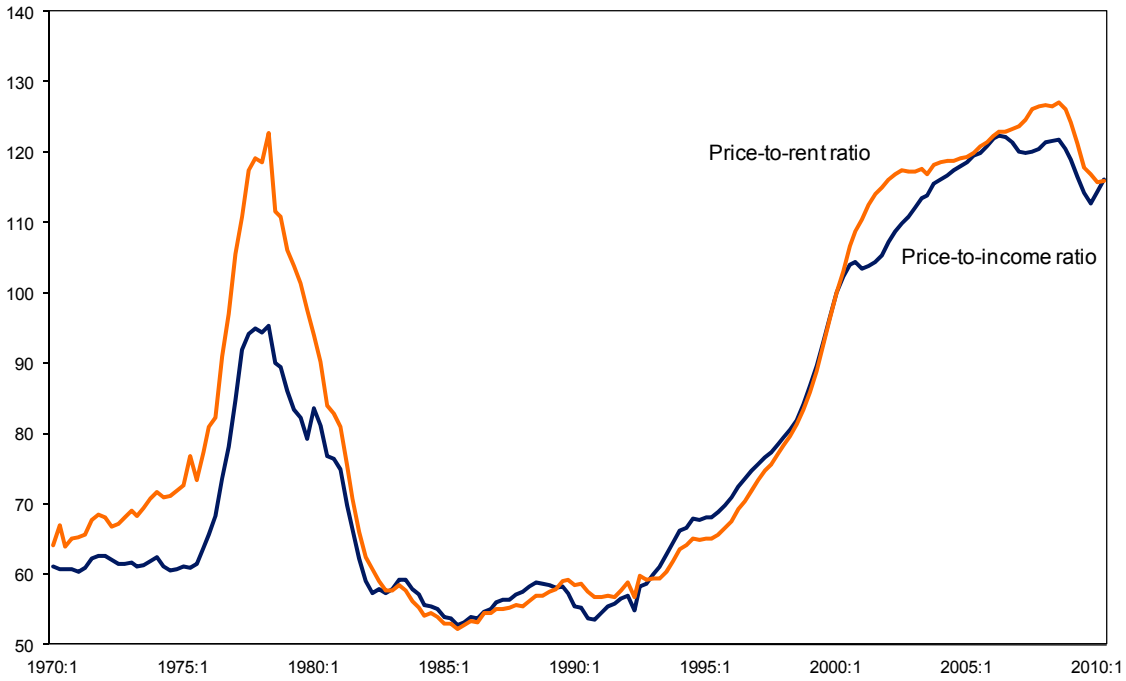
Source: Dutch Land Registry Office

Figure 4-1. Dutch House Prices
(2000q1 = 100)



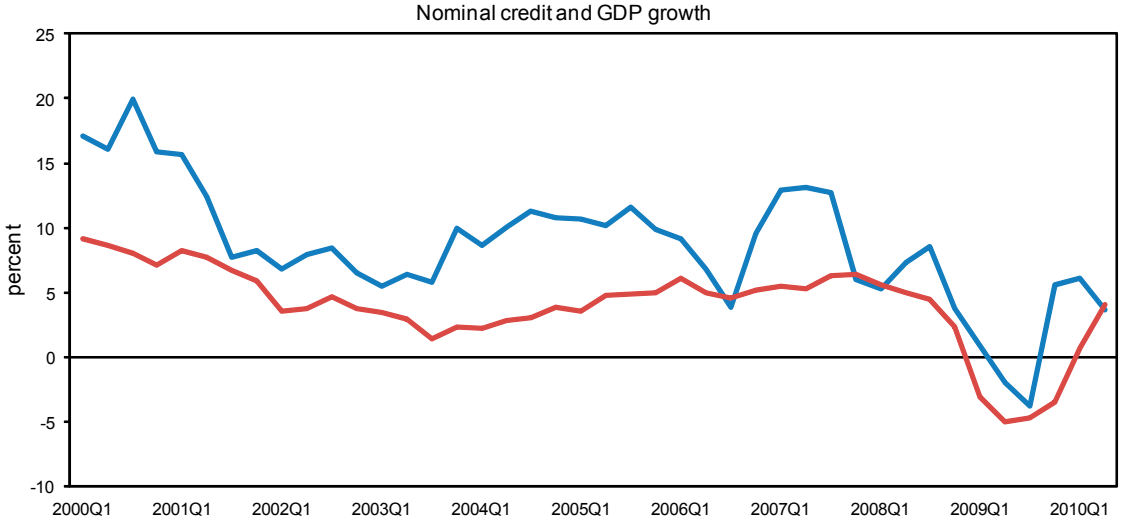
Source: OECD; IMF staff estimates.

Figure 4-2. Dutch House Price Ratios
(2000q1 = 100)

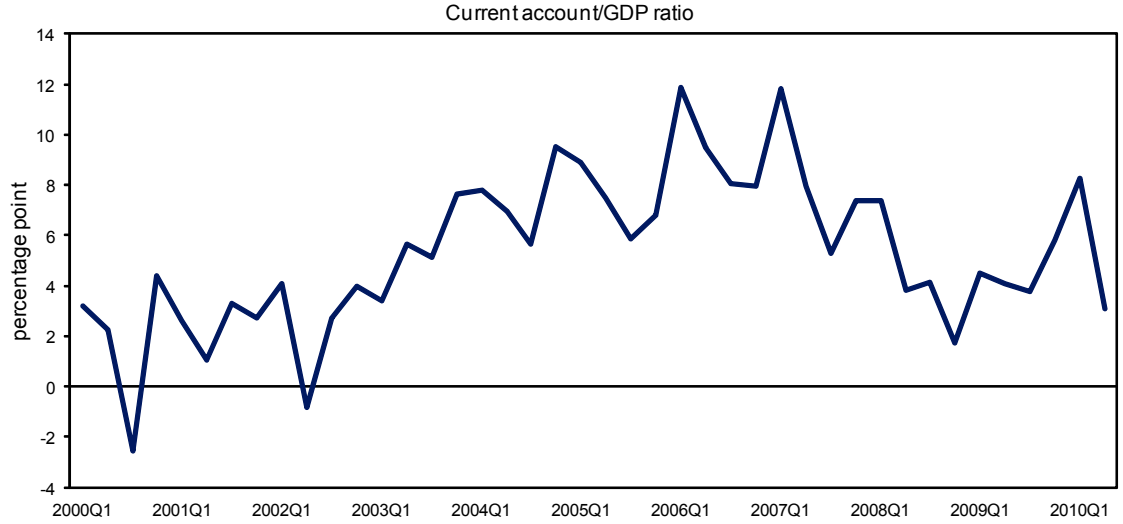


Source: OECD; IMF staff estimates.

Figure 4-3. Indicators of House Price Busts



Source: IMF staff estimates.



Source: IMF staff estimates.

Figure 4-4. Recent House Price Booms and Household Balance Sheets

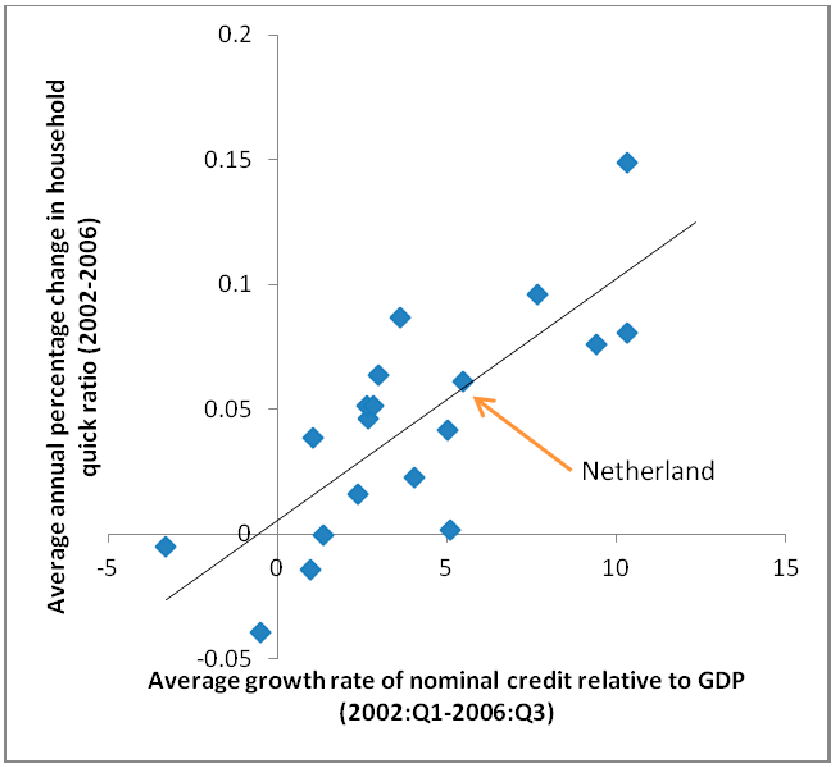
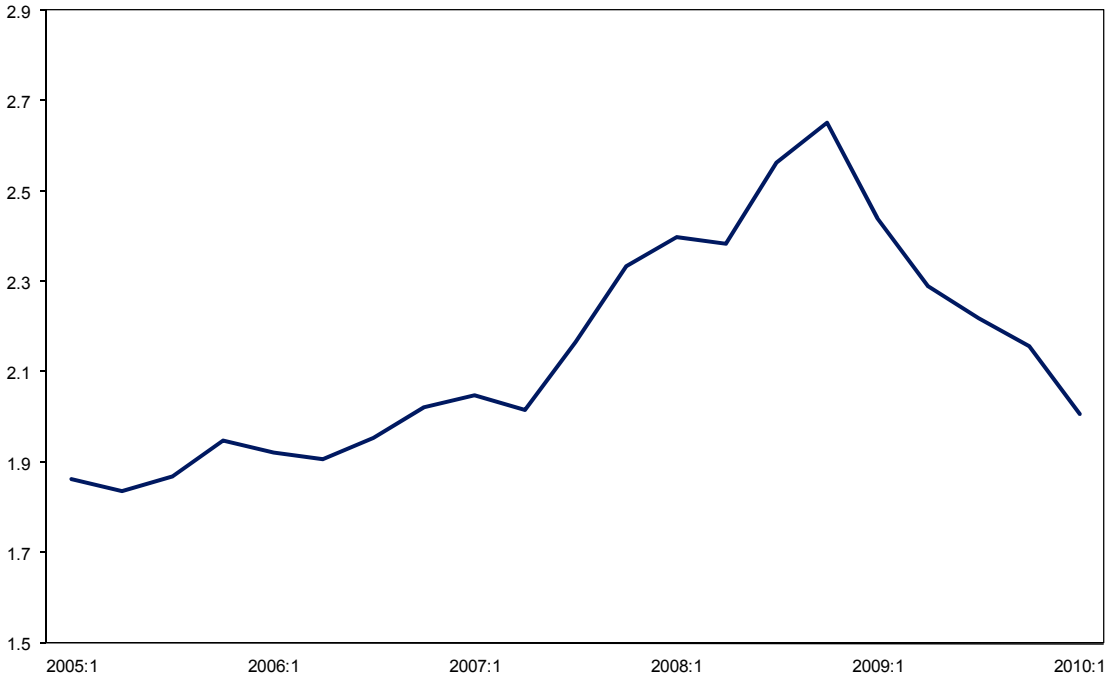
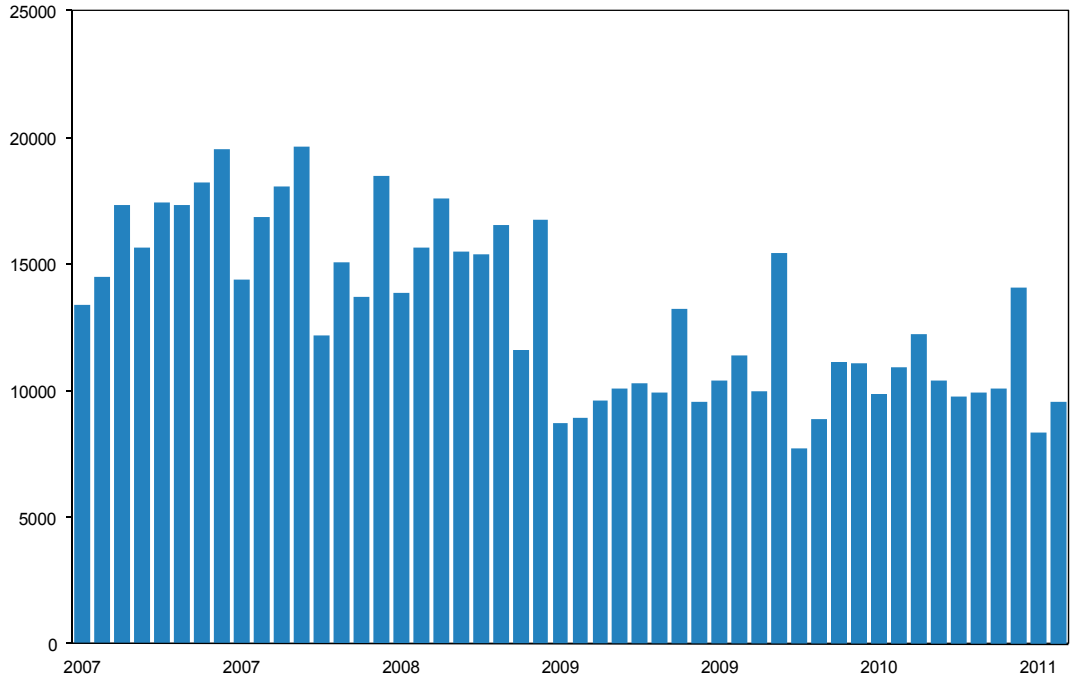


Figure 4-5. Ratio of Mortgages Outstanding to Redeemable Deposits



Source: Statistics Netherlands; IMF staff estimates.

Figure 4-6. Number of Registered Sold Houses



Source: Dutch Land Registry

References

International Monetary Fund (2009a), "Lessons for monetary policy from asset price fluctuations," Chapter 3 in October 2009 World Economic Outlook (Washington: International Monetary Fund).

International Monetary Fund (2009b), "Dutch housing markets: what went up will come down?" Analytical Note 1 in Staff Report for the 2009 Article IV Consultation (Washington: International Monetary Fund).

Kannan, Prakash, Pau Rabanal, and Alasdair Scott, 2009, "Leading indicators of asset price booms," *Journal of Applied Economics*,

Kranendonk, Henk, and Johan Verbruggen, 2008, "Are houses overvalued in the Netherlands?" CPB Memorandum 200.

Vermeulen, Wouter, and Jan Rouwendal, 2007, "Housing supply in the Netherlands," CPD Discussion Paper No. 87.

APPENDIX: REGRESSION AND PROBIT MODEL SPECIFICATIONS

Model Type	Dependent Variable	Explanatory Variables
Single equation	House price inflation	household disposable income, percentage change; real mortgage rates
Single equation	House price inflation	household disposable income, quarterly percentage change; real long interest rates; real household financial assets, annual percentage change; housing stock, quarterly percentage change
ECM	House price inflation	real house prices divided by disposable income, lagged; per capita disposable income, quarterly percentage change; long interest rate, percent; short interest rate, percent; real credit, annual percentage change; real stock prices, annual percentage change; population, annual percentage change
VECM	Real house prices, log	household disposable income, log; real mortgage rates
VECM	Real house prices, log	household disposable income, log; real long interest rates; real household financial assets, log; housing stock, log
VECM	Real house prices, log	household disposable income, log; short interest rate; credit, log; stock prices, log; population, log
Probit	House price inflation	long interest rate, lagged change in moving average; real house price index, lagged moving average; residential investment, share of GDP

ANALYTICAL NOTE 5: POTENTIAL OUTPUT ESTIMATES AND STRUCTURAL POLICY[1]

A. Introduction

1. **The Dutch economy has suffered a very severe downturn by its own historical standards and those of other countries**. For the first time in two decades, the Netherlands experienced a recession: from the second quarter of 2008, quarterly growth was negative for five quarters, with a cumulative (peak-to-trough) loss of output of 5.4 percent of GDP.[2] Positive growth has returned, but output remains well below its peak of mid 2009. To put it in perspective: if the economy were to grow from its trough in the middle of 2009 at its pre-crisis trend rate of 2.2 percent per year it would still need 10 quarters to merely reach the level of output attained in 2008 (i.e. the end of 2011).

2. **An important factor bearing on the strength of the recovery is the potential growth rate**. Given the depth and duration of the recession, it is imperative that the economy grow as quickly as possible. This will be more difficult if the economy has also suffered losses to potential output, such that the recovery is not simply a case of restoring demand but also taking appropriate supply side measures. The level of potential output will also have implications for appropriate monetary and fiscal policy.

3. **History suggests that financial crises can damage potential output**. Studies of recoveries of previous recessions arising from financial crises suggest that recoveries are slower, on average, than those following other types of recessions (IMF 2009a). This weakness can be attributed in part to permanent output losses, which imply that economies that experience financial crises suffer losses to productive potential (IMF2009b). Consequently, it is important to have a sense of whether the Dutch economy has experienced permanent losses to potential output.

4. **Estimating the level of potential output is especially difficult in the aftermath of a major recession**. Even in normal times, estimates of potential output are subject to considerable uncertainty. The obvious problem is that potential output is not directly measured, and has to be inferred from observable data. This is particularly complicated in the current situation. In particular, one must be careful when using methods that impose the answer by construction—for example, the popular practice of using two-sided moving averages to smooth through data can work well when business cycles are regular, but is associated with more uncertainty when the only available data are from the immediate aftermath of a recession, especially one as severe as the recent recession.

---

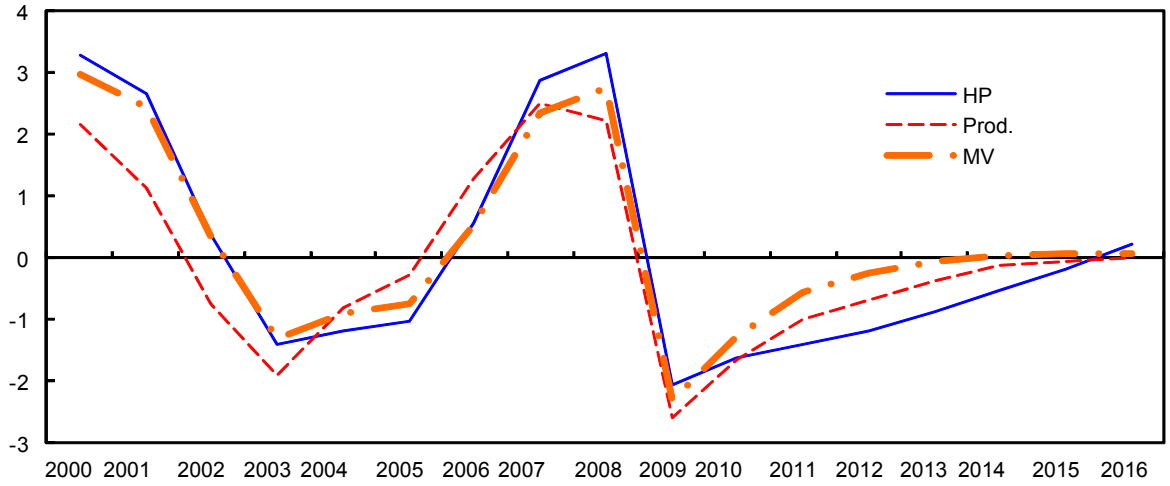
[1] Prepared by Alasdair Scott and Sebastian Weber.

[2] Quarterly real GDP growth has been negative on several occasions during the previous two decades, but never for two successive quarters, which is often used as a criterion for identifying classical recessions.

B. Estimates of Potential Output

5. **This note discusses the results from three different estimates of potential output comparing a standard HP filter, a production function approach and a multivariate approach**. While the HP filter is a univariate approach and uses only the information derived from output, the production function approach derives the output potential from capital, labor and TFP trend, which, in turn, are determined using an HP filter. The multivariate filter approach (MVF) instead models the joint behavior of output, unemployment, capacity utilization, inflation, and inflation expectations. The approach can be thought of as using a reduced form New Keynesian model, estimated on data for the Netherlands, to infer the levels of potential output and the NAIRU that would be consistent with these observations. The technical details of the model and its assumptions are presented in an appendix.

Figure 5-1. Output Gap Estimates (In percent of potential output)

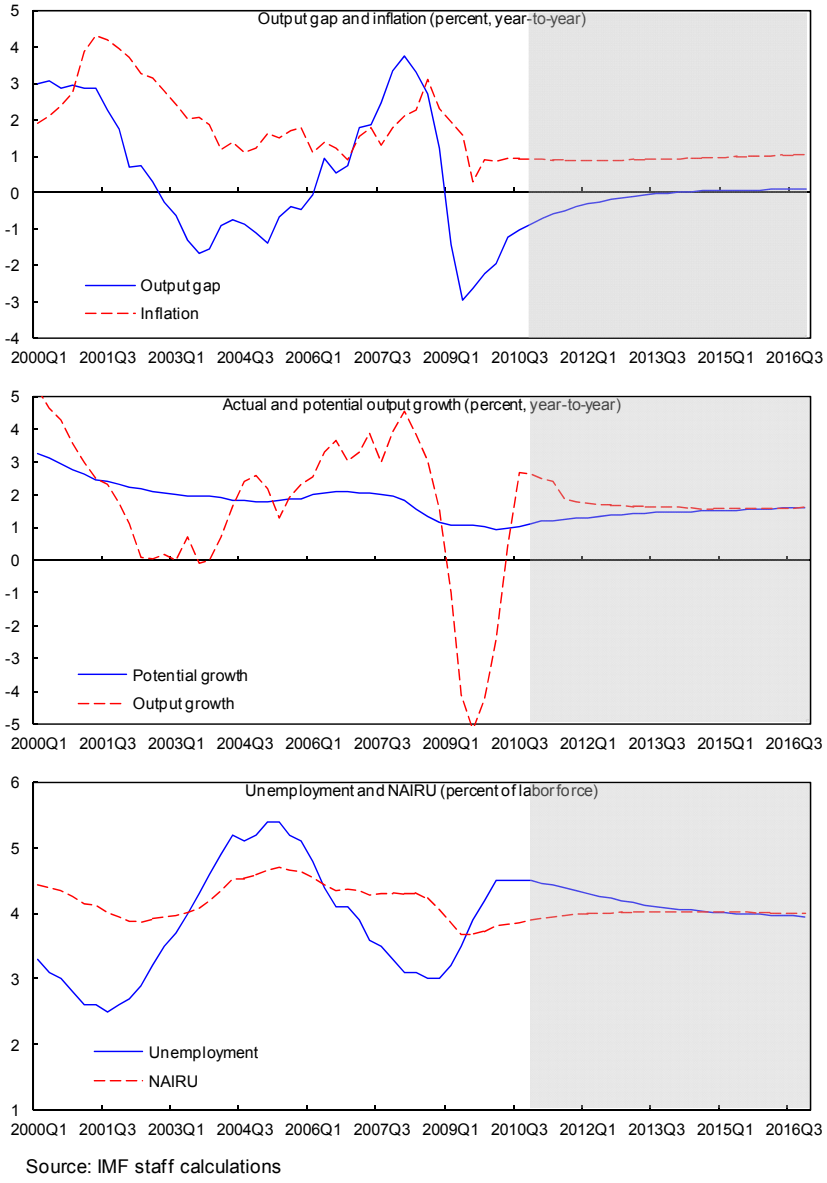


Source: IMF staff calculations.

6. **The estimates of the output gap following the crisis are large by normal standards, but not as severe as for other major advanced economies.** The output gap is estimated to have been as large as -2 to -2.5 percent in 2009 (Figure 5-1). However, this gap is less than those for other advanced economies. Estimates in Benes et al. (2010), which apply the MVF approach to data from other major economies, range from -4 and -3½ percent for Germany and France to -4 and -7 percent for the U.K. and U.S., respectively.

7. **The production function approach and the HP filter suggest a closing of the output gap by 2015.** Both approaches imply a rather gradual closing of the output gap. The multivariate approach suggests a faster recovery and a closing by 2014. This is due to higher growth forecasts in the years 2011 and 2012 compared to the forecasts underlying the HP filter and the production function approach. The higher forecast is in turn a result of the estimation approach, which is based on past recessions and can thus not include additional forward looking information such as the consolidation efforts across most countries in the aftermath of this crisis or other factors which are likely to retard growth.

Figure 5-2. Estimated Output Gap, Potential Growth and NAIRU



Source: IMF staff calculations

8. **All model estimates imply some losses in potential growth itself**. The production function estimates indicate that the crisis resulted in a substantial, albeit temporary, reduction in potential growth rates of nearly 2 percent (yoy). The multivariate approach suggests a somewhat lower drop of slightly above 1 percent (yoy). However, there is a considerable amount of uncertainty around this estimate, and the 95 percent confidence band includes a drop of the size suggested by the production function approach. Qualitatively, we can interpret the MVF estimates as saying that the economy appeared able to grow steadily at high rates, with inflation largely under control, up until the crisis hit. Although inflation has fallen during the recession period, it has not fallen by as much as would be needed to conclude that the output gap is as large as the fall in output.

9. **Multivariate model estimates indicate that the labor market is close to equilibrium**. In comparison with other economies, the estimated path for the NAIRU is only marginally affected, rising slightly above its very low pre crisis level (Figure 5-2).[3] The unemployment rate has neither increased during the crisis period by much, nor to anything like the levels seen in a number of other advanced economies, nor has the unemployment gap been large by historical standards.

C. Prospects

10. **The multivariate model-based estimates suggest that growth rates will stabilize around 1.7 percent (yoy)**. To some extent, this forecast is imposed by the model (the steady-state growth rate assumption is 1.8 percent), but it is also a result of the estimated dynamics from previous business cycles in the Netherlands, which imply rather gradual convergence back to equilibrium.[4]

11. **This implies a permanent loss of output**. Year-on-year potential output growth is estimated at 1 percent in 2010Q3 under the multivariate approach. Continued growth at the predicted rate would imply a permanent loss of output relative to the pre-crisis trend of 4.5 percent. Results from the production function approach indicate a higher potential output loss of 6.75 percent. Although, the Dutch economy will eventually recover to and surpass the level of output at its pre-crisis peak, a sustained period of higher growth would be needed to restore the level of output to that implied by extrapolating the pre-crisis trend. IMF research indicates that such a pattern is commonplace in the aftermath of financial crises.

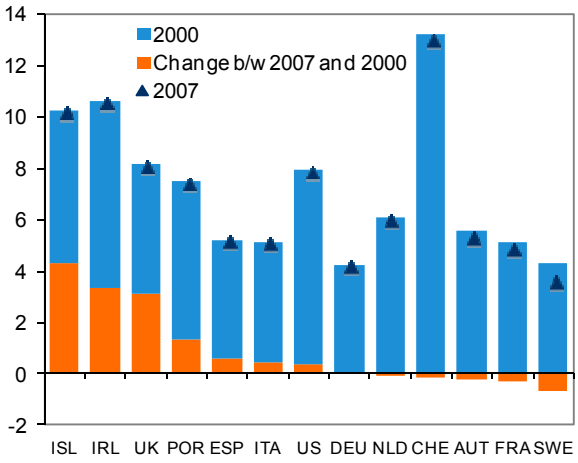
12. **This loss could be alleviated if growth rates exceed the recent historical average for a sustained period.** Higher growth rates have happened before: for example, the Dutch economy recovered from previous business cycle lows in 1993 and 2003 to reach growth rate peaks of 5.2 percent and 4.6 percent, respectively. Two factors give grounds for cautious optimism that growth rates could rebound more strongly if demand was higher, and need not be limited by short-run potential growth constraints:

[3] This result is neither driven solely by nor very sensitive to assumptions about the steady-state NAIRU, which was assumed to 4 percent, a value that could be considered *high* given that unemployment peaked at 4½ percent during the previous cycle.

[4] See the parameter estimates in Table A2 of the Appendix. The values for the ρ and the τ parameters imply near-unit root behavior for the output gap and output gap trend growth.

- Growth analysis suggests no substantial damage to labor participation or capital intensity. One approach to inferring whether there has been long-term damage to productive capability is to look at a decomposition of output growth by factors. After financial crises, capital intensity, the employment rate, and labor productivity are typically permanently lower. Analysis of data up until the end of 2009 suggests that the decline in output since the peak at the end of 2008 was mainly accounted for by a substantial fall in labor productivity (Figure 4-3). Comparison with the downturns of 1992 and 2003 illustrates that the decline in productivity has been unusually severe. However, labor productivity growth has rebounded strongly, and there are some signs of growth in other factors. Hence, to the extent that there has been no substantial reduction in capital intensity or labor participation, there should be no long-term damage to productive capability.

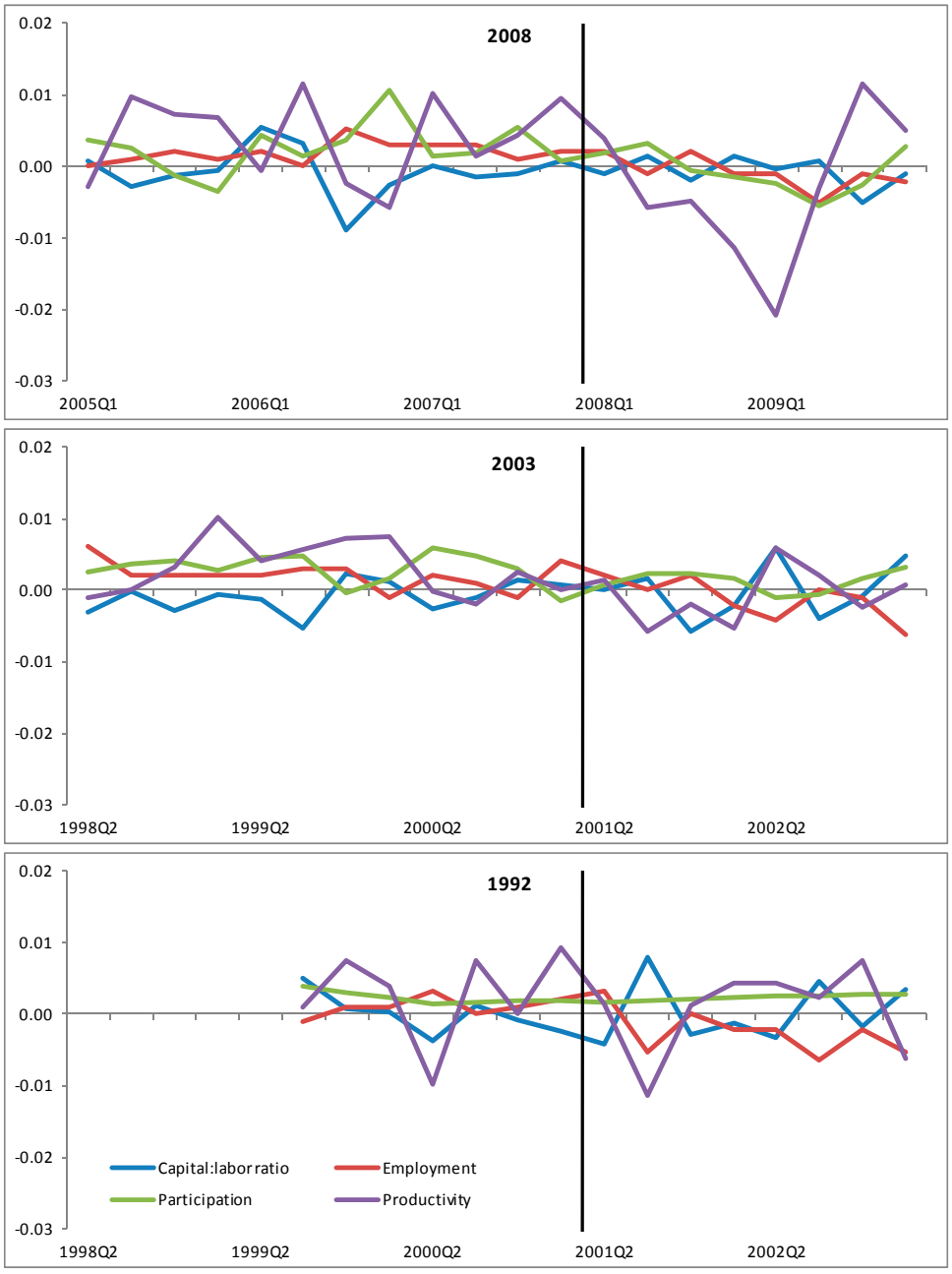
- Decomposing output by production sectors indicates that the financial sector did not grow excessively. The nature of the crisis is to put particular stress on the financial sector. In those economies in which the financial sector expanded much more rapidly than other production sectors, one could expect that a consequence of the shock would be to reduce total output as resources are redirected away from the financial sector to other sectors. Given costs of shifting and adjusting labor and capital, this process could constrain potential output for some time. Analysis of the share of value added from financial services in total value added indicates that the financial sector in the Netherlands is important, but not excessively sized in comparison with other advanced economies. Moreover, the share has stayed roughly constant during the period leading up to the crisis, indicating less vulnerability of potential output to reallocations away from financial services.



Source: Eurostat, national authorities, and IMF staff calculations,
*Iceland: 2000-2005; Portugal: 2000-2006

13. **Higher growth will depend on favorable demand conditions.** Although there are no obvious signs of permanent damage to growth rates, higher actual growth than currently experienced would depend on very favorable external and internal demand. It will be important, for example, not to damage growth momentum by excessive fiscal consolidation in the short term.

Figure 5-3. Production Factors Around Output Peaks

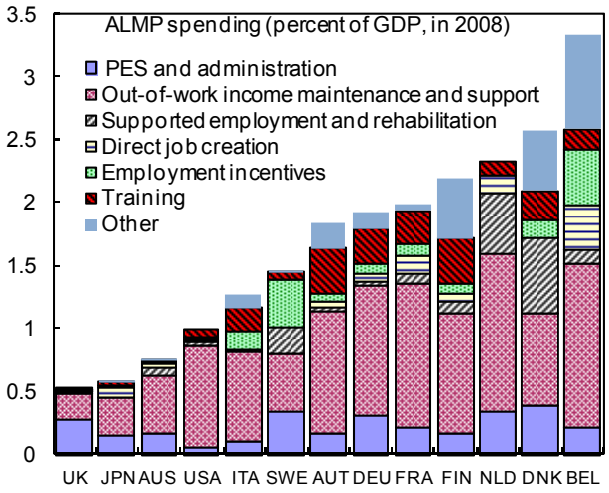


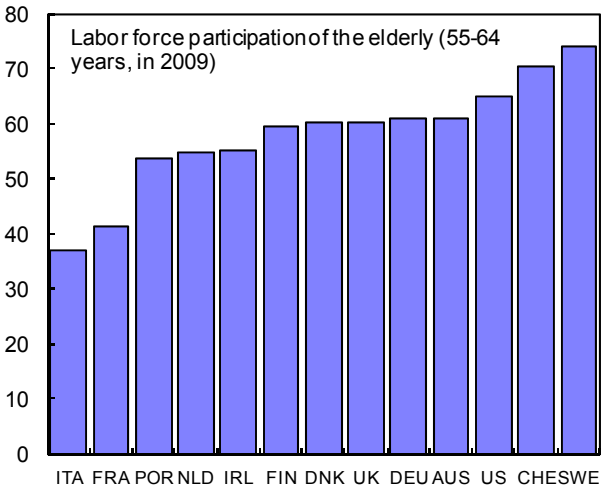
Source: National authorities and IMF staff calculations

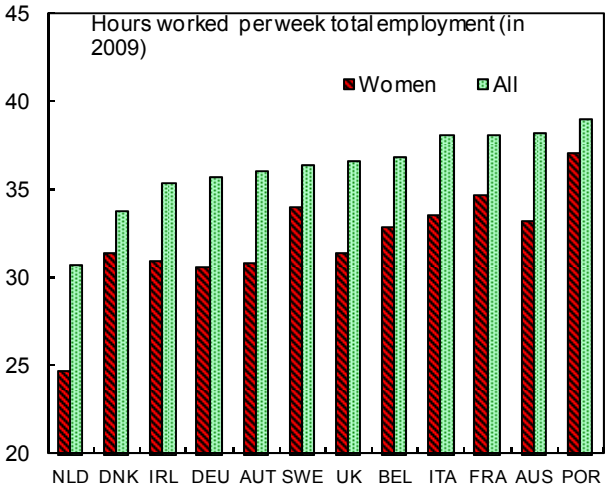
D. Policies to Promote Growth

14. **In the absence of strong population growth, policies will be needed to encourage greater work effort, capital intensity, and productivity**. Trend population growth is low and declining. Over the past ten years, growth in working age population has averaged only just over 0.3 percent per annum. Population projections from Statistics Netherlands imply that this rate will decline further, to reach zero by 2038. Moreover, the population is aging, and the growth rate for those 65 years and older will be positive and substantially greater than the working age population growth rate for a sustained period. Consequently, the ratio of those of working age to those older than 65 years is projected to shrink from 4:1 to 2:1 within a generation. This has severe implications for output and the sustainability of social policies.

15. **Encouraging women to work longer hours and increasing participation of the elderly could enhance growth and reduce the costs of an aging population.** The average participation rate of those aged 55–64 is relatively low by international standards. The estimated effective average retirement age is almost 4 years below the statutory retirement age of 65 years. Increasing the minimum age for early retirement and introducing steeper penalties to the replacement rate for early retirement could form an important element in reforming the pension system to encourage longer work lives and



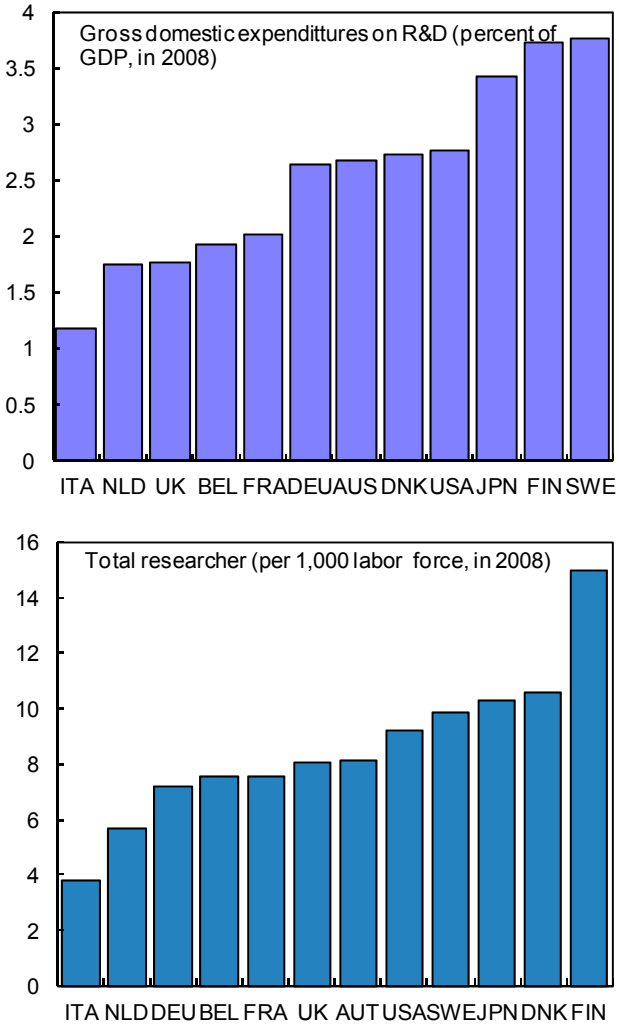




Source: OECD

boosting output growth in light of the demographic developments.[5] While the authorities are committed to increase the official retirement age, it is equally, if not more, important to raise the effective retirement age. The authority's decision to maintain the subsidy system to firms that employ the elderly is one potential step.

16. **Non-work income support is relatively high and potentially discourages a quick re-employment.** Unemployment benefits in the Netherlands are among the most generous in advanced economies. Long-term unemployment benefits play a key role in the transmission of shocks on aggregate unemployment to long term unemployment. A disproportionately higher share of the recently unemployed could remain without work in the long term in the absence of a better incentive scheme to return to the work force. Thus there is a strong case to reduce the fraction of income which is replaced by the unemployment benefits. This would free up resources which could be redirected into training programs and other employment incentive measures for which Dutch spending is currently very low. De Mello and Padoan (2010) find from simulations that a reduction of the replacement rate by 10 percentage points can increase GDP per capita by 3 percent.



Source: OECD

17. **To enhance productivity, research and development (R&D) should be fostered more rigorously.** Gross domestic expenditure on R&D is fairly modest. This is partly due to lower public R&D investment but also to lower direct or indirect public funding of business R&D. The low R&D figures are mirrored in a low share of researchers relative to the labor force. More funding for R&D could not only increase

[5] Euwals et. al. (2010) find positive effects on the participation of the elderly of reforms aimed at discouraging early retirement as implemented in the Netherlands in the 90s. Arpia et. al (2009) find similar effects and a marked impact on the participation of women aged 55-59 in a sample of EMU countries. De Mello and Padoan (2010) find from simulation exercises that an increase in the retirement age by one year increases GDP per capita by 0.3 percent.

productivity through innovation but also contribute to improved incentives for higher education by stimulating demand for highly skilled workers. Empirical evidence on R&D spending shows a clear positive effect on output. For example, a study by Guellec and van Pottelsberge (2001) find that an increase of 1 percent in business R&D generates an increase of 0.13 percent in growth while an increase of 1 percent in public R&D generates 0.17 percent in productivity growth.

18. **Both productivity and working hours are negatively affected by traffic congestion**. The Netherlands is one of the most densely populated regions in Europe and traffic is expected to increase further. Highly congested regions suffer output losses due to the lost value of time in traffic jams as well as potential effects on health (OECD 2010). While estimates of the total cost of congestion vary widely (0.2–4.2 percent of GDP) depending on the definition of the congestion cost and the exact method employed, the Netherlands features generally among the countries with highest costs. The large network of roads in the Netherlands is not sufficient due to the elevated population density and the transit character of the country. High congestion is also the result of the preference for passenger car transportation as opposed to public transportation. More investment in roads, while needed, could also have adverse effects unless complementary steps to promote public transport are undertaken. It potentially shifts demand from rail to road transportation as long as no parallel pricing of road traffic is introduced. While the authorities intend to increase investment in roads, implementation of a road pricing scheme has been postponed. A pricing scheme that reflects the social cost of private road transportation and opening up the transportation sector to more competition could provide a way to tilt incentives toward the use of public transport by increasing the opportunity cost of private transportation.

Table 5-1. Summary of Impact of Relevant Structural Policy Reforms on Growth

Policy	Definition of shock	Effect
Statutory retirement age	+ 1 year	+ 0.3 percent GDP per capita
Unemployment benefits, replacement rate	+ 10 percentage points	+ 3 percent GDP per capita
Business R&D	+ 1 percent	+ 0.13 percent TFP growth
Public R&D	+ 1 percent	+ 0.17 percent TFP growth
Investment in infrastructure and road pricing	- 10 percent congestion	+ 0.22 percent GDP

Source: OECD.

References

Arpaia, Alfonso, Kamil Dybczak, and Fabiana Pierini, 2009, "Assessing the short-term impact of pension reforms on older workers' participation rates in the EU: a diff-in-diff approach", Economic Papers 385, September 2009, European Commission.

Benes, Jaromir, Kevin Clinton, Roberto Garcia-Saltos, Marianne Johnson, Douglas Laxton, Petar Manchev, and Troy Matheson, 2010, "The global financial crisis and its implications for potential output," manuscript (Washington: International Monetary Fund).

De Mello, Luiz, and Pier C. Padoan, 2010, "Promoting potential growth: The role of structural reforms", OECD Economic Department Working Papers, No. 793.

Euwals, Rob, Daniel van Vuuren, and Ronald Wolthoff (2010) "Early retirement behavior in the Netherlands: Evidence from a policy reform", De Economist, 158:209–236

Guellec, Dominique, and Bruno van Pottelsberge de la Potterie, 2001, "R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries", *OECD Science, Technology and Industry Working Papers*, 2001/3,

International Monetary Fund, 2009a, "From recession to recovery: how soon and how strong," Chapter 3 in the World Economic Outlook (April) (Washington: International Monetary Fund).

International Monetary Fund, 2009b, "What's the damage? Medium-term output dynamics after financial crises," Chapter 4 in the World Economic Outlook (October) (Washington: International Monetary Fund).

Organization for Economic Cooperation and Development, 2010, "Economic Survey of the Netherlands", Paris.

APPENDIX: DETAILS OF THE MULTIVARIATE MODEL OF POTENTIAL OUTPUT

The approach of the multivariate model of potential output is to treat the unobserved levels of potential output ($\overline{Y_t}$), the NAIRU ($\overline{U_t}$), and equilibrium capacity utilization ($\overline{C_t}$) as latent variables. After specifying a system of economic relationships between observed output, unemployment, capacity utilization, inflation, and long-term inflation expectations, the parameters of the system and the latent variables can be simultaneously estimated using maximum likelihood and the Kalman filter.[1]

There are four main economic relationships. First, an inflation equation relates the level and the change in the output gap to observed annual inflation, π4:

$$\pi 4_t = \pi 4_{t-1} + \beta y_t + \Omega(y_t - y_{t-1}) + \varepsilon_t^{\pi 4}$$

where *y* is the output gap and $\varepsilon^{\pi 4}$ denotes shocks to inflation expectations. A simple random walk extracts inflation expectation shocks from observed inflation expectations, π^{4LTE}:

$$\pi 4_t^{LTE} = \pi 4_{t-1}^{LTE} + \varepsilon_t^{\pi 4 LTE}$$

The (unobserved) unemployment gap, *u*, is related to the output gap by an Okun's law relationship:

$$u_t = \phi_1 u_{t-1} + \phi_2 y_t + \varepsilon_t^u$$

where ε^u is the shock term. Finally, the capacity utilization gap, *c*, is also related to the output gap:

$$c_t = \kappa_1 c_{t-1} + \kappa_2 y_t + \varepsilon_t^c$$

Given these economic relationships, identification of the gaps is accomplished by relating the gaps to the levels of actual output, unemployment, capacity utilization, and inflation. This is done by estimating equilibrium, or potential, levels for each of output, unemployment, and capacity utilization. The respective laws of motion for the potential output, unemployment, capacity utilization are as follows:

$$\bar{Y}_t = \bar{Y}_{t-1} - \theta(\bar{U}_t - \bar{U}_{t-1}) - \frac{(1-\theta)(\bar{U}_t - \bar{U}_{t-20})}{19} + \frac{G_t^{\bar{Y}}}{4} + \varepsilon_t^{\bar{Y}}$$

$$\bar{U}_t = \bar{U}_{t-1} + G_t^{\bar{U}} - \frac{\omega}{100} y_{t-1} - \lambda(\bar{U}_{t-1} - U^{ss}) + \varepsilon_t^{\bar{U}}$$

$$\bar{C}_t = \bar{C}_{t-1} + G_t^{\bar{C}} + \varepsilon_t^{\bar{C}}$$

[1] In practice, Bayesian methods are used to aid the estimation.

where, in each equation, the *G* term is a damped autoregressive process, meaning that the trend rate of change itself is stochastic. The system is completed by the three measurement equations which are given by the definitions of the (log) output, unemployment, and capacity utilization gaps

$$y_t = Y_t - \overline{Y_t}$$

$$u_t = U_t - \overline{U_t}$$

$$c_t = C_t - \overline{C_t}$$

The following assumptions are made about steady-state levels:

Table A1: Steady-State Calibration Values

Variable	Mnemonic	Value
Trend growth	$G_{ss}^{\bar{Y}}$	1.8
Long-run equilibrium unemployment	U^{ss}	4.0
Labor share of income	θ	0.6

After estimation on Netherlands data, the values of the dynamic parameters are:

Table A2: Estimated Parameter Values

Parameter	Posterior
α	0.891
β	0.100
ρ_1	0.852
ρ_2/100	0.051
κ_1	0.212
κ_2	0.800
φ_1	0.715
φ_2	0.161
τ	0.071
Δ	0.496
Ω	0.395
Λ	2.051

ANALYTICAL NOTE 6: ASSET BOOMS, SECTORAL CHANGES, AND THE ESTIMATION OF DUTCH STRUCTURAL FISCAL BALANCES[1]

1. **The calculation and use of structural fiscal balances has gained in importance in recent years for several reasons**. Structural balances provide guidance as to the health and direction of fiscal policy and help determine the size and direction of automatic stabilizers. In addition, they are a key component in the assessment of long-run fiscal sustainability by providing a view of what the fiscal balance is likely to tend towards as temporary factors dissipate. Reflecting these considerations, the calculation of structural fiscal balances has taken a central position in the assessment of fiscal policy in the member countries of the European Union, under the Stability and Growth Pact (SGP). Under the SGP all member states are required to maintain a medium-term fiscal objective defined in terms of the structural fiscal balance.

2. **However, there are well known measurement problems in calculating the structural balance**. These include the estimation of potential output and output gaps, the adjustment of fiscal revenues for the effect of the business cycle using estimated revenue elasticities, and the question of whether adjustments for asset price cycles, changes in the shares of various components of national income, or other factors are also needed. Several approaches have been proposed for dealing with these challenges. However, the most prominent is the approach developed by the OECD (see Girouard and Andre, 2005), which adjusts for the business cycle but not for asset price cycles or changes in the composition of national income. A variant of the OECD approach was developed by the European Commission (see Larch and Turrini, 2009) to form the basis for calculating the structural balance under the SGP. In contrast, the European Central Bank (ECB) has developed a disaggregated approach which takes changes in the composition of national income into account (Bouthevillain and others, 2001).

3. **The IMF's calculations of the structural balance for the Netherlands have traditionally broadly followed the OECD approach as follows**:[2]

- Potential output is estimated using a Cobb Douglas production function, and output gaps can thus be derived.

- Structural revenues are then calculated by using an aggregate elasticity of revenue with respect to the output gap, and the estimated output gap, to extract the cyclical component of revenue.

---

[1] Prepared by Daniel Kanda.

[2] This approach is similar to that used by the IMF's Fiscal Affairs Department—described in Fedelino, Ivanova, and Horton (2009)—in recent publications such as Horton, Kumar, and Mauro (2009) and IMF (2009).

- On the expenditure side it is assumed that the only type of expenditure with a cyclical component is unemployment-related benefits. Using data on the unemployment rate and estimates of the NAIRU (obtained using a HP filter on unemployment rate data), we are able to estimate the impact of the cycle on unemployment benefits and thus obtain the estimates of structural expenditure. The structural balance is then the difference between structural revenues and structural expenditures.

4. **While this approach works well in many cases, recent events have highlighted its limitations under certain circumstances, such as property or other asset price booms**.[3] Indeed, European Commission (2008) examines why tax elasticities in several member countries appear to undergo substantial changes during economic booms, and recommends extending the assessment of tax elasticities to incorporate a broader number of explanatory variables. There is also a substantial literature—see Eschenbach and Schuknecht (2002), Girouard and Price (2004), and Morris and Schuknecht (2007), among others—that finds that excluding asset prices from the analysis can lead to serious biases in the estimation of the structural balance.

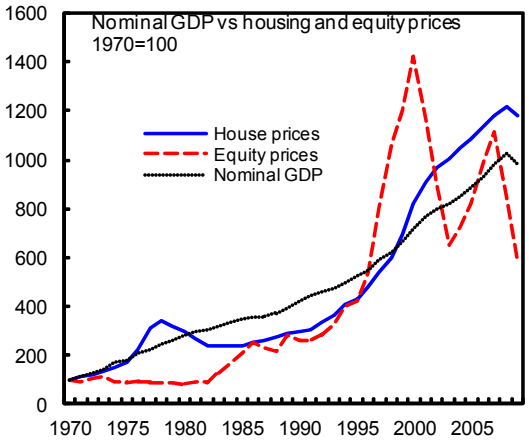
5. **This note expands the methodology by taking explicit account of asset prices and sectoral shifts in the economy**. Given the potentially costly policy errors that can result from biases in the calculation of structural balances, we then use this expanded methodology to explore whether the standard approach has been robust to the influence of these factors in the case of Netherlands. Our broad conclusion is that Dutch fiscal revenues have not been substantially influenced by asset price cycles or sectoral shifts, and taking explicit account of these factors leads to relatively modest revisions in the estimates of the structural balance.

A. Dutch Experience

6. **GDP contracted sharply in 2009, following years of robust growth, as a result of the global financial crisis and the associated shock to global trade**. As a result, the economy contracted 4 percent in 2009. Alongside, the fiscal position deteriorated sharply, moving from a surplus of ½ percent of GDP in 2008 to a deficit of 5½ percent of GDP in 2009. Revenues fell a bit faster than GDP and as a result the revenue-GDP ratio declined by one percent of GDP. However, different revenue categories reacted very differently to global shocks in 2009, with direct taxes increasing slightly in percent of GDP whereas indirect taxes and social contributions showed significant declines in percent of GDP. This suggests that an approach where nominal GDP is essentially the sole determinant of revenues may be prone to bias in times of substantial changes to GDP, which are often the times when policy errors can be most costly.

[3] An important example of this being the case of Ireland, where a property boom led to substantial distortions in the calculation of the structural balance, which continued to signal healthy fiscal positions even as underlying vulnerabilities mounted.

7. **House prices have tended to appreciate faster than nominal GDP, whereas equity prices have tended to appreciate at a slower pace, albeit with greater volatility**. In general, the two asset prices that have been found to have influence on fiscal revenues across various countries are house and equity prices. Data for Netherlands indicates that over the past 40 years, house prices have risen at a slightly faster pace on average than nominal GDP, with the increase relatively more pronounced since the mid-1990s. On the other hand, equity prices have tended to grow on average at a pace lower than that of GDP, but with much more volatility than GDP. This then suggests that any revenue source that is significantly influenced by house prices is likely to have been rising in percent of GDP in recent years, whereas a revenue source significantly influenced by equity prices would have shown significant volatility but with a slightly negative trend overall and would have suffered a disproportionately large decline in 2009.

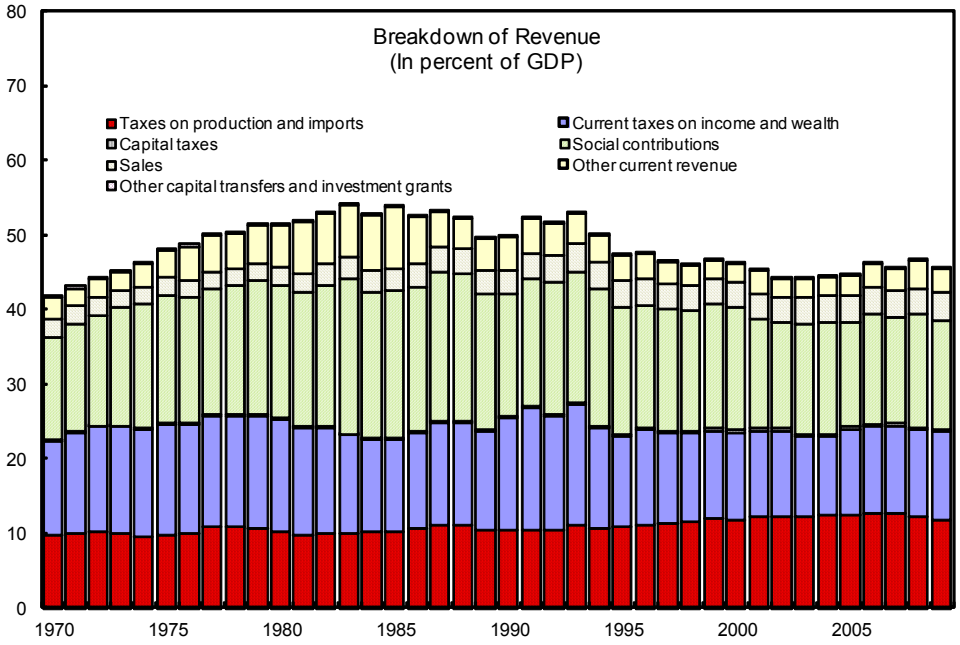


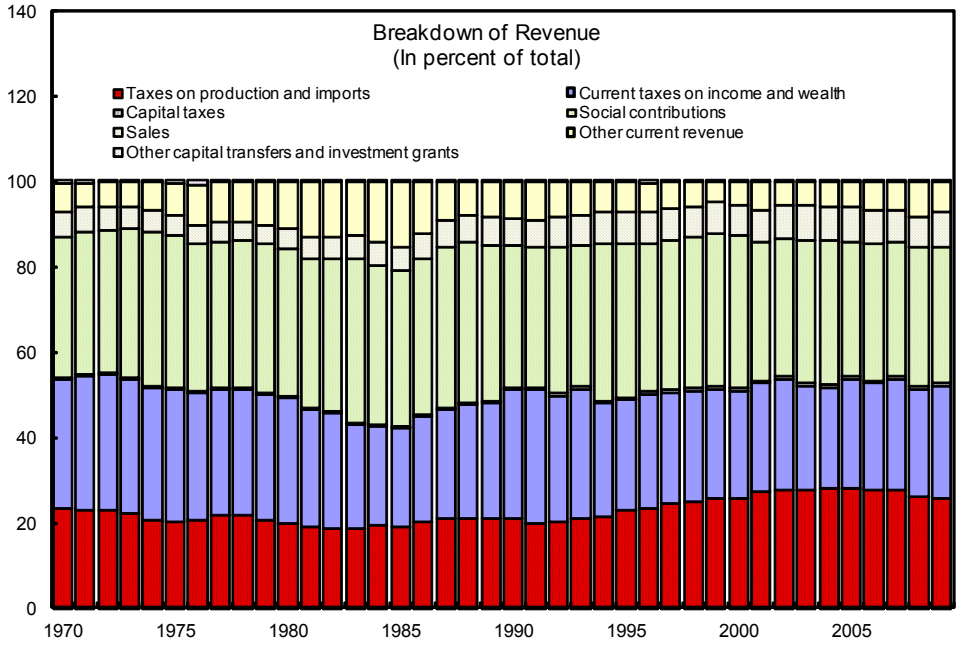
Sources: OECD, Haver, and author's calculations

8. **Asset prices do not appear to have had a major impact on fiscal revenues in recent years**. Figure 6-1 presents a breakdown of fiscal revenues over 1970–2006. The overall revenue/GDP ratio rose to a peak in the mid-1908s and subsequently declined, with the bulk of the decline concentrated in social contributions and other current revenue. The most important item under other current revenue is property income, and so the movements in this category could be reflecting changes to earnings from exports related to the gas industry. Direct and indirect taxes have been broadly stable over the period, but indirect taxes do appear to have been on a modestly rising trend in recent years, and also declined in 2009. Overall, however, the impression one gets is that the various revenues appear to have been broadly stable in relation to GDP in the past decade, which would suggest that asset price movements have not had a major influence on revenues. Figure 6-2 generally confirms that the growth rates of the various revenue categories have on average been close to that of nominal GPD, and we do not see evidence of any bubble-induced divergence that could signal the onset of significant bias in the calculation of structural revenues using the standard approach.

9. **Use of the "eyeball" metric only serves to give broad impressions, however, and more rigorous methods are needed to come to grips with the issue**. The next section outlines an estimated model for fiscal revenues that takes into account asset prices and sectoral changes based on a disaggregated approach, in an effort to provide a more complete assessment of what portion of fiscal revenues could be considered structural. The estimated equation could be thought of as a reduced form of a structural model that links revenue and its base to a set of explanatory macro variables.

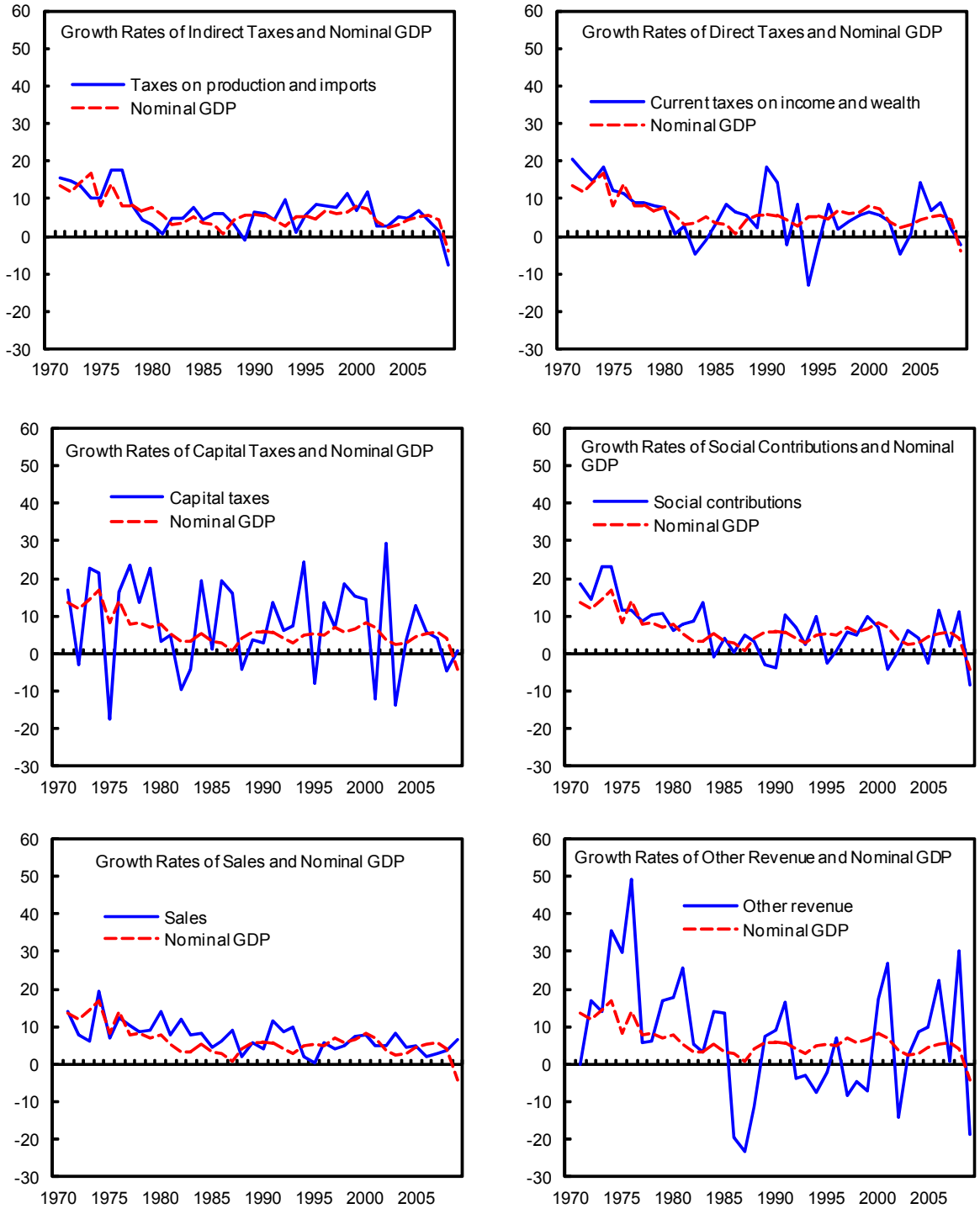
Figure 6-1. Netherlands: Revenue Breakdown, 1970-2009





Sources: Eurostat, CPB, and Author's calculations.

Figure 6-2. Netherlands: Comparison of Revenue and Nominal GDP Growth Rates, 1970-2009



Sources: Eurostat, CPB, and Author's calculations.

B. The Model[4]

10. **The estimated equation depends on whether the data are stationary or not, and we present below the model in both cases**.

Model with Stationary Data

11. **With stationary data, the model is given by equation (1) below**:

$$\ln R_t = \sum_{i=0}^{m} a_{0i} \ln M_{it} + \sum_{i=0}^{m} a_{1i} \ln M_{it-1} + ... + \sum_{i=0}^{m} a_{li} \ln M_{it-l} + \varepsilon_t \quad (1)$$

where R_t represents revenue in time t; M_{it} represents the value of the ith explanatory variable in time t; a_{li} represents the elasticity of revenue to the l^{th} lag of the i^{th} explanatory variable; and ε_t is the error term.

Taking exponents of both sides of equation (1) to eliminate the natural logs, and using a star and hat to represent the structural level of the variable and the estimated value of the coefficient, respectively, then the estimated structural revenue is given by equation (2) as:

$$R_t^* = R_t \prod_{i=0}^{m} \left(\frac{M_{it}^*}{M_{it}} \right)^{\hat{a}_{0i}} \prod_{i=0}^{m} \left(\frac{M_{it-1}^*}{M_{it-1}} \right)^{\hat{a}_{1i}} ... \prod_{i=0}^{m} \left(\frac{M_{it-l}^*}{M_{it-l}} \right)^{\hat{a}_{li}} \quad (2)$$

Model with Non-stationary Data

12. **Where the data are nonstationary, it is often fruitful to first explore if a stationarity inducing transformation is possible**. This can substantially simplify the estimation process and the calculation of structural revenues. Division by GDP is a good candidate here, because the ratios of all the macro variables used (and underlying tax bases) to GDP are likely to be bounded, and may therefore be more likely to be stationary. Indeed, we find this to be the case for all the variables used in the estimation in this paper.

13. **With all variables divided by GDP, the approach is very similar to that used in the case of stationary data**. The main difference is that the variables are interpreted as ratios

[4] This note abstracts from consideration of the effects of discretionary measures on tax elasticities. European Commission (2009) attempts to adjust revenue data for discretionary measures in a number of countries (excluding Netherlands), and finds that overall this has a relatively small impact on the tax elasticity estimates, though in some cases substantial divergences are observed in certain years. In any case, the bias is likely to be small in our exercise for a sufficiently long time series that allows positive and negative errors arising from discretionary measures to mostly cancel each other out.

to GDP. On this basis, dividing both numerator and denominator of the ratio (M_{it}^{*}/M_{it}) by nominal GDP (Y_t) and denoting the resulting scaled variable by m_t, the ratio becomes (m_{it}^{*}/m_{it}). Thus we have the structural value of the revenue/GDP ratio given by:

$$r_t^{*} = r_t \prod_{i=0}^{m}\left(\frac{m_{it}^{*}}{m_{it}}\right)^{\hat{a}_{0i}} \prod_{i=0}^{m}\left(\frac{m_{it-1}^{*}}{m_{it-1}}\right)^{\hat{a}_{1i}} \ldots \prod_{i=0}^{m}\left(\frac{m_{it-l}^{*}}{m_{it-l}}\right)^{\hat{a}_{lt}} \tag{3}$$

where r_t represents the ratio of revenue to GDP.

14. **If scaling by GDP or other such transformation does not work, the model can be estimated in first differences, or an error correction model**. For example, equation (4) below, which allows for cointegration, could be used.

$$\Delta \ln R_t = \sum_{i=0}^{m} a_i \Delta \ln M_{it} - \lambda\left(\ln R_{t-1} - \sum_{i=0}^{m} \mu_i \ln M_{it-1}\right) + \varepsilon_t \tag{4}$$

In this case, the estimation results are in relation to growth rates rather than levels of the variables, and the structural revenue is determined by the formula:

$$R_t^{*} = R_t\left(\frac{R_{t-1}^{*}}{R_{t-1}}\right)^{(1-\lambda)} \prod_{i=0}^{m}\left(\frac{M_{it}^{*}}{M_{it}}\right)^{\hat{a}_i} \prod_{i=0}^{m}\left(\frac{M_{it-1}^{*}}{M_{it-1}}\right)^{(\hat{\lambda}\hat{\mu}_i - \hat{a}_i)} \tag{5}$$

Since the right-hand side includes the lagged value of structural revenue, pinning down actual values for the level of structural revenue will require additional assumptions to identify the level of structural revenue in at least one year.

C. Estimation Results

15. **Log-linear regressions were estimated for all the revenue categories on annual data for 1970–2008**. Data used were all divided by GDP. For all variables (in percent of GDP), the unit root hypothesis is rejected using the Ng-Perron test (Table 6-1). Ng and Perron (2001) show that this test generally has superior power and size properties compared to the traditional Dickey-Fuller and Phillips-Perron tests. Division by GDP has the implication that the regression equations seek to explain movements in the ratios of various revenue types to GDP, rather than their levels. In addition, GDP itself does not enter any equation as a stand-alone explanatory variable.

Table 6-1. Ng Perron Unit Root Tests 1/

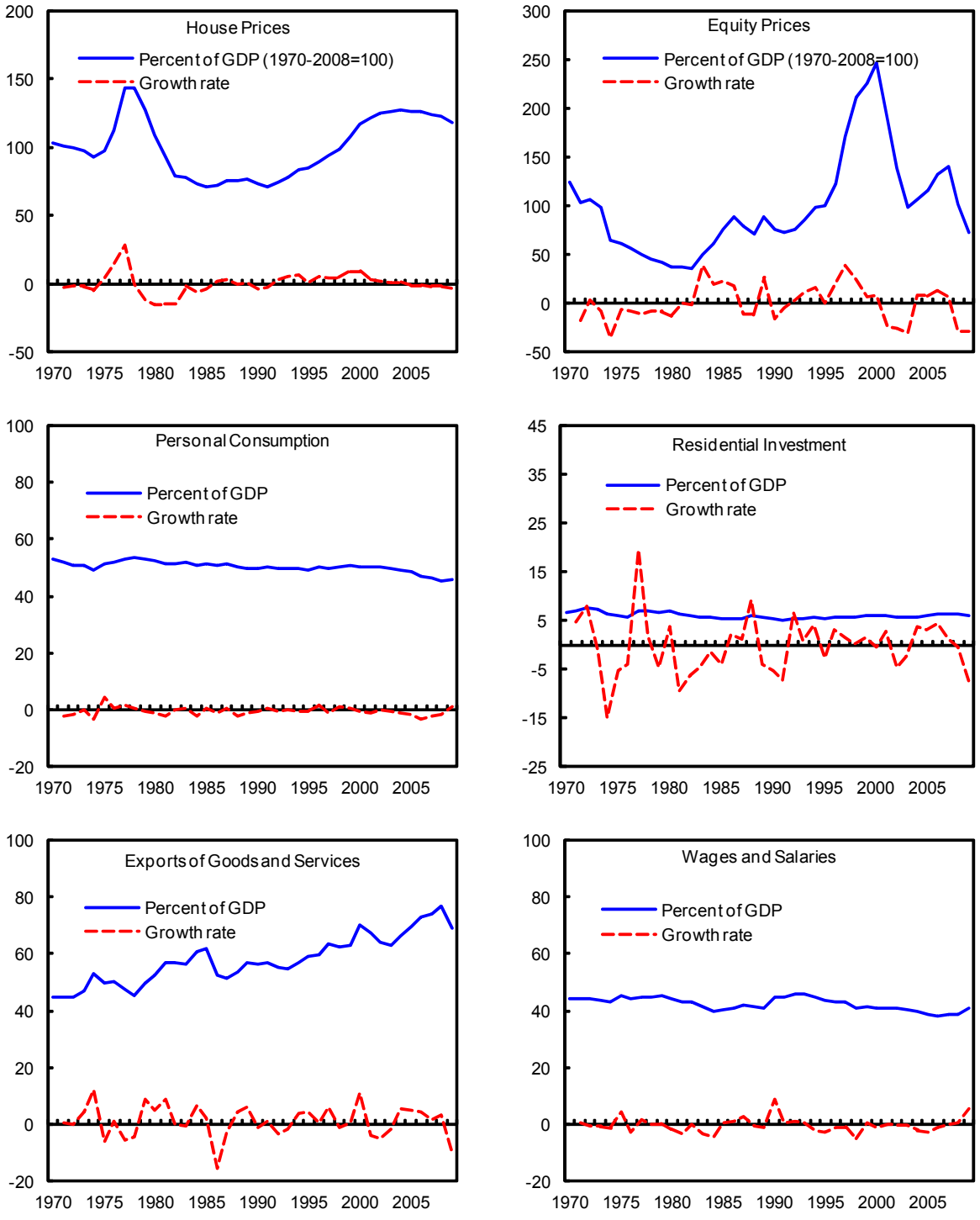
	Test statistics 2/
Taxes on production and imports	-26.45 ***
Current taxes on income and wealth	-30.08 ***
Capital taxes	-19.00 **
Social contributions	-23.33 **
Sales	-28.85 ***
Other current revenue	-18.23 **
Other capital transfers and investment grant	-21.90 **
Personal consumption	-44.86 ***
Residential investment	-24.68 ***
Wages	-66.63 ***
Exports of goods and services	-24.28 ***
House price index	-29.61 ***
Equity Price index	-18.48 **

Source. Author's calculations
1/ All variables are in logs and in percent of GDP.
2/ MZa statistic, as in Eviews; *** and ** represent rejection of the unit root hypothesis at the 1 and 5 percent levels, respectively. Critical values: 1% level, -23.8; 5% level, -17.3.

16. **A variety of macroeconomic variables were examined for explanatory power in the regression exercise**. In each equation, variables and lags were added or dropped on the basis of significance, goodness of fit, and implications for serial correlation of the residuals. At the end, the variables that showed significant explanatory power in the equations were nominal consumption, nominal residential investment, house price index, equity price index, exports, and wages. It does not appear plausible that any of these explanatory variables is significantly influenced by movements in any single revenue type, so OLS—which is what is used—should yield consistent estimates. Figure 6-3 presents these variables and their movement over the estimation period.

17. **Most equations were estimated with high precision, with coefficients generally plausible (Table 6-2)**. As all variables are in percent of GDP a positive or negative sign on a coefficient for a regressor does not translate to a similarly signed relationship between the respective variables in levels. In particular, a positive coefficient simply means that faster-than-GDP increases in the explanatory variable are associated with faster-than-GDP increases the revenue type under consideration, while a negative coefficient means that faster-than-GDP increases in the explanatory variable are associated with slower-than-GDP increases in the revenue type under consideration.

Figure 6-3. Netherlands: Revenue Determinants, 1970-2009



Sources: Statistics Netherlands and Author's calculations

Table 6-2. Regresssion Estimates 1/ 2/

Regressors	Dependent variable estimated coefficient						
	Indirect Tax	Direct Tax	Capital tax	Soc. Contrib	Sales	Other Curr. Revenue	Capital Rev.
Constant	2.43 ***	-1.67 **	-2.98 ***	-5.76 **	7.46 ***	-17.97 ***	54.26 ***
Personal consumption				1.85 ***			
First lag personal consumption	-0.33 **				-1.16 ***	4.21 ***	6.82
Second lag personal consumption							-16.94 ***
Residential investment	0.22 ***			0.46 **			-3.47 ***
First lag residential investment	-0.35 ***				-0.60 ***	0.85 **	3.20 **
Second lag residential investment	-0.26 ***		-1.60 ***	0.33 **	-1.13 ***		
Exports of goods and services			0.66 **	0.56 ***	0.43 ***		-3.50 ***
First lag exports of goods and services			-0.44	-0.43 **	-0.31 *	2.01 ***	2.44
Second lag exports of goods and services	0.19 ***			0.61 ***			-3.38 **
House price index			-0.35 **	-0.16 *	-0.48 ***		
First lag house price index	0.35 ***						
Second lag house price index			0.82 ***	-0.38 ***	0.55 ***	-0.73 ***	
Equity price index						-0.42 ***	0.77 *
First lag equity price index	0.05 ***		0.31 ***	-0.13 ***			-1.09 *
Second lag equity price index		-0.09 ***			0.11 ***	-0.37 ***	0.67 *
Wages		2.33 ***					
First lag wages							
Second lag wages		-1.08 ***					
R-square	0.97	0.87	0.90	0.87	0.95	0.93	0.70

Source. Author's calculations.
1/ All variables are in logs and in percent of GDP.
2/ ***, **, and * represent significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

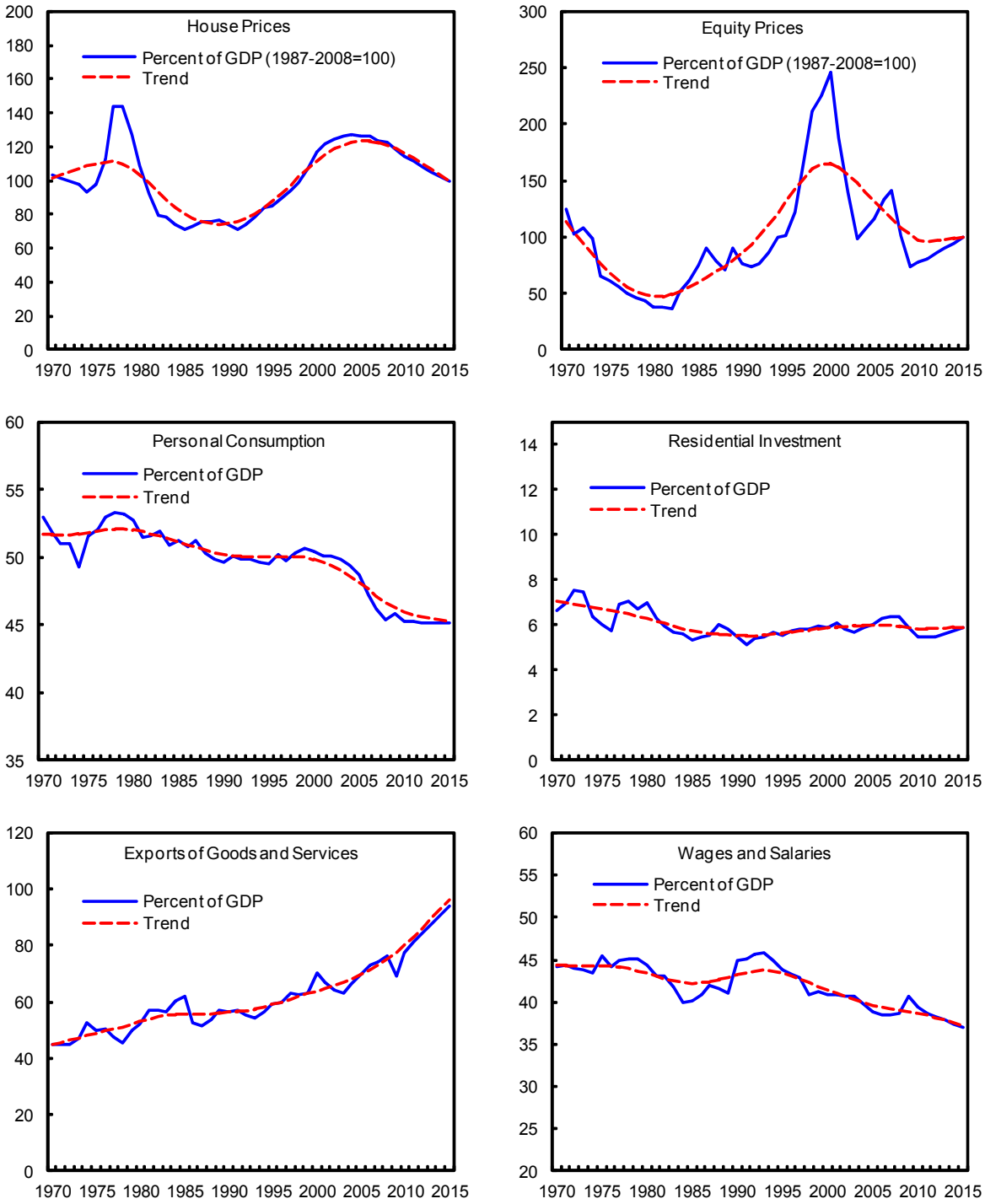
D. Calculating Structural Revenues

18. **Estimates of the structural values of the explanatory variables are obtained using the HP filter**. Calculating the structural revenue/GDP ratio for each revenue type requires us to obtain estimates for the ratios (m_{it}^{*} / m_{it}), which measure how far each explanatory variable is from its structural or fundamental value. To do so, we need to generate estimates for the structural values m_{it}^{*} of the explanatory variables. One way is to use a smoothing technique, such as the HP filter, to extract the trend value of the variable, which is then treated as the structural value. This is the approach taken by Morris and Schuknecht (2007) among others.

19. **Figure 6-4 presents the results of using the HP filter on all the explanatory variables**. Our focus is on measuring structural revenues over the historical period up to 2009. However, to minimize end-point problems, projections up to 2015 are added. The extraction of trend appears satisfactory in all cases. Thus, for all explanatory variables we use the HP filtered values as our estimates of the structural values. Overall structural revenue is then the sum of the structural levels of the different revenue types.

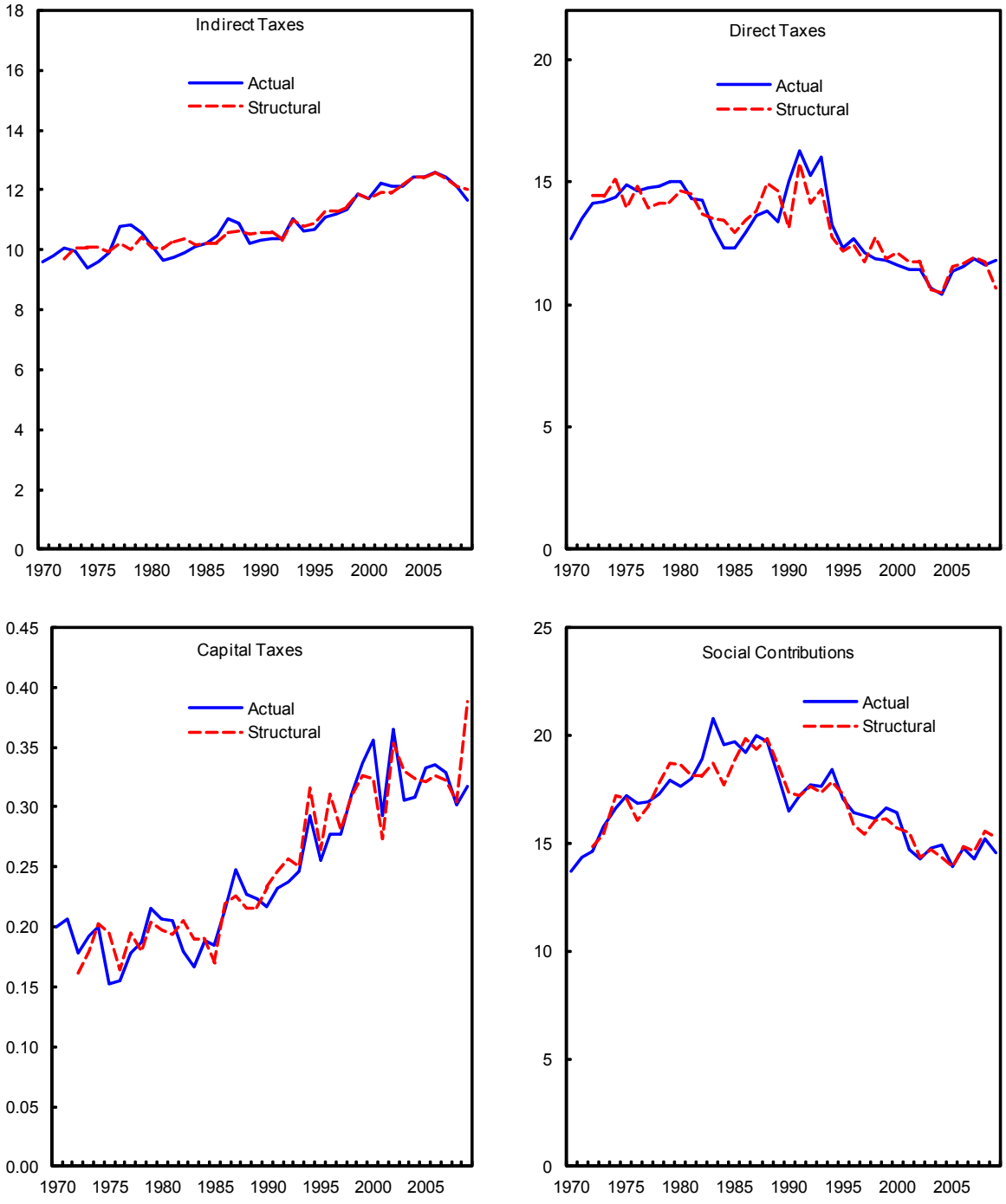
20. **For all revenue types there has been not been much divergence between actual and structural levels in percent of GDP**. Figure 6-5 presents the actual and structural values (from the estimated equations in Section III) of the various revenue types. Thus, the traditional manner of calculating structural revenues does not appear to have led to substantial biases.

Figure 6-4. Netherlands: Revenue Determinants and HP-Filtered Trends, 1970-2015



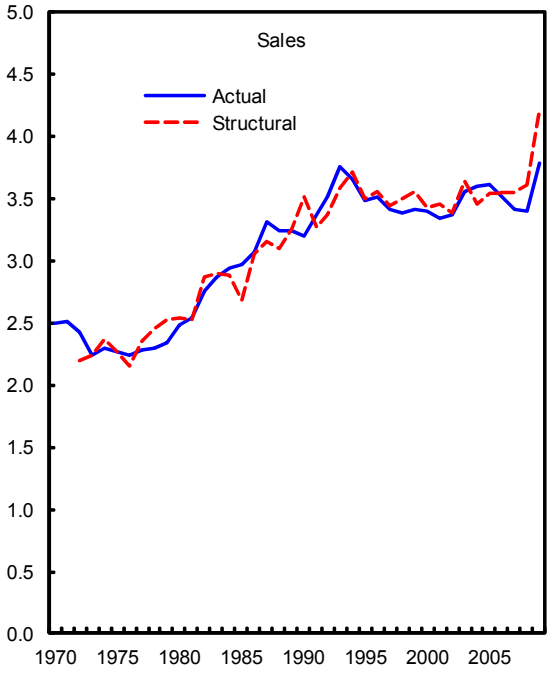
Sources: Statistics Netherlands and Author's calculations.

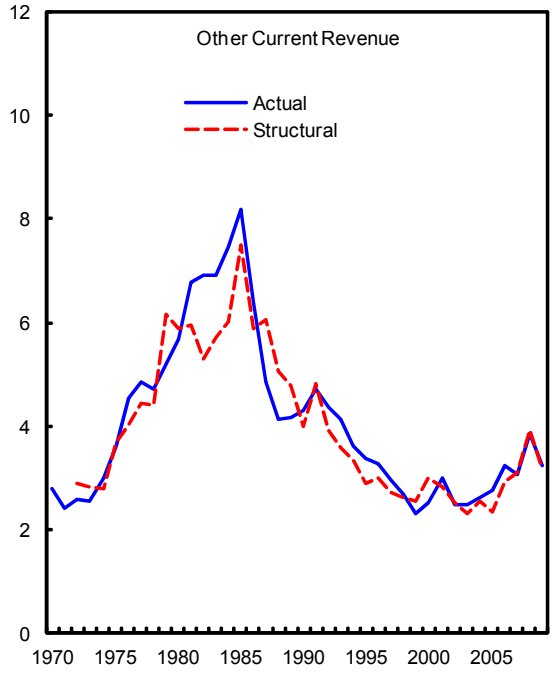
Figure 6-5. Netherlands: Actual and Structural Revenues, 1970-2009
(In percent of GDP)

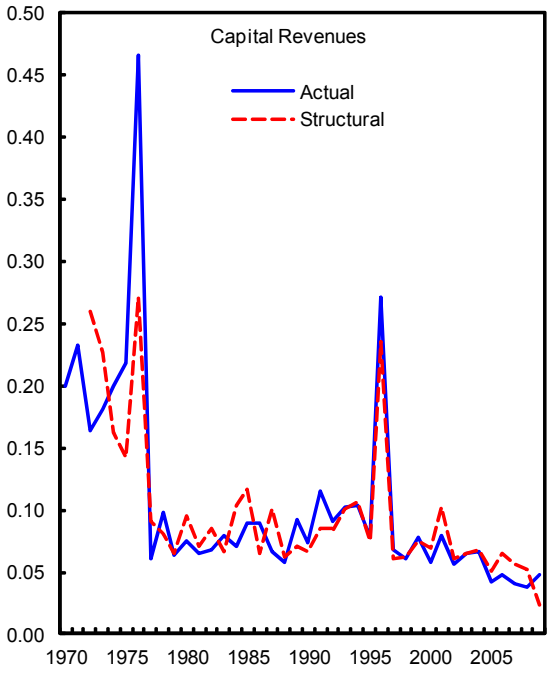


Source: Eurostat, CPB, and Author's calculations.

Figure 6-5. Netherlands: Actual and Structural Revenues, 1970-2009 (concluded)
(In percent of GDP)







Source: Eurostat, CPB, and Author's calculations.

E. Structural Expenditures and Structural Balance

21. **As indicated above, unemployment benefits are assumed to be the only component of fiscal expenditure with a significant cyclical component**. On this basis, structural expenditure, $E,^{*}$ can be expressed as follows:

$$E^{*} = E_{s} + \left(\frac{NAIRU}{UR}\right)U \tag{6}$$

Structural expenditure is then divided by potential GDP and this ratio is then subtracted from the structural (revenue/GDP) ratio to obtain the estimated structural balance in percent of potential GDP.

Table 6-3. Structural Fiscal Position 1/

	Estimates										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Structural revenue	46.4	45.8	44.3	43.8	43.7	44.1	46.0	46.0	47.3	45.8	45.1
Structural expenditure	46.2	47.1	46.5	46.2	45.3	44.2	46.0	46.7	47.5	49.6	49.3
Structural balance	0.2	-1.3	-2.2	-2.3	-1.6	-0.1	0.0	-0.7	-0.2	-3.9	-4.2
Memo items											
Structural balance under standard approach	-0.1	-2.0	-2.4	-2.2	-0.9	0.3	0.1	-1.2	-0.9	-4.3	-4.7
Headline revenue (%GDP)	46.1	45.1	44.1	43.9	44.3	44.5	46.1	45.4	46.6	45.4	44.5
Headline expenditure (%GDP)	44.2	45.4	46.2	47.1	46.1	44.8	45.5	45.3	45.9	50.7	50.4
Headline balance (%GDP)	2.0	-0.3	-2.1	-3.2	-1.8	-0.3	0.5	0.2	0.7	-5.3	-5.9

Sources: Eurostat, CPB, and author's calculations.
1/ In percent of potential GDP unless otherwise stated.

22. **Differences in the estimates of the structural balance between our approach and the standard one are modest**. Table 6-3 presents the estimates of structural revenues, structural expenditure, and the structural balance. Interestingly it indicates that the deterioration in the structural balance in 2007 may have been overstated by the estimates derived using the standard approach. On the other hand, the deterioration of 2009 was very similar under the two approaches, though the estimated structural balance under the disaggregated approach is about ½ percent of GDP better than suggested by the standard approach. For 2010, the disaggregated approach indicates no improvement in the structural position, whereas the standard approach points to modest tightening. Nevertheless differences between the two estimates are generally not very large, suggesting that the standard approach has been basically robust to the effects of asset prices and sectoral changes in the case of Netherlands.

References

Bouthevillain, C., P. Cour-Thimann, G. van den Dool, P. Hernandez de Coz, G. Langenus, M. Mohr, S. Momigliano, and M. Tujula, 2001, "Cyclically Adjusted Budget Balances: An Alternative Approach," European Central Bank, Working Paper No. 77.

Eschenbach, F., and L. Schuknecht, 2002, "Asset Prices and Fiscal Balances," European Central Bank, Working Paper No. 141.

European Commission, 2008, "Public Finances in EMU—2008," European Commission, Directorate-General for Economic and Financial Affairs, European Economy 4/2008.

———, 2009, "Public Finances in EMU—2009," European Commission, Directorate-General for Economic and Financial Affairs, European Economy 5/2009.

Fedelino, A., A. Ivanova, and M. Horton, 2009, "Computing Cyclically-Adjusted Balances and Automatic Stabilizers," International Monetary Fund, Fiscal Affairs Department, Technical Notes and Manuals 09/05.

Girouard, N., and C. Andre, 2005, "Measuring Cyclically-adjusted Budget Balances for OECD Countries," OECD Economics Department Working Papers, No. 434, OECD Publishing.

Girouard, N., and R. Price, 2004, "Asset Price Cycles, "One-off" Factors and Structural Budget Balances," OECD Economics Department Working Papers, No. 391, OECD Publishing.

Horton, M., M. Kumar, and P. Mauro, 2009, "The State of Public Finances: A Cross-Country Fiscal Monitor," IMF Staff Position Note 09/21, http://www.imf.org/external/pubs/ft/spn/2009/spn0921.pdf.

IMF, 2009, "The State of Public Finances: Outlook and Medium-Term Policies after the 2008 Crisis," http://www.imf.org/external/np/pp/eng/2009/030609.pdf.

Joumard, I., and C. Andre, 2008, "Revenue Buoyancy and its Fiscal Policy Implications," OECD Economics Department Working Papers, No. 598, OECD Publishing.

Kanda, D., 2010, "Asset Booms and Structural Fiscal Positions: The Case of Ireland," International Monetary Fund, Working Paper No. WP/10/57.

Larch, M. and A. Turrini, 2009, "The Cyclically-adjusted Fiscal Balance in EU Fiscal Policy making: A Love at First Sight Turned into a Mature Relationship," European Commission, Directorate-General Economic and Financial Affairs, European Economy Economic Papers 374.

Morris, R., and L. Schuknecht, 2007, "Structural Balances and Revenue Windfalls: The Role of Asset Prices Revisited," European Central Bank, Working Paper No. 737.

Ng, S., and P. Perron, 2001, "Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power," *Econometrica*, Vol. 69, pp. 1519–54.

ANALYTICAL NOTE 7: FISCAL SUSTAINABILITY AND OPTIMAL CONSOLIDATION PATHS IN THE NETHERLANDS[1]

1. **This note provides an assessment of fiscal sustainability in the Netherlands, and also examines the optimal pace of consolidation under quadratic preferences.** The estimates of aging pressures from the European Commission's Stability Report 2009 are incorporated in the analysis, as well as the implications of the recent weakening in the fiscal position. The sustainability gap is evaluated from a starting point of 2012, and thus incorporates only those consolidation measures that are anticipated for 2011. We conclude that the sustainability gap as of 2012 is moderately smaller than that estimated for 2011 in the 2009 Staff Report, reflecting the strong consolidation plans for 2011. Measures to help erase the sustainability gap are briefly discussed. In addition, we develop a model to shed light on optimal fiscal consolidation paths under quadratic preferences concerning the sustainability and output gaps.

A. Recent Fiscal Developments and Outlook

2. **The headline fiscal balance deteriorated sharply in 2009.** This was largely driven by the sharp decline in economic activity—which drove revenues down while at the same time raising expenditure-GDP ratios—as well as discretionary stimulus. Revenues fell by one percent of GDP, led by social contributions, while expenditures rose by almost 5 percent of GDP with almost half of the increase due to social benefits. As a result the headline balance fell from a surplus of ½ percent of GDP in 2008 to a deficit of 5½ percent of GDP in 2009. Staff estimates that structural worsening accounted for half of this deterioration, with the robust deficit (i.e. the structural primary deficit excluding property income) rising from 2¼ percent of GDP in 2008 to 5¼ percent of GDP in 2009. Alongside, public debt rose 2½ percentage points to 60¾ percent of GDP, breaching the SGP debt limits.

3. **But improved in 2010**. The headline fiscal deficit declined modestly to 5¼ percent of GDP in 2010, with a revenue decline of ¼ percent of GDP more than offset by a decline of ½ percent of GDP in expenditure. The revenue decline was concentrated in non tax revenues, whereas the expenditure reduction broad based. Alongside, the robust deficit improved by ¼ percentage point to 5 percent of GDP, while public debt rose to 63¾ percent of GDP.

4. **And substantial consolidation is planned for 2011**. The headline deficit is expected to contract by 1½ percent of GDP, primarily as a result of consolidation efforts that reduce the robust deficit by almost 1 percent of GDP. In this regard, revenues are expected to increase by ¾ percent of GDP, with a significant increase in social contributions partly offset by reduced taxes. Expenditures are also expected to decline by ½ percent of GDP, with the cuts led by the wage bill but spread in a broadly uniform fashion across most expenditure

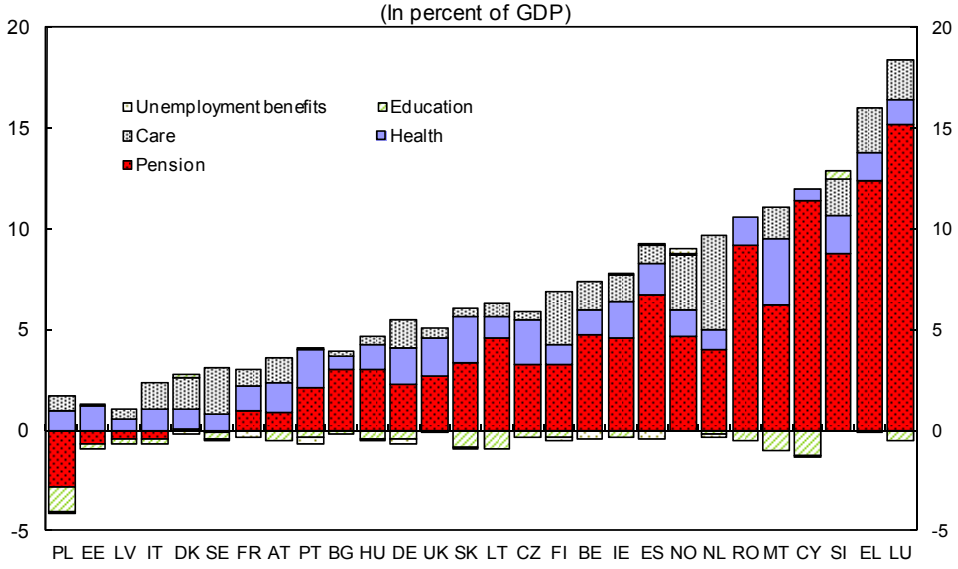
[1] Prepared by Daniel Kanda

categories. Notwithstanding this consolidation, public debt continues to grow, reaching 65½ percent of GDP, as the deficit remains substantial.

5. **The year for the calculation of the sustainability gap is taken to be 2012, one year later than that in the 2009 Staff Report**. This implies that the impact of the strong consolidation in 2011 is taken into account in the calculation, unlike the case of the 2009 staff report, which will reduce the size of the sustainability gap in comparison with the estimate of 8 percent of GDP estimated in the 2009 Staff Report.

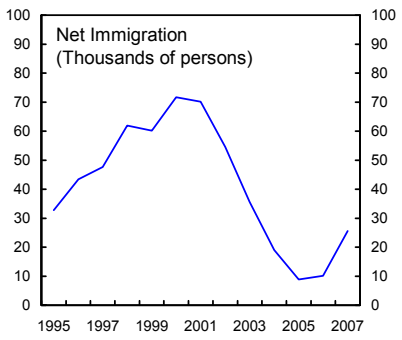
6. **Recent ECFIN baseline estimates of aging pressures for the Netherlands are in the relatively high range in comparison with other European countries (Figures 7-1 and 7-2)**. From 2007 to 2060, aging pressures are estimated to add 9.4 percent of GDP to fiscal expenditures in the Netherlands, well above the median of 5.3 percent of GDP across the European Union. The increase for the Netherlands is composed of increased pension expenditure of 4 percent of GDP, larger long-term care expenditure of 4.7 percent of GDP, higher health-care expenditure of one percent of GDP, and reduced education and unemployment-benefit expenditures of 0.2 and 0.1 percent of GDP, respectively.

Figure 7-1. Change in Expenditure Due to Aging, 2007-60
(In percent of GDP)



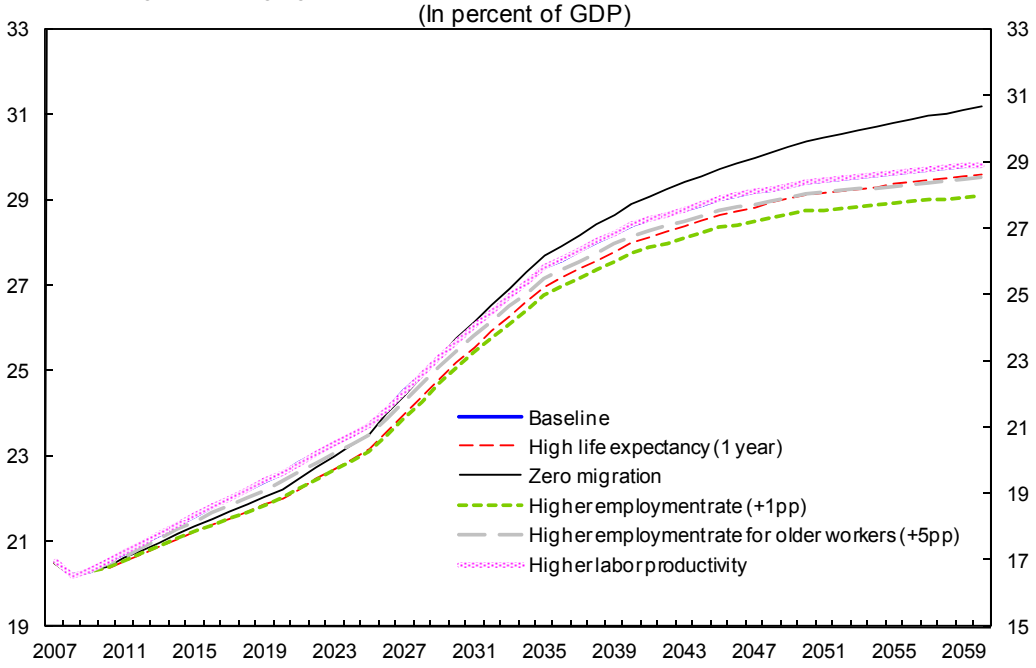
Source: DG ECFIN, The 2009 Ageing Report, and IMF staff calculations.

7. **These baseline estimates are sensitive to the underlying assumptions used**. In particular, the assumptions on immigration have a significant influence on the projections. The baseline scenario assumes that average annual net immigration over 2010–60 is about 9,500 persons, which is among the lowest in share of population (0.06 percent) in the EU27, and also below



inflows in recent years. In comparison, an alternative scenario with zero immigration is projected to add 1.4 percent of GDP to the increase in aging related spending over 2011–60. Roughly speaking, therefore, an increase in annual immigration flows by 1,000 would reduce the buildup of aging pressures by about 0.15 percent of GDP. In contrast, however, an analysis of the benefits of immigration carried out by the CPB in 2003 is more pessimistic, finding little or even negative fiscal benefits to the Netherlands from recent immigration, given that immigrants often have different labor market characteristics than the native population and will also ultimately add to the number of the aged.[2]

Figure 7-2. Aging-Related Expenditure Under Different Scenarios, 2007-60
(In percent of GDP)



Sources: DG ECFIN;The 2009 Ageing Report; and IMF staff estimates.

B. Estimating the Fiscal Sustainability Gap

8. **The sustainability indicator used is based on the general government intertemporal budget constraint**. This is consistent with the approach used by the Dutch authorities and the S2 sustainability indicator used in the EC's sustainability reports.[3] The starting point for this analysis is the equation defining the evolution of public debt:

$$B_t = B_{t-1}(1+r) - P_{t-1} \qquad (1)$$

[2]Roodenberg, H., R. Euwals, and H. ter Rele, 2003, "Immigration and the Dutch Economy," CPB Netherlands Bureau for Economic Analysis, The Hague.

[3]See van Ewjik, C., N. Draper, H. ter Rele, and E. Westerhout, 2006, "Ageing and the Sustainability of Dutch Public Finances," CPB Netherlands Bureau for Economic Analysis, The Hague; and European Commission, 2009, "Sustainability Report 2009."

Where B_t, r, and P_t, represent the debt stock at the beginning of period t, the discount rate, and the primary surplus in period t, respectively. Dividing equation (1) by GDP gives the following equation:

$$b_t = b_{t-1}\left(\frac{1+r}{1+g}\right) - p_{t-1}\left(\frac{1}{1+g}\right) \tag{2}$$

Where b_t and p_t represent the debt to GDP ratio at the beginning of period t and the primary surplus to GDP ratio in period t, respectively, and g represents the growth rate of GDP, assumed to be constant for algebraic simplicity. Solving equation (2) forward and imposing the no-Ponzi-scheme condition yields the government intertemporal budget constraint:

$$b_t = \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j p_{t+j} \tag{3}$$

For any given fiscal stance (e.g. the current structural primary fiscal balance) and given the outlook for growth and other expected exogenous changes such as demographic change and depletion of natural resources, a "passive" path for the primary surplus over an infinite horizon can be estimated, and on that basis the sustainability gap in stock terms (which is the total intertemporal debt in present value terms) is then given by:

$$V_t = b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j p_{t+j} \tag{4}$$

And the sustainability gap in flow terms—hereafter simply called the sustainability gap—which is defined as the constant change to the primary balance in percent of GDP such that the sustainability gap in stock terms is zero is thus derived as:

$$S_t = (r-g)\left[b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j p_{t+j}\right] \tag{5}$$

9. **Staff's updated estimate of the sustainability gap is about ½ percent of GDP lower than that in the 2009 Staff Report**. Taking into account the consolidation of almost 1 percent of GDP in 2011 (bearing in mind that we now calculate the sustainability gap as of 2012, in contrast to the last staff report where it was calculated as of 2011), slightly offset by the impact of the one-year delay on the accumulation of debt and a somewhat lower projection for medium term growth of nominal GDP, we find that the estimate of the

sustainability gap has declined to 7½ percent of GDP.[4,5] While higher pension payments would also increase tax receipts on pension income, this offers only a small offset to the increase in the sustainability gap. However, the sustainability gap could turn out to be less than 7½ percent of GDP if the large external current account surplus unwinds as a rising number of retirees draw down their accumulated pensions, raising consumption-based tax revenues over the long run as share of output. The authorities' estimates (also published by Bettendorf et al, 2011) indicate that this effect is substantial.[6] However, we have not taken this into account in our calculations because the size of this effect is quite uncertain.

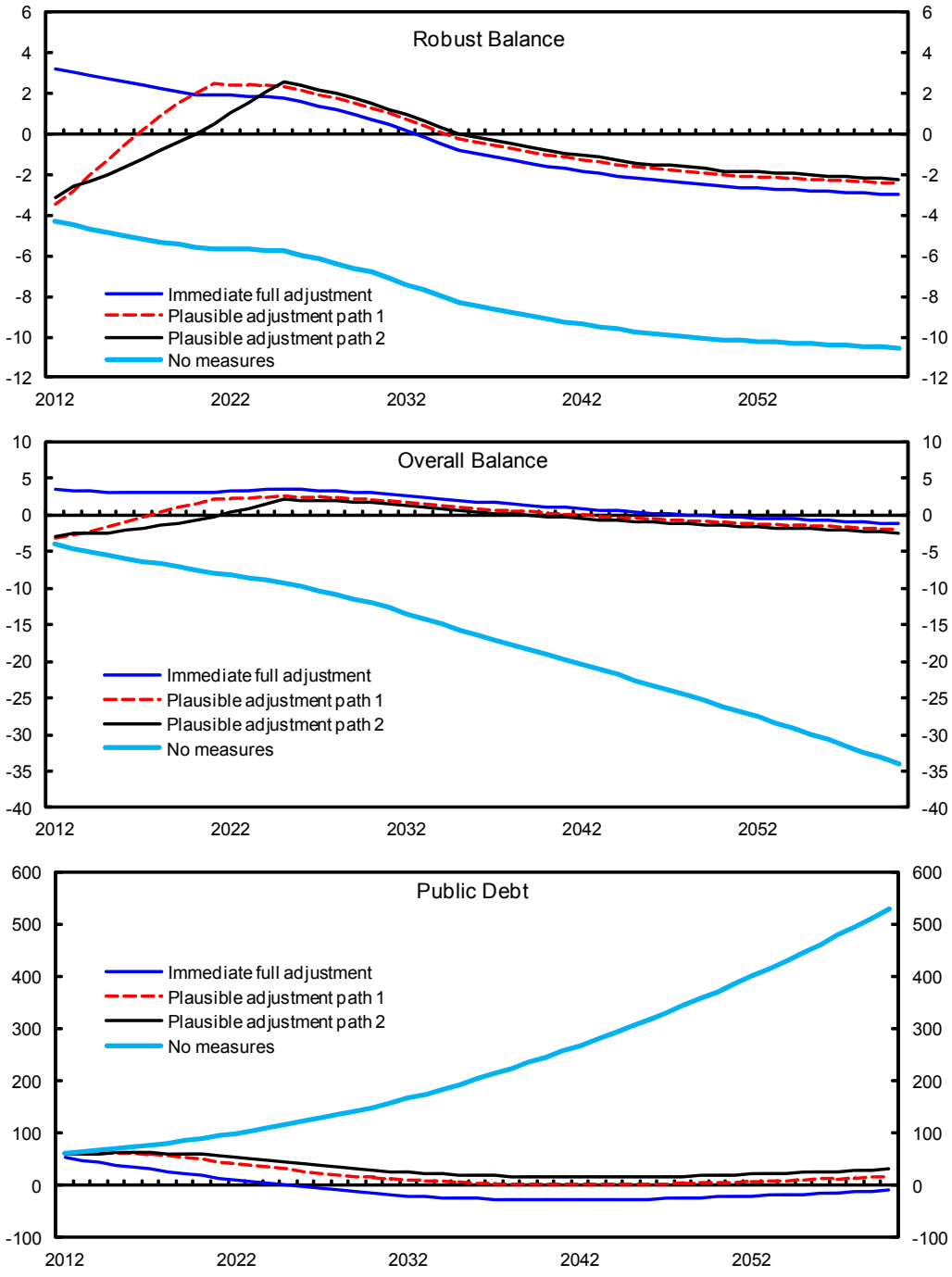
10. **Absent corrective measures, public debt is projected to exceed 500 percent of GDP by 2060 in view of the large sustainability gap (Figures 7-3 and 7-4)**. Alongside, the robust deficit is projected to increase by 6¼ percentage points to 10½ percent of GDP, while the overall fiscal deficit deteriorates by 30 percentage points to 34 percent of GDP as interest payments consume an ever-increasing share of fiscal expenditure. In contrast, immediate full adjustment implies that gross debt is driven to zero by 2026, with a notable buildup of government assets thereafter to help defray the long-run costs of aging.

[4] This assumes that the outlays for financial sector bailout—including any additional interest payments from the debt issued for this purpose—are fully recouped. With zero recoupment of these outlays the sustainability gap increases to 7¾ percent of GDP.

[5] In comparison, ECFIN estimates the fiscal sustainability gap for the Netherlands in 2009 at 6.9 percent of GDP.

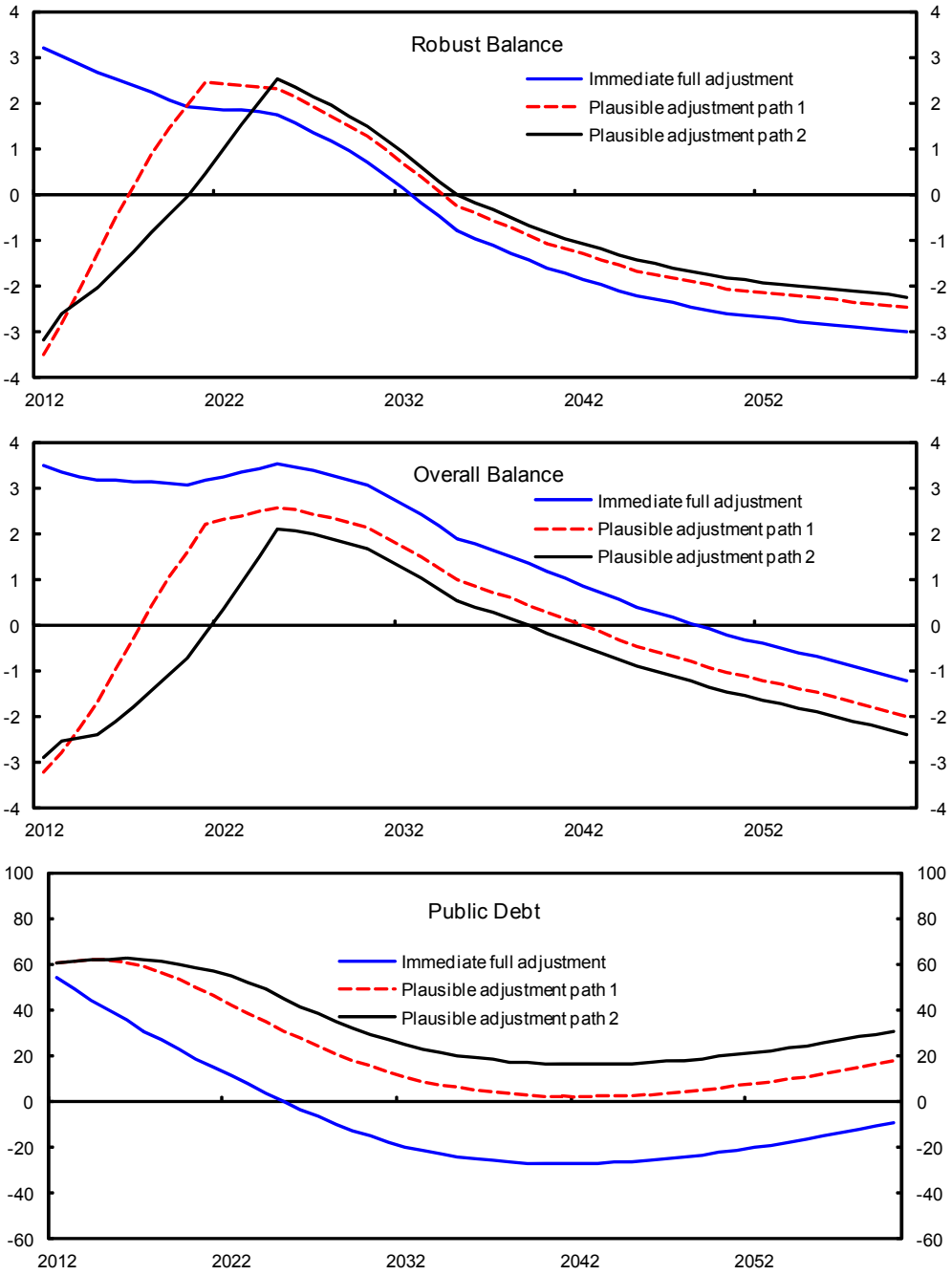
[6] See Bettendorf, L., A. van der Horst, N. Draper, C. van Ewjik, R. de Mooij, and H. ter Rele, 2011, "Ageing and the Conflict of Interest Between Generations," published online in De Economist, Springer. http://www.springerlink.com/content/l066481t43655j32/fulltext.pdf

Figure 7-3. Netherlands: Fiscal Sustainability, 2012–60 1/
(in percent of GDP)



Sources: CPB: Ageing and the Sustainability of Dutch Public Finances (2006), ECFIN: The 2009 Ageing Report, and Staff calculations.
1/ Plausible adjustment path 1 is somewhat less ambitious than authorities' adjustment path in the short run, but envisages stronger consolidation thereafter such that the sustainability gap is closed in 2021. This also corresponds to the variable weights scenario in Table 7-1. Plausible adjustment path 2 is consistent with the authorities' adjustment path up to 2015, and further assumes that consolidation continues at a pace of ½ percent of GDP until the sustainability gap is closed in 2025.

Figure 7-4. Netherlands: Fiscal Sustainability Excluding No Measures Path, 2012-60 1/ 2/



Source: CPB: Ageing and the Sustainability of Dutch Public Finances (2006), ECFIN: The 2009 Ageing Report, and Staff calculations.
1/ Same data as immediately preceding panel chart, but excluding no-measures path in order to highlight constrasts between the various sustainable paths.
2/ Plausible adjustment path 1 is somewhat less ambitious than authorities' adjustment path in the short run, but envisages stronger consolidation thereafter such that the sustainability gap is closed in 2021. This also corresponds to the variable weights scenario in Table 7-1. Plausible adjustment path 2 is consistent with the authorities' adjustment path up to 2015, and further assumes that consolidation continues at a pace of ½ percent of GDP until the sustainability gap is closed in 2025.

11. **Other commonly-used sustainability indicators generally show smaller gaps, but do not satisfy the intertemporal budget constraint**. In particular, the European Commission defines another indicator, S1 as the constant change to the primary balance in percent of GDP such that the public debt to GDP ratio is 60 percent of GDP in 2060, and the IMF's Fiscal Affairs Department sometimes uses an indicator (which we will call S3 here for brevity) defined similarly as the constant change to the primary balance in percent of GDP such that the public debt to GDP ratio is 60 percent of GDP in 2030. S1 and S3 however generally do not satisfy the intertemporal budget constraint, as they do not address what happens beyond the respectively envisaged time horizons. For Netherlands, we estimate S1 and S3 to be 6½ percent of GDP and 4 percent of GDP, respectively. In both cases our estimates indicate that debt is on a strongly rising path beyond the respective time horizons used. Thus, we do not focus on these indicators beyond this point.

C. Measures to Achieve Sustainability

12. **The authorities plan significant consolidation in 2011 and beyond**. Deep cuts in expenditure are envisaged over 2011–15, with a view to reduce the headline deficit to less than one percent of GDP by 2015. The cuts are broad-ranging, and will include reducing public administration costs, restraining growth of public wages, efficiencies in health care, and reductions in grants and transfers. However, the new government stepped back from some key structural measures announced by the previous government: in particular, the retirement age is now to be increased by one year to 66 rather than 67 announced previously. Also, there is to be no action to modify the generous regime for mortgage interest deductibility. Cuts to unemployment benefits are also off the table. While the fiscal measures for the medium term are ambitious, the total from these efforts falls short of the size of the sustainability gap, so more measures will need to be identified over the longer horizon to close the sustainability gap.

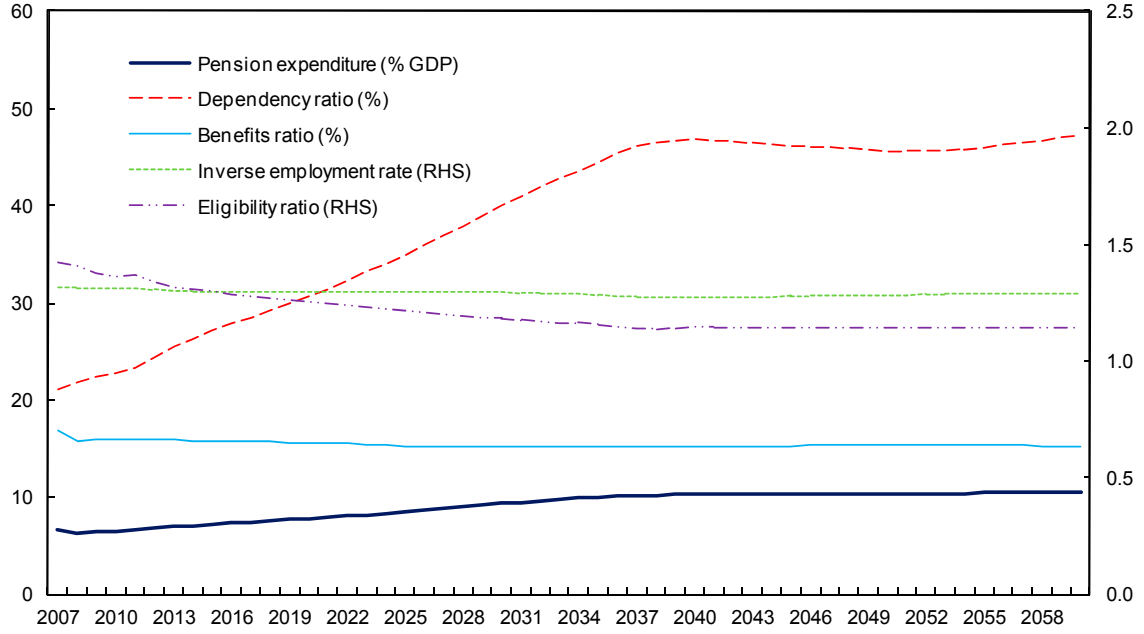
13. **Measures to directly contain the impact of aging on the public finances should be a key plank of efforts to secure sustainability**. In this regard, pension reform is critical. The OECD notes that the state pension has not been changed since it was set up in 1957, even as life expectancy has increased by more than 6 years and a strong second-pillar pension system has been built up. Also, it is relatively generous by international standards, at about 31 percent of average earnings compared to an average 22 percent for neighboring countries. The decomposition of the projected buildup in pension pressures indicates that the increase arises from a pronounced increase in the old-age dependency ratio, which is projected to be partly offset by tightening of eligibility rules (Figure 7-5). However, more could be done, including by gradual reduction of benefits as well as improvements in the employment ratio. In addition, the rise in the old-age dependency ratio could be limited by increasing the retirement age.

14. **The authorities do not dispute the need for such measures**. Indeed, they have already moved in this direction by abolishing tax incentives for early retirement. And while

the previous government's intention to raise the retirement age from 65 to 67 by 2025 has been scaled back, there is still time to reconsider this position as the measure takes place over a long horizon. These measures could also be supported by intensified efforts to increase labor participation rates and immigration in order to increase the base for funding pensions. Consideration could also be given to reducing or means-testing the generosity of pensions, while strengthening dependence on the second pillar pension.

15. **Major health sector reform in 2006 has increased competition in the sector, but more is needed to contain the rise in health-care expenditures**. The reforms harmonized the basic health insurance package, increased consumer information on premiums, facilitated the switching of insurance providers, blocked insurance companies from refusing coverage on the basis of pre-existing conditions, and mandated that all acquire insurance. This has intensified competition amongst insurers, leading to increased mergers and some downward pressure on premiums. However, expenditure pressures are still significant, and the new government is rightly seeking efficiencies in this area. There are also concerns that mergers of insurance companies will ultimately reduce competition. Thus sustained vigilance will be needed to keep a lid on health costs.

Figure 7-5. Netherlands: Decomposition of Pension Expenditure Projections, 2007-60



Sources: DG ECFIN; The 2009 Ageing Report; and IMF staff estimates.

16. **Moreover, eligibility, entitlements, and arrangements for old-age care will also need reform, as this is an area where aging pressures will be substantial.** The projected increase in long-term care spending for the Netherlands is by far the highest in the EU, which

suggests that reforms drawing on lessons from other EU countries could yield substantial savings.

D. Optimal Fiscal Consolidation Paths

17. **The pace of consolidation will reflect the balancing of the government's twin stated objectives of reducing both the output and the fiscal sustainability gaps**. We construct a model to assess the optimal pace of consolidation as follows: the authorities are assumed to care about both the sustainability and output gaps, and to prefer that both be zero. However, these objectives are conflicting, in that action to close the sustainability gap (fiscal tightening) comes at the expense of widening the output gap, while on the other hand, action to close the output gap (fiscal loosening) increases the sustainability gap. Thus, over an infinite horizon, the authorities' problem can be characterized as choosing a path for the fiscal stance that minimizes the following quadratic objective function.

$$\sum_{t=0}^{\infty} \beta^t \left(\alpha \mathrm{O}_t^2 + \gamma S_t^2 \right) \tag{6}$$

Where O_t, α γ and β, represent the output gap in percent of GDP in period t, the weight placed by the authorities on closing the output gap, the weight placed by the authorities on closing the sustainability gap, and the authorities' rate of time preference, respectively, with $\beta = 1/(1+r)$.

18. **The output gap is assumed to evolve according to the following equation**:

$$\mathrm{O}_t = \lambda \mathrm{O}_{t-1} - \xi \left(f_t - f_{t-1} \right)) \tag{7}$$

Where f_t, λ and ξ, represent, respectively, discretionary fiscal measures taken (in percent of GDP) in period t, an autoregressive parameter on the output gap which determines how long it would take for the output gap to be eliminated through self-repair of the economy rather than fiscal action, and the fiscal multiplier.

19. **Discretionary fiscal measures are assumed to have no effect on potential growth**. In effect, discretionary measures only affect GDP growth temporarily, with corresponding changes to the output gap. The constant growth rate assumed in the derivation of the sustainability gap is best interpreted as the average of the annual growth rates that obtain over the infinite horizon. With the underlying potential growth path unchanged, temporary deviations of annual growth rates have a negligible impact on the average calculated over the infinite horizon. Moreover, since the output gap closes, temporarily low growth rates must be offset by temporarily higher growth rates. Thus, notwithstanding some variation in growth rates, equation 5 would still give a close approximation to the sustainability gap.

20. **It is necessary to adjust the sustainability gap formula to reflect discretionary actions**. If we adjust equation 5 to take account of discretionary fiscal measures taken in time t, in addition to the "passive" evolution of the primary surplus, this yields:

$$S_t = (r-g)\left[b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j p_{t+j} - \left(\frac{1}{r-g}\right)f_t\right] \tag{8}$$

And some algebraic manipulations reveal that the sustainability gap evolves as follows:

$$S_t = \left(\frac{1+r}{1+g}\right)S_{t-1} - \left(f_t - f_{t-1}\right) \tag{9}$$

21. **Equation 9 reveals that in the normal case where the discount rate exceeds the GDP growth rate, delaying actions to ensure sustainability is costly**. The magnitude of the sustainability gap increases over time absent discretionary measures to close it, since the discount rate (which governs the pace of debt accumulation) exceeds the GDP growth rate (which governs the burden of debt relative to GDP). We estimate in the Netherlands case that whereas immediate full adjustment to sustainability requires measures totaling 7½ percent of GDP, phasing in the adjustment over a 10 year period requires measures totaling about 8 percent of GDP for sustainability.

22. **The authorities' problem is to choose the size of fiscal measures in time t to minimize the objective function (6) subject to equations (7) and (9)**. Given the quadratic preferences and linear constraints, we know that the optimal fiscal tightening in any time period is a linear function. We therefore speculate that the fiscal consolidation pace is governed by the following equation:

$$f_t - f_{t-1} = A\mathrm{O}_{t-1} + BS_{t-1} \tag{10}$$

Where $A > 0$ and $B > 0$. Substituting equation (10) into the first order condition of the authorities' problem, and solving for A and B yields:

$$A = \frac{\alpha\xi\lambda}{\left(\alpha\xi^2 + \gamma\right)} \tag{11}$$

$$B = \frac{\gamma(1+r)}{(\alpha\xi^2 + \gamma)(1+g)} \tag{12}$$

23. **Thus, the optimal path for fiscal consolidation depends on the starting values for the output and sustainability gaps, the fiscal multiplier, the speed of self-correction of output gaps, the discount and GDP growth rates, and the authorities' preferences**. For Netherlands, starting in year 2012, the initial sustainability gap is calculated above at

7½ percent of GDP, while it is estimated that the (negative) output gap in 2011 was one percent of GDP. λ is calibrated to equal 0.5, implying that the Dutch output gap would be essentially eliminated by 2016. The fiscal multiplier is taken to be 0.6. The discount rate and GDP growth rate are taken to be 5 percent and 3.4 percent respectively, consistent with the EC Sustainability Report 2009. On this basis, we then zero-in on the impact of the authorities' preferences on the optimal consolidation path.

24. **In general, the optimal consolidation path includes some front-loading of adjustment, but also envisages that full elimination of the sustainability gap takes place over a long horizon**. Quadratic preferences mean that the pressure to act to reduce any of the two gaps under consideration increases in nonlinear fashion with the size of that gap. Thus, if the sustainability gap is large enough relative to the output gap, the optimal immediate fiscal tightening would be one that trades a substantial reduction the sustainability gap for some increase in the output gap. Therefore (subject to the weights in the authorities' preferences) the larger the sustainability gap, the more optimal it is to front-load adjustment. Also, the authorities have a very long horizon over which to consider and implement adjustment, and under quadratic preferences they would tend to select a path in which both the output and sustainability gaps trend toward zero, which then pushes back the timing for full sustainability to be achieved.

25. **Table 7-1 illustrates various consolidation paths, reflecting different preference weights of the authorities on the output and sustainability gaps**. In the case where there are equal weights on the output and sustainability gaps, the optimal fiscal tightening for 2012 is 5¼ percent of GDP, which is rather large, and certainly well beyond what most advanced economies could contemplate. The next two cases deal with "corner" solutions where the authorities care only about the sustainability gap (and therefore eliminate it totally in one year) or care only about the output gap (and therefore eliminate it totally in one year by appropriate fiscal loosening). The case where alpha=0.9 and gamma=0.1 yields results that are quite plausible, with annual consolidation starting at about ¾ percent of GDP and declining gradually over time such that the sustainability gap is kept on a steady downward path. However, at that pace the sustainability gap is only eliminated over a very long horizon. As of 2021 the sustainability gap, though substantially reduced, is still at 3¼ percent of GDP.

26. **The last scenario (variable weights) considers the case where the authorities have a fixed time horizon (taken to be 10 years) to close the sustainability gap**. This is modeled in a simple fashion by allowing the weights on the sustainability and output to vary, with alpha declining from 0.9 to zero over the 10 years while gamma rises at the same pace from a starting value of 0.1. Here we observe a relatively uniform but plausible pace of consolidation, with annual tightening averaging about ¾ percent of GDP. The "Plausible adjustment path 1" scenario shown in the text chart on fiscal sustainability corresponds to this scenario. In contrast, the "Plausible adjustment path 2" scenario in the same text chart is consistent with the authorities' announced adjustment path up to 2015, and further assumes that consolidation is continued at a pace of ½ percent of GDP annually from 2016 onward,

which leads to the sustainability gap being closed in 2025. It is thus a bit more frontloaded in the short run, but with the pace of consolidation declining more significantly than in "Plausible adjustment path 1" over the medium and long run.

Table 7-1. Illustrative Optimal Annual Fiscal Adjustment Paths Under Quadratic Preferences 1/

Loss Function Weights 2/		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Alpha= 0.5 Gamma= 0.5	Annual consolidation	5.1	0.9	0.6	0.4	0.2	0.2	0.1	0.1	0.0	0.0
	Sustainability gap	2.4	1.6	1.0	0.7	0.4	0.3	0.2	0.1	0.1	0.1
	Underlying output gap 4/	-3.7	-2.4	-1.6	-1.0	-0.7	-0.4	-0.3	-0.2	-0.1	-0.1
Alpha= 0.0 Gamma= 1.0	Annual consolidation	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sustainability gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Underlying output gap 4/	-5.3	-2.7	-1.3	-0.7	-0.3	-0.2	-0.1	0.0	0.0	0.0
Alpha= 1.0 Gamma= 0.0	Annual consolidation	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sustainability gap	8.2	8.3	8.5	8.6	8.7	8.9	9.0	9.1	9.3	9.4
	Underlying output gap 4/	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alpha= 0.9 Gamma= 0.1	Annual consolidation	0.8	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.3
	Sustainability gap	6.7	6.2	5.7	5.2	4.8	4.5	4.1	3.8	3.5	3.2
	Underlying output gap 4/	-1.0	-0.9	-0.8	-0.8	-0.7	-0.6	-0.6	-0.5	-0.5	-0.5
Memorandum item:											
Variable weights 3/	Annual consolidation	0.8	0.8	0.9	0.9	0.9	0.8	0.8	0.7	0.6	0.5
	Sustainability gap	6.7	6.0	5.1	4.3	3.4	2.6	1.8	1.1	0.5	0.0
	Underlying output gap 4/	-1.0	-1.0	-1.1	-1.2	-1.2	-1.1	-1.1	-1.0	-0.9	-0.8

Source: IMF staff calculations.
1/ Initial sustainability gap (given no consolidation from 2012 onward) = 7.5 percent of GDP; Initial output gap (in 2011) = -1.0 percent of GDP; fiscal multiplier is taken to be 0.6; autoregressive parameter for output gap (lambda) is taken to be 0.5; nominal interest rate = 5 percent; nominal GDP growth rate = 3.4 percent.
2/ Alpha is the weight on the output gap, while gamma is the weight on the sustainability gap.
3/ Alpha is assumed to decline over time from an initial value of 0.9 to zero over a 10-year period, while Beta rises at the same pace from an initial value of 0.1.This scenario corresponds to "Plausible adjustment path 1" in the Netherlands: Fiscal Sustainability, 2012-60 textchart.
4/ The underlying output gap is not directly comparable with the output gap in staff's WEO projections, as the WEO projections assume that other effects (including confidence e.t.c) will provide some offset to the negative impact of fiscal tightening, such that the output gap closes in 2016. These other effects could be modeled by introducing an exogenous term into the equation governing the evolution of the underlying output gap.

ANALYTICAL NOTE 8: MODELING OPTIMAL FISCAL CONSOLIDATION PATHS IN A SELECTION OF EUROPEAN COUNTRIES [1]

A. Introduction

1. **This paper develops a tractable inter-temporal model that elicits the implied country-preferences over balancing the conflicting objectives of fiscal consolidation and reduction of the slack in the economy in a selection of European countries**. Given country preferences and starting points, the model then predicts the most advantageous pace of fiscal adjustment needed to close fiscal sustainability gaps. The first part of the paper examines the issues related to the calculation of sustainability gaps, and then goes on to calculate sustainability gaps for the selected countries. The second part develops a model incorporating quadratic preferences of the authorities and laws governing the evolution of sustainability gaps and output gaps over time. The rationale here is that country authorities would prefer that both output and sustainability gaps be zero, but that action to reduce one gap typically comes at the expense of widening the other gap. Thus these two objectives must be balanced over time, given authorities' preferences and various features of the economy which are expounded on below.

2. **A country's fiscal position can be measured in a variety of ways, with each having its strengths and weaknesses**. Typically, a more theoretically satisfactory measurement of the fiscal position comes at the cost of requiring better quality data and greater institutional capacity for successful use. The most commonly used measures are the headline fiscal balance, public gross or net debt-GDP ratio, the structural or cyclically adjusted fiscal balance, the structural primary balance, and the fiscal sustainability gap. A key determinant of the degree of usage is the difficulty of measurement. Virtually all countries calculate the headline fiscal balance, but many countries with institutional capacity limitations do not attempt the calculation of the cyclically adjusted balances, as these require reasonably accurate estimation of potential output and various elasticities that determine the impact of output gaps on the headline balance. Nevertheless, it is also clear that structural balances—properly calculated—give a more satisfactory indication of the fiscal position of a country, as output gaps obscure the true underlying fiscal position expected to obtain over the medium to long run. In a similar vein, sustainability gaps provide a more satisfactory measure of the fiscal position than structural balances, but generally require greater institutional capacity and resources to implement successfully, as they require long run projections of the evolution of the economy.

3. **The concept of fiscal sustainability is the most satisfactory basis for measuring the fiscal health of a country**. It poses the following question: if the authorities decide to take no further fiscal measures from now onward, can they maintain that posture over the

[1] Prepared by Daniel Kanda

long run? If they can do so, then the fiscal position is considered sustainable (and the sustainability gap is then zero). However, in most countries this is not the case, and protracted inaction then typically leads to a situation where the debt-GDP ratio rises continuously without bound, implying that interest payments take an ever increasing share of government expenditure. This crowds out non-interest spending and increases the difficulties associated with financing the debt until the government is forced to take drastic action to restore sustainability. The measurement of sustainability gaps thus informs policymakers as to the amount of measures needed to get to the point of sustainability. Since this is inherently a forward looking exercise, most of the measurement issues one has to deal with to estimate sustainability gaps have to do with projecting the likely evolution of the economy and key fiscal variables over the long run, which then provides the basis to project the likely evolution of the headline balance and public debt, and thus the means to answer whether debt grows without bound over the long run under current policies.

4. **Reflecting these considerations, and the central need to ensure healthy fiscal policies in the European Monetary Union (EMU), the European Commission (EC) has been at the forefront of pushing for the widespread calculation and use of fiscal sustainability gaps**. Indeed, it is now customary for all EU countries to calculate fiscal sustainability gaps, in coordination with the EC, every few years, with the last such exercise conducted in 2009 (EC 2009a and 2009b). The practical experience gained has helped refine the exercise into a credible coherent one that takes into account all the major changes expected over the long run—particularly population aging—and identifies the scale of fiscal effort needed in each country to achieve sustainability.

5. **The analysis in the EC's sustainability exercise forms the point of departure for our analysis**. We focus on only six countries rather than all 27 countries in the EU, and first update the estimates of sustainability gaps for those countries. This is done to give a view of the degree of damage done to fiscal health from the global crisis, and therefore the scale of adjustment effort these countries now face. We then develop a model of the authorities' problem, and elicit country preferences by comparing model-predicted consolidation paths to the near- term adjustment paths announced by these countries. This then gives insights on the implications for the timing and overall scale of efforts needed to achieve sustainability. We then finally do a sensitivity test to see how adjustment paths should change if the value used in the calibration of the fiscal multiplier turns moderately higher.

B. Estimating the Fiscal Sustainability Gap

6. **Consistent with the approach used to calculate the S2 sustainability indicator in the EC's sustainability reports, a country is considered to be running a sustainable fiscal policy if it satisfies the general government inter-temporal budget constraint**. This constraint is derived from the equation defining the evolution of public debt as follows:

$$B_t = B_{t-1}(1+r) - P_{t-1} \qquad (1)$$

Where B_t, r, and P_t, represent the debt stock at the beginning of period t, the discount rate, and the primary surplus in period t, respectively. Dividing equation (1) by GDP gives the following equation:

$$b_t = b_{t-1}\left(\frac{1+r}{1+g}\right) - p_{t-1}\left(\frac{1}{1+g}\right) \tag{2}$$

Where b_t and p_t represent the debt to GDP ratio at the beginning of period t and the primary surplus to GDP ratio in period t, respectively, and g represents the growth rate of GDP, assumed to be constant for algebraic simplicity. Solving equation (2) forward and imposing the no-Ponzi-scheme condition yields the government inter-temporal budget constraint:

$$b_t = \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j p_{t+j} \tag{3}$$

7. **Thus, essentially, for a government to satisfy its inter-temporal budget constraint it must run future primary surpluses of sufficient size in present value terms to pay off the initial stock of debt**. This is required so that over the long run the government can meet all its obligations. Otherwise, at some point it will become clear that the government cannot meet all its obligations, which will prompt investors to refuse to buy its debt and thus force drastic changes to fiscal policy.

8. **For any given structural primary fiscal balance, and given the outlook for growth and the impact of other expected exogenous changes such as demographic change and depletion of natural resources, a "passive" path for the primary surplus over an infinite horizon can be estimated**. For most advanced countries the most substantial change expected is that due to population aging. Whereas this used to be a relatively abstract concern about a decade ago, signs of aging are now perceptible in several countries, adding renewed urgency to the need to address its likely impact on fiscal health. The EC has done substantial work on this in coordination with member countries, and as a result, estimates are available for all member countries on the likely impact of aging on public expenditure and taxation (EC 2009a and EC 2009b). On that basis the sustainability gap in stock terms (which is the total inter-temporal debt in present value terms) is then given by:

$$V_t = b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j p_{t+j} \tag{4}$$

And the sustainability gap in flow terms—hereafter simply called the sustainability gap—which is defined as the constant change to the primary balance in percent of GDP such that

the sustainability gap in stock terms is zero is thus derived as:

$$S_t = (r-g)\left[b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j p_{t+j}\right] \tag{5}$$

As an operational matter, in using equation (5) to calculate the sustainability gap one has to also take into account the fact that in most years the output gap is not zero, so that the passive path for the primary balance over the medium term is influenced also by the closing of the output gap. For example, if—as is currently the case for most industrial countries—the output gap is negative, then even without measures one would expect the primary surplus to improve as the output gap closes, with the amount of improvement dependent on the sensitivity of the primary surplus to the output gap. We model this explicitly, using the following commonly used equation for estimating the structural primary balance:

$$p_t^* = p_t - \partial O_t \tag{6}$$

Where O_t, p_t^* and ∂ represent the output gap in percent of GDP in period t, the structural primary balance in percent of GDP in period t, and the elasticity of the primary balance with respect to the output gap, respectively. Substituting equation (6) into equation (5), we obtain:

$$S_t = (r-g)\left[b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j \left(p_{t+j}^* + \partial O_{t+j}\right)\right] \tag{7}$$

And we can then write:

$$S_t = S_t^* - \left[\left(\frac{\partial(r-g)}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j O_{t+j}\right] \tag{8}$$

where

$$S_t^* = (r-g)\left[b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j p_{t+j}^*\right] \tag{9}$$

Equations (8)-(9) thus separate the calculation of the sustainability gap into a part that captures structural changes in the fiscal stance and a part that captures the impact of the cycle.

9. **Another issue that arises operationally is how to calculate the infinite sum in the formula**. Here, a common assumption used is that at some point in the distant future a steady state is achieved, beyond which the primary balance in percent of GDP stays constant. This then means that the sum of terms from the point the steady state is achieved to infinity

becomes that of a geometric progression with a finite sum, and so we can calculate the sustainability gap over an infinite horizon.

10. **Figure 8-1 presents a comparison of sustainability gaps for a selection of European countries as well as a breakdown of the key components of the calculations**. Countries included are Germany, France, Italy, Ireland, the Netherlands, and the U.K. Year *t* is taken to be 2011. Estimates of the impact of aging pressures on budgets over the long run are taken from EC 2009a and EC 2009b, but the estimate of the initial structural primary balance and initial public debt are taken from IMF staff projections as of March 2011. Of these countries, Italy has by far the smallest sustainability gap at 2½ percent of GDP, while on the other hand Ireland has the largest sustainability gap at 12¼ percent of GDP.

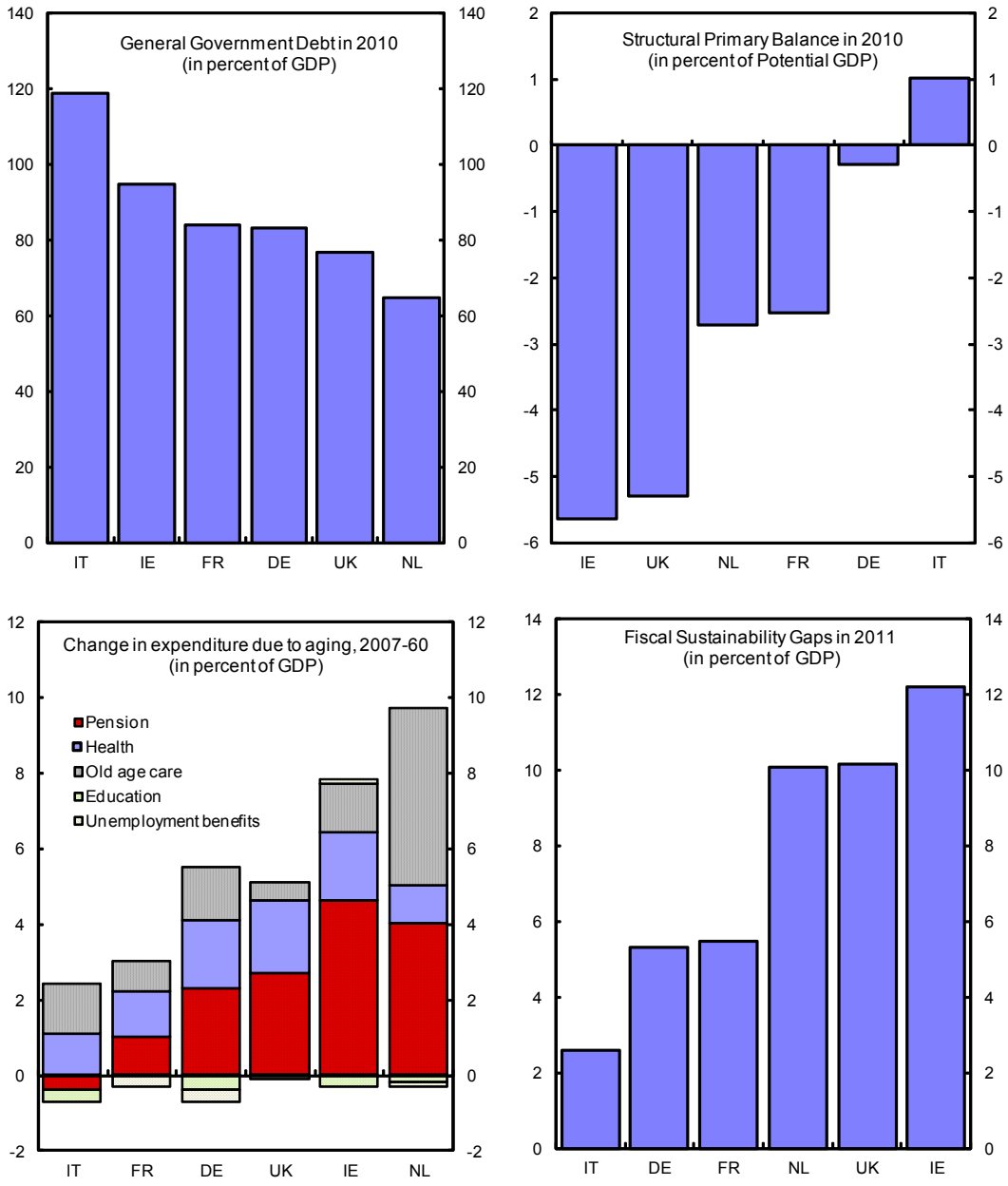
11. **A look at the various indicators that go into the calculation of the sustainability gap reveals that if used alone they would each have given sharply different rankings of fiscal health**. Thus, for example, on the basis of the public debt burden Italy is in the worst shape fiscally, yet it has the smallest sustainability gap because it is already running a structural primary surplus, and as the result of deep pension reforms enacted pension expenditures are actually expected to decline over the long run, keeping the overall impact of aging low. The U.K. has relatively moderate debt by advanced European country standards, but has a very large sustainability gap because of its very large structural primary deficit. Ireland overall, however, is consistently ranked at or near the bottom by all the indicators, with high debt, large structural primary deficits, and a substantial impact of aging expected on public expenditure.

12. **Similarly, France and Germany have comparable levels of public debt, and their sustainability gaps are also similar, because although France has a much weaker structural primary balance than that of Germany, it also has lower expected impact of aging**. The Netherlands has comparatively low debt, but its weak structural primary balance and the large expected impact of aging on public expenditure (which is most notable for old age care) yields one of the largest sustainability gaps. This then demonstrates that the most satisfactory way to compare fiscal health across countries is by use of sustainability gaps, which allow for the appropriate integration of all the relevant indicators in a coherent fashion.

13. **It should be understood that long run projections, by their very nature, are prone to wide error margins**. Indeed for each country EC 2009a provides several alternative scenarios concerning the impact of aging on pensions, health, old age care education, and unemployment benefits which demonstrate this point. Therefore our estimates could be thought of as a baseline with a significant margin of error. Even the underlying population projections themselves are also prone to wide error margins. For example, in the case of Netherlands the demographic projections of Statistics Netherlands yield a significantly more favorable profile for the buildup of aging pressures than those used by the EC, with aging pressures peaking around 2040 and then declining thereafter, and it is

estimated that this shaves off about one percent of GDP from the estimate of the sustainability gap.

Figure 8-1. Fiscal Indicators for Selected European Countries



Source: WEO, European Commission: Sustainability Report 2009, and Author's calculations.

14. **In all countries, substantial and sustained efforts will be required in order to achieve fiscal sustainability**. This however will come at some cost, as fiscal tightening is well known to dampen economic activity. For example, recent research by the IMF (WEO October 2010) reveals that there is very little evidence in the data to support the hypothesis of

expansionary fiscal contractions, and that the fiscal multiplier for advanced European countries is around 0.5. Moreover, Christiano, Eichenbaum, and Rebelo (2010) suggest that the fiscal multiplier could be even higher under certain conditions such as interest rates at the zero lower bound.

15. **In most cases, 2011 has been identified as the opportune time to commence the process of fiscal tightening, following the substantial fiscal stimulus packages implemented to stem further economic deterioration during the global crisis**. However, different countries have announced different consolidation paths reflecting different country circumstances and preferences, and there is still a considerable debate in several countries as to the appropriate pace for fiscal consolidation, with the concern often voiced that overly rapid consolidation would undermine the nascent global recovery.

C. Modeling the Fiscal Consolidation Path

16. **This paper contributes to this debate by constructing a model of the most advantageous pace of fiscal consolidation as follows**. The authorities are assumed to care about both the sustainability and output gaps, and to prefer that both be zero. However, these objectives are conflicting, in that action to close the sustainability gap (fiscal tightening) dampens domestic demand and opens up a negative output gap, while on the other hand, action to close the output gap (fiscal loosening) increases the sustainability gap. The pace of consolidation will therefore reflect the balancing of the government's twin objectives of reducing both the output and the fiscal sustainability gaps.

17. **If we adjust the sustainability gap in equation (7) to take account of discretionary fiscal measures taken in time t, in addition to the "passive" evolution of the primary surplus, this yields**:

$$S_t = (r-g)\left[b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j\left(p^*_{t+j} + \partial O_{t+j}\right) - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j f_t\right] \tag{10}$$

where f_t represents discretionary fiscal measures (in percent of GDP) taken in period t. Since discretionary measures taken in time t are expected to uniformly change the path for the primary balance over the entire horizon, the last expression in equation (10) is the sum of a geometric progression with a finite sum, and we can therefore express equation (10) as:

$$S_t = (r-g)\left[b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j\left(p^*_{t+j} + \partial O_{t+j}\right) - \left(\frac{1}{r-g}\right)f_t\right] \tag{11}$$

The output gap is assumed to evolve according to the following equation:

$$\mathrm{O}_t = \lambda \mathrm{O}_{t-1} - \xi\left(f_t - f_{t-1}\right) \tag{12}$$

Where λ and ξ represent an autoregressive parameter on the output gap which determines how long it would take for the output gap to be eliminated absent fiscal action, and the fiscal multiplier. Thus, λ reflects the impact of all non-fiscal factors that have an impact on the output gap, including spillovers from developments in the external environment, endogenous responses of monetary authorities to the state of the economy, confidence effects, and other factors that promote the self-repair of the economy. Following any shock that produces a non-zero output gap, the output gap is assumed to close at a pace governed by λ unless fiscal policy changes delay or accelerate this process, with the impact of fiscal policy governed by the size of the fiscal multiplier.

Substituting equation (12) into equation (11), and bearing in mind that in calculating the sustainability gap in period t the only fiscal measures that are included are those that are implemented in period t, we have:

$$S_t = (r-g)\left[b_t - \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\left(\frac{1+g}{1+r}\right)^j p^*_{t+j} - \left(\frac{\partial}{1+r-\lambda(1+g)}\right)O_t - \left(\frac{1}{r-g}\right)f_t\right] \tag{13}$$

And some algebraic manipulations reveal that the sustainability gap evolves as follows:

$$S_t = \left(\frac{1+r}{1+g}\right)S_{t-1} + \left(\frac{\partial(r-g)}{1+g}\right)O_{t-1} - \left(1-\left(\frac{\partial\xi(r-g)}{1+r-\lambda(1+g)}\right)\right)(f_t - f_{t-1}) \tag{14}$$

We can simplify equation (14) further by noting that for plausible values of the parameters the coefficients of the second and third expressions are closely approximated by zero and -1, respectively, and doing so yields:[2]

$$S_t = \left(\frac{1+r}{1+g}\right)S_{t-1} - (f_t - f_{t-1}) \tag{15}$$

18. **Equation (15) reveals that in the normal case where the discount rate exceeds the GDP growth rate, delaying actions to ensure sustainability is costly**. The magnitude of the sustainability gap increases over time absent discretionary measures to close it, since the discount rate (which governs the pace of debt accumulation) exceeds the GDP growth rate (which governs the burden of debt relative to GDP). Moreover, the larger the gap between the discount rate and the GDP growth rate, the higher is cost of delaying adjustment. This

[2]This approximation of the coefficients of equation (14) is accurate to one decimal place, and the simplification enables us to derive analytical solutions for the optimal fiscal path below. As a check, equation (14) was also used directly in the optimization problem, and the coefficients obtained in the policy functions for the different countries from a numerical solution method closely matched those obtained algebraically using equation (15) even for values of ∂ as high as 1.

then suggests that for countries in monetary union, where the discount rate can be expected to be similar across countries, slower growing countries have less room for maneuver in addressing fiscal sustainability issues than the faster growing countries.

19. **Discretionary fiscal measures are assumed to have no effect on potential growth**. In effect, discretionary measures only affect GDP growth temporarily, with corresponding changes to the output gap. The constant growth rate assumed in the derivation of the sustainability gap is best interpreted as the average of the annual growth rates that obtain over the infinite horizon. With the underlying potential growth path unchanged, temporary deviations of annual growth rates have a negligible impact on the average calculated over the infinite horizon. Moreover, since the output gap closes, temporarily low growth rates must be offset by temporarily higher growth rates, and vice versa. Therefore, notwithstanding some variation in growth rates, equation (15) would still give a close approximation to the evolution of the sustainability gap.

20. **Thus, over an infinite horizon, the authorities' problem can be characterized as choosing a path for the fiscal stance that minimizes the following quadratic objective function**.

$$\sum_{t=0}^{\infty} \beta^t \left(\alpha \mathrm{O}_t^2 + \gamma S_t^2 \right) \tag{16}$$

Where α, γ, and β represent the weight placed by the authorities on closing the output gap, the weight placed by the authorities on closing the sustainability gap, and the authorities' rate of time preference, respectively, with $\beta = 1/(1+r)$.

The authorities' problem is to choose f_t to minimize the objective function (16) subject to equations (12) and (15). The first order condition for this optimization problem is given by:

$$\begin{aligned} &\alpha\xi\left[\lambda O_{t-1} - \xi\left(f_t - f_{t-1}\right)\right] - \gamma\left[\left(\frac{1+r}{1+g}\right)S_{t-1} - \left(f_t - f_{t-1}\right)\right] + \beta\alpha\xi\left[\lambda O_t - \xi\left(f_{t+1} - f_t\right)\right] + \\ &\beta\gamma\left[\left(\frac{1+r}{1+g}\right)S_t - \left(f_{t+1} - f_t\right)\right] = 0 \end{aligned} \tag{17}$$

Given the quadratic preferences and linear constraints, we know that the policy function is linear. We therefore guess that the fiscal consolidation pace is governed by the following equation:

$$f_t - f_{t-1} = A\mathrm{O}_{t-1} + BS_{t-1} \tag{18}$$

where $A > 0$ and $B > 0$. Substituting equation (18) into equation (17) and bearing in mind that the first order condition equals zero we are able (after some tedious algebraic

manipulations) to derive two polynomial equations in A and B. Solving these simultaneously yields: [3]

$$A = \frac{\alpha\xi\lambda}{\left(\alpha\xi^2 + \gamma\right)} \tag{19}$$

$$B = \frac{\gamma(1+r)}{(\alpha\xi^2 + \gamma)(1+g)} \tag{20}$$

Thus, the chosen path for fiscal consolidation depends on the starting values for the output and sustainability gaps, the fiscal multiplier, the speed of correction of output gaps via non-fiscal means, the discount and GDP growth rates, and the authorities' preferences.

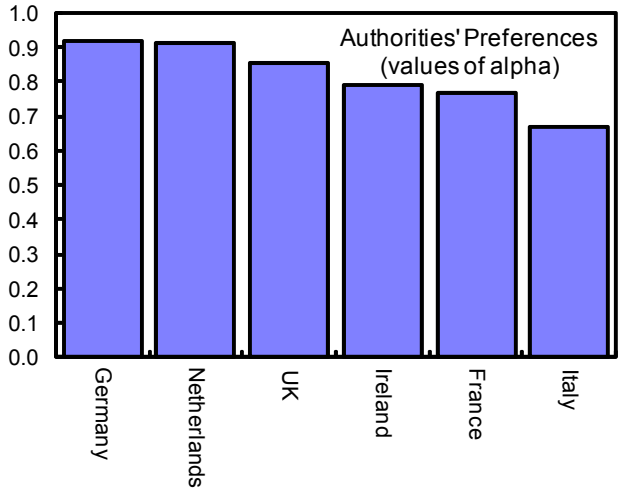
D. Calibration

21. **Determining the adjustment path for each country requires a calibration exercise to provide estimates of the parameters in the policy function**. The discount rate is taken from the EC Sustainability Report 2009, and is set at 5 percent for all countries. The GDP growth rate is calculated as the geometric average of annual growth rates, with IMF staff projections up to 2015 augmented by estimates from the EC Sustainability Report 2009 for later years. λ is calibrated to equal 0.5, implying that absent fiscal measures and all other things equal an output gap of 2 percent of GDP is eliminated after 6 years via spillovers, confidence effects, monetary policy reactions, and self-repair. The October 2010 WEO estimates a fiscal multiplier of 0.5 for advanced European countries, and that is what we use as the value for ξ.

22. **Given these estimates, the parameters governing the authorities' preferences are pinned down by "revealed preference."** We renormalize the policy function, without loss of generality, by assuming that $\gamma = 1 - \alpha$, where $0 \le \alpha \le 1$. On this basis, for each country the value of α is taken to be that which is consistent with the size of the announced change in the structural primary balance in 2011, given the initial values of the output and sustainability gaps.

[3]Strictly speaking, there are three solutions found, but only one where both A and B are positive.

23. **The text chart presents the values of α derived in this manner**. Bearing in mind that higher values of α indicate greater sensitivity to output gaps and thus lower fiscal hawkishness, in all countries the authorities place a significantly greater weight on closing the output gap than closing the sustainability gap, and in fact only in the case of Italy do we see α even approaching the neighborhood of 0.5. The ordering of preferences is somewhat surprising at first glance, with Germany—with a reputation for sound fiscal policy—placing the highest weight on closing the output gap, and Italy (with very high debt) the most hawkish. However, given the scale of Italy's debt and the associated risks to macroeconomic stability inherent in this, it is perhaps not a surprise that Italy be more sensitive to fiscal sustainability issues.[4]



E. Application of the Model to Countries

24. **In general, the predicted consolidation path includes some front-loading of adjustment, but also envisages that full elimination of the sustainability gap takes place over a long horizon**. Quadratic preferences mean that the pressure to act to reduce any of the two gaps under consideration increases in nonlinear fashion with the size of that gap. Thus, if the sustainability gap is large enough relative to the output gap, the appropriate immediate fiscal tightening would be one that trades a substantial reduction in the sustainability gap for some increase in the output gap. Therefore (subject to the weights in the authorities' preferences) the larger the sustainability gap, the more the front-loading of adjustment. Also, country authorities have a very long horizon over which to consider and implement adjustment, and under quadratic preferences they would tend to select a path in which both the output and sustainability gaps trend toward zero, taking proper advantage of the non-fiscal factors that help close the output gap over time. This then pushes back the timing for full sustainability to be achieved.

25. **Figure 8-2 presents announced and predicted fiscal adjustment paths for each country**. In each year the announced tightening is calculated as the change to the structural

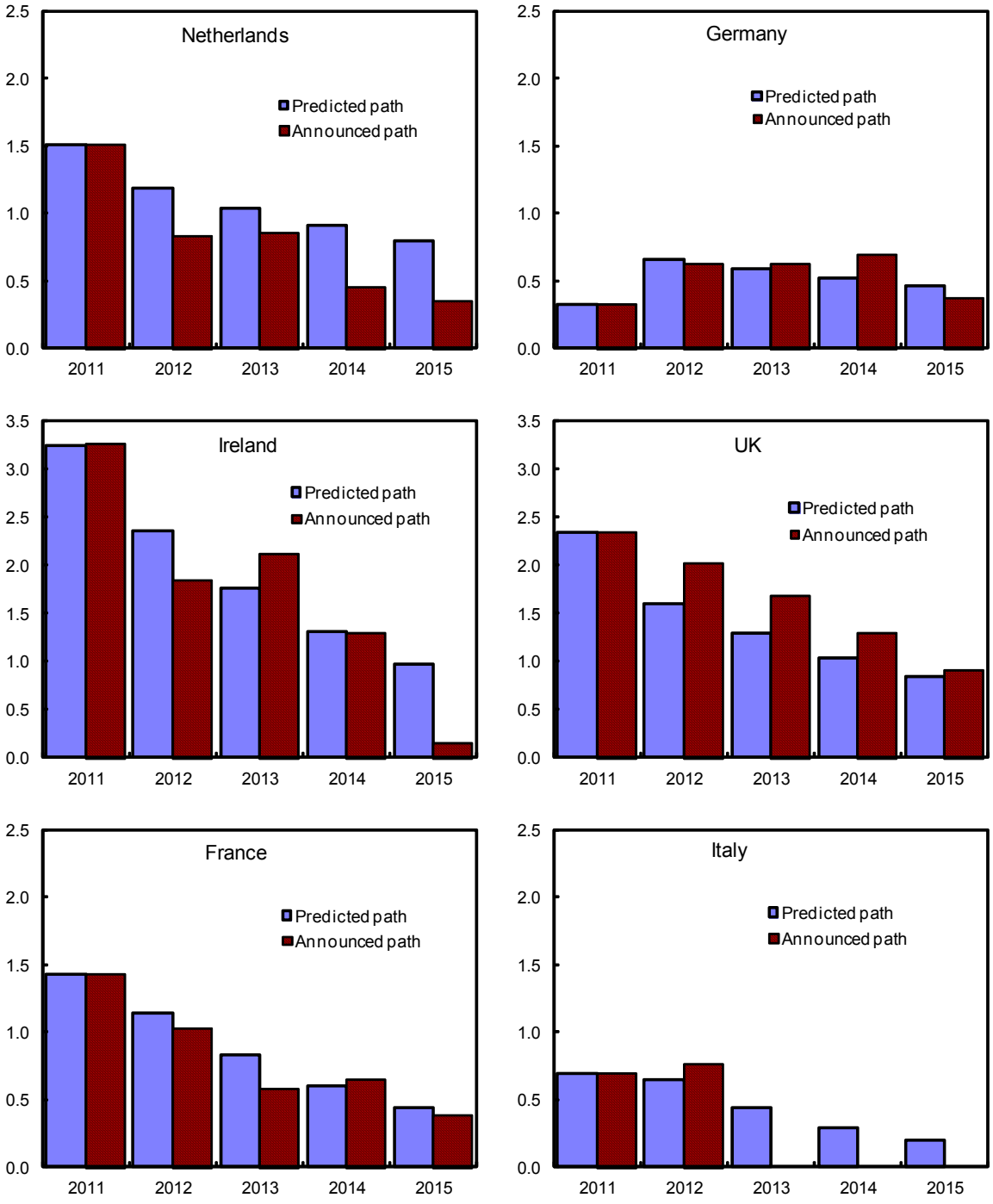
[4]In the case of Germany, another issue that arises is that estimating the structural primary balance using the output gap (as in equation (6)) may have biased downward our estimates of the annual structural fiscal adjustment, because labor market indicators showed significantly smaller economic slack than indicated by the size of the output gap. In that case, the value of alpha for Germany could be significantly smaller than estimated here.

primary balance in IMF staff projections as of March 2011, obtained by translating the authorities' announced measures into IMF staff projections of the medium term macro outlook. One caveat is that for Italy measures have been announced for only 2011–12, with the structural primary balance remaining flat thereafter in the projection, so the comparison of optimal and announced paths is only valid for those two years. Similarly, for Ireland measures have not been fleshed out for 2015.

26. **In general, the predicted and announced paths are broadly consistent, which offers a degree of comfort that the model and calibrated parameters give a reasonable approximation of the real world**. Deviations are modest, though for Netherlands there is a tendency for the announced consolidation to decline a bit faster than would be envisaged under the predicted path, while, on the other hand, for the U.K. there is a tendency for the announced consolidation path to be a bit more ambitious than would be envisaged under the predicted path. These deviations could reflect variations in the values of λ and the fiscal multiplier underpinning the decisions of different country authorities. For the Netherlands, the differences between predicted and announced path could reflect either a higher value of λ than the 0.5 used in our exercise—indicating a view that output gaps tend to be somewhat more persistent than our calibration suggests—or a concern that the fiscal multiplier may be larger than our calibrated value of 0.5. The opposite effect is observed for the U.K., and could indicate a view that the persistence of output gaps is somewhat less than what we have calibrated, or that the fiscal multiplier is thought to be lower than 0.5. For the other countries there does not appear to be any systematic deviation between the predicted and announced paths, albeit that we only have two observations to compare for Italy.

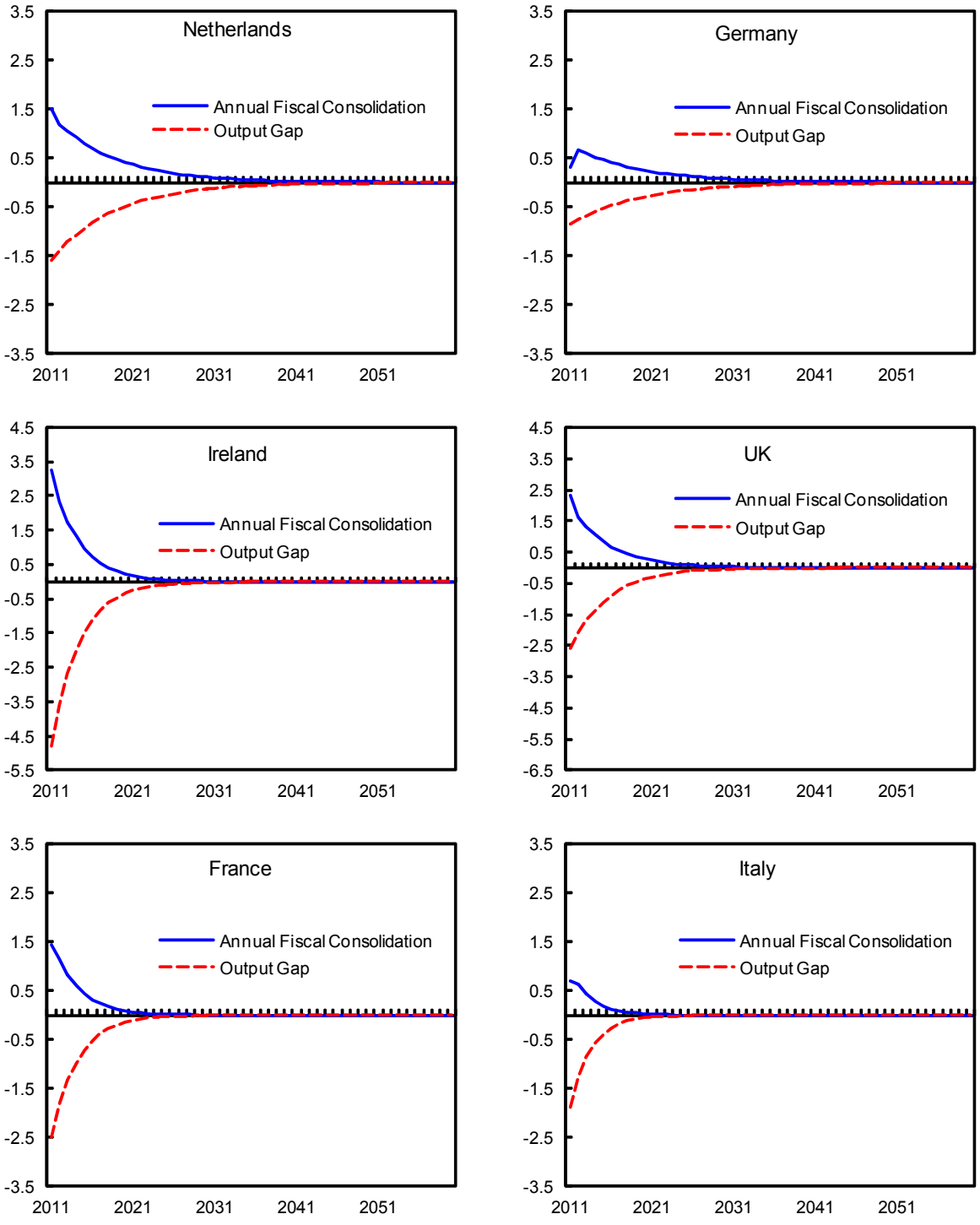
27. **Figure 8-3 presents the evolution of fiscal consolidation paths and the associated output gaps over 2011–60**. As indicated above, in all cases there is front loading of adjustment, and also output gaps close smoothly over time, regardless of the starting point, which is to be expected given the authorities' preferences that are heavily weighted towards closing output rather than sustainability gaps.

Figure 8-2. Comparison of Predicted and Announced Fiscal Consolidation, 2011-15
(in percent of GDP)



Source: WEO database, and author calculations.

Figure 8-3. Predicted Fiscal Adjustment Paths and Associated Output Gaps, 2011-60
(in percent of GDP)



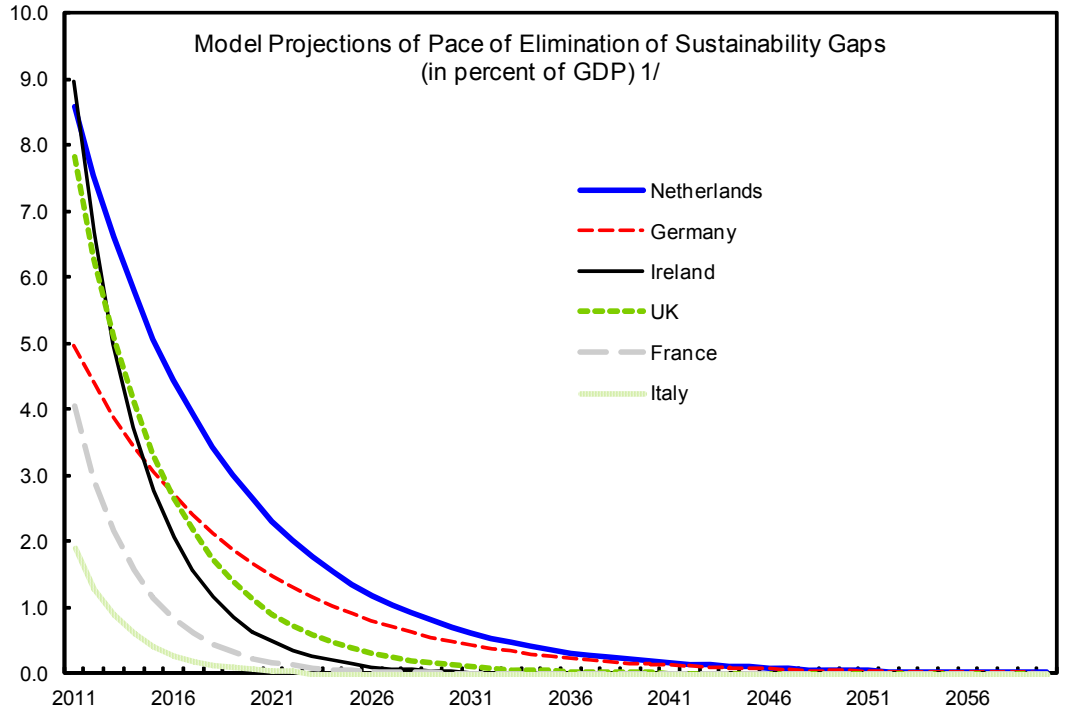
Source: Author's calculations.

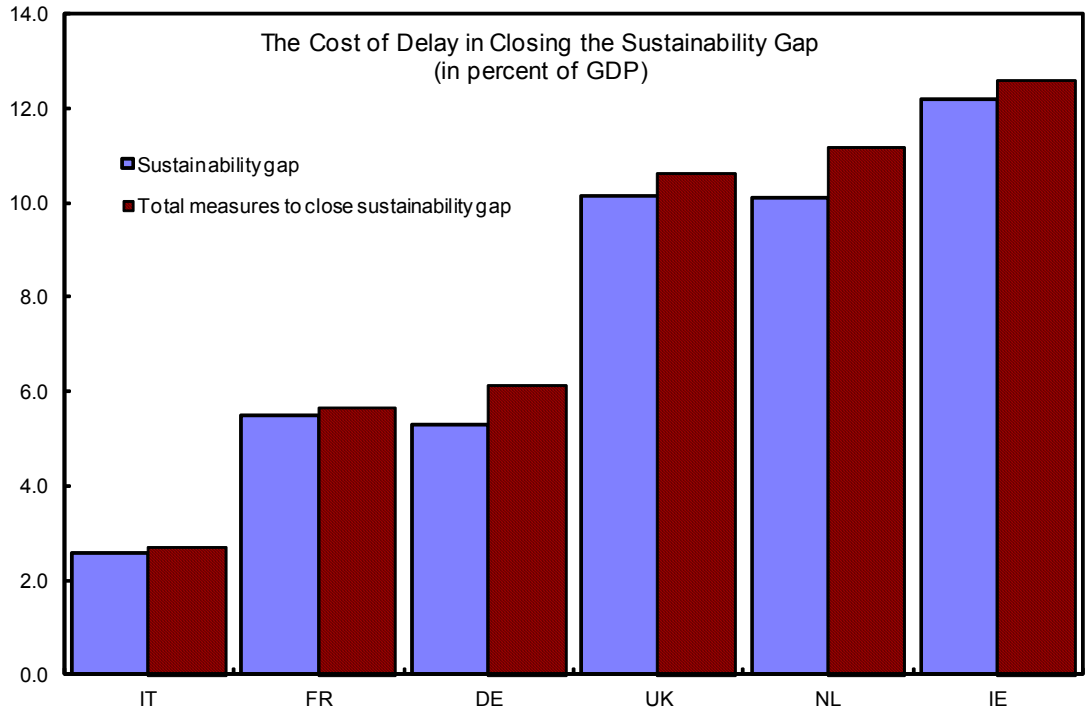
28. **Our model allows us to project how long it will take for the different countries to achieve fiscal sustainability, given the initial values for output and sustainability gaps, authorities' preferences, and the calibrated values of the other parameters of the model**. Figure 8-4 presents those results, as well as the additional effort (above that indicated by the sustainability gap) required to achieve sustainability because of the delay in closing the sustainability gap. In general, as one would expect, the time period to eliminate the sustainability gap depends positively on the size of the sustainability gap, and negatively on the authorities' fiscal hawkishness. Thus, while Ireland has the highest sustainability gap it is projected to achieve sustainability after about 20 years, well ahead of Netherlands which comes to this point more than a decade later. The U.K. achieves sustainability slightly later than Ireland. And while Germany has a relatively modest sustainability gap, as a result of its preferences it achieves sustainability after a prolonged period—at about the same time as Netherlands. Italy and France are projected to have the shortest periods to achieve sustainability.

29. **In general, Figure 8-4 indicates that the additional fiscal effort required due to the delay in achieving sustainability is quite moderate, particularly for the more hawkish countries, ranging from 0.1 percent of GDP for Italy to one percent of GDP for Netherlands**. It is less than ½ percent of GDP for all countries but Germany (¾ percent of GDP) and Netherlands. These relatively modest costs of delay however also reflect the fact that the pace of consolidation is sufficiently aggressive to keep the sustainability gap on a strong declining path throughout. The cost of delay would be substantially higher if the delay were one where there is no adjustment effort at all for a number of years, followed by an attempt to catch up.

30. **Figure 8-5 presents the associated primary and overall fiscal balances and public debt path given the consolidation paths in Figure 8-4**. For all countries, there is strong initial improvement in the primary balance, which however is later partially offset as aging pressures kick in, leading to a gradual but sustained reduction in the primary balance. Interestingly, for Italy the primary balance starts to improve again after 2040 as the impact of pension reforms begins to bite strongly with the passing away of pensioners whose benefits were grandfathered during the reforms. This path, however, with the impact of pension reform back-loaded, has the consequence that Italian public debt does not decline much over 2011–60. Indeed as of 2060 Italian public debt is projected to be still well above 100 percent of GDP (but beyond that time horizon debt goes on a sustained declining trend as the benefits of the pension reform kick in). For other countries a sustained fall in public debt is projected over 2011–60, and in the case of Ireland debt even turns significantly negative, allowing for even a small primary deficit by 2060. For Ireland, however, given well known concerns with rising government bond yields, perhaps the ambitious path chosen also reflects a concern that the discount rate may prove higher than the 5 percent used in our calibration, and debt in that case would not decline as far as we have projected.

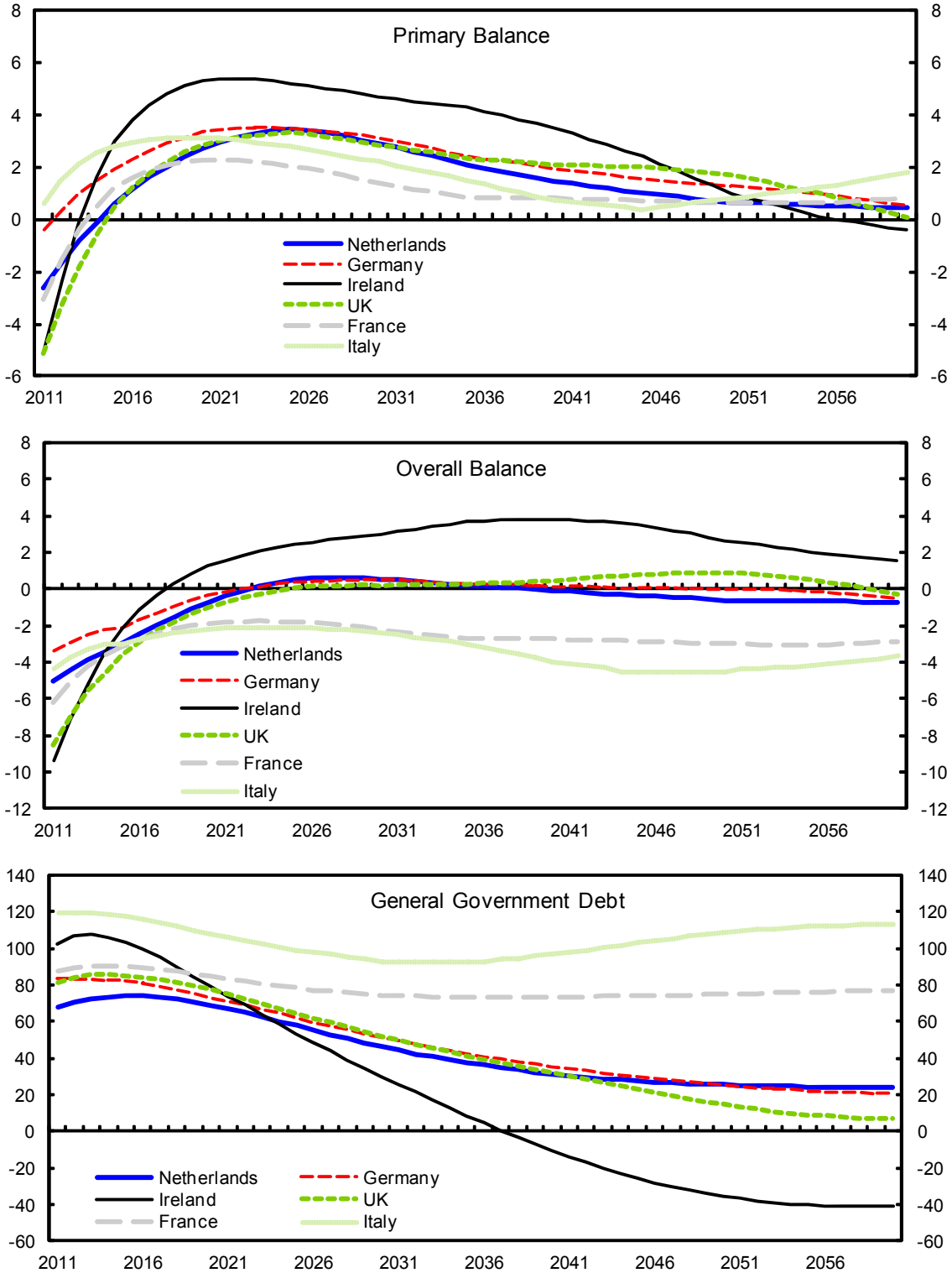
Figure 8-4. Projected Paths for Closing Sustainability Gaps, and Costs of Delay





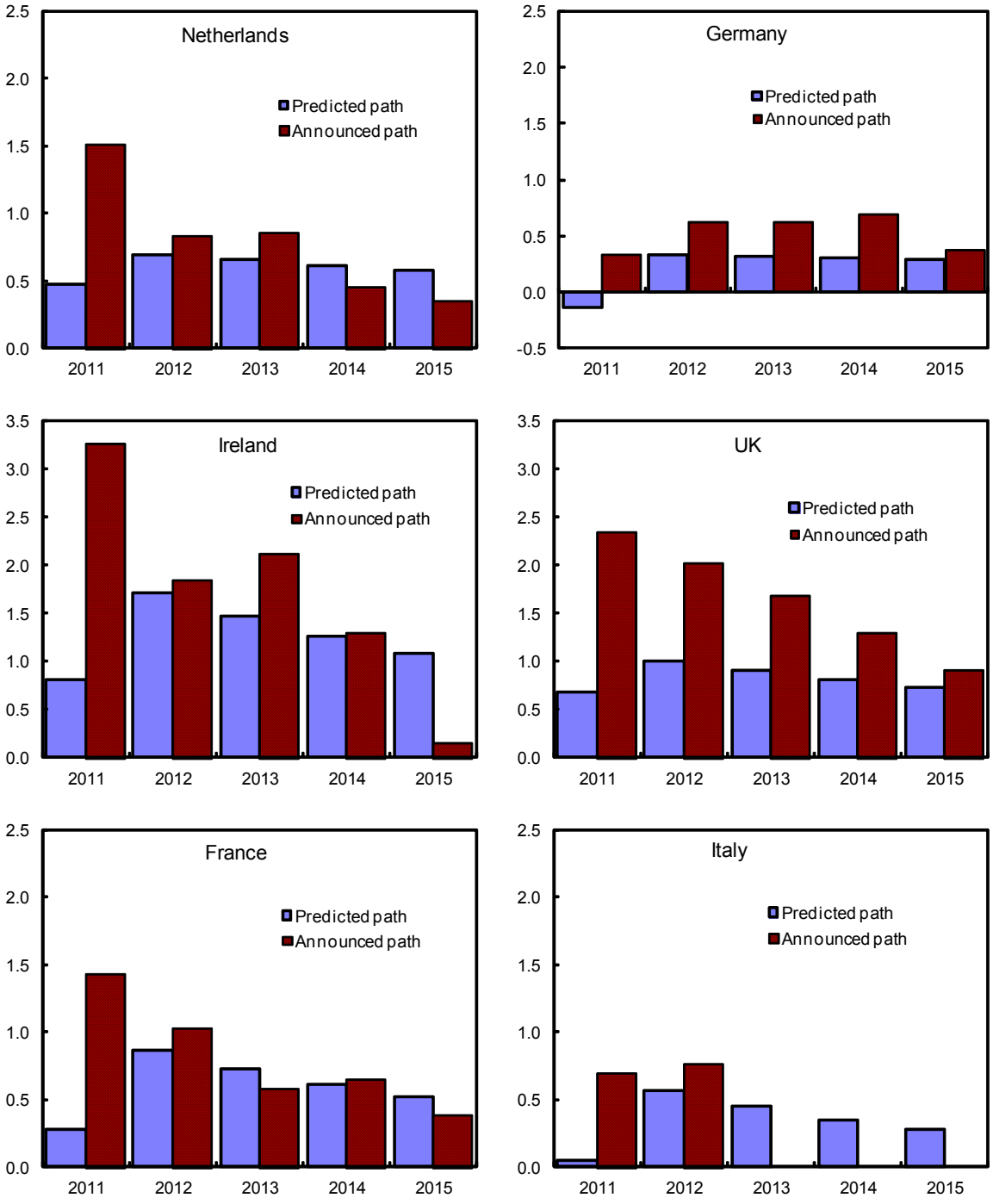
Source: Author's calculations.
1/ Projected path for the sustainability gap assuming the optimal fiscal adjustment is implemented in each year. The value of the sustainability gap for each year takes into account the measures taken in that year.

Figure 8-5. Projected Evolution of Fiscal Balances and Debt, 2011-60
(in percent of GDP)



Sources: WEO database, author's calculations.

Figure 8-6. Comparison of Predicted and Announced Fiscal Consolidation Assuming Fiscal Multiplier is 0.75, 2011-15, (in percent of GDP)



Source: WEO database, and author calculations.

31. **Finally, we do a sensitivity test to see how the predicted path might change if the fiscal multiplier turned out to be significantly larger than currently estimated**. This is of significant interest, in view of ongoing discussions regarding the concern that the size of fiscal adjustment currently envisaged by some European authorities may be too large and could potentially undermine economic recovery. Indeed, the October 2010 WEO alludes to this by warning that with several European countries tightening fiscal policy simultaneously, spillover effects might significantly increase the size of the fiscal multiplier, increasing the negative impact on growth.

32. **Figure 8-6 presents a comparison of announced fiscal consolidation with what the predicted path would be if the fiscal multiplier were increased from 0.5 to 0.75, all other things equal**. The contrast between predicted and announced policy is stark in this case, particularly bearing in mind that when the fiscal multiplier in 0.5 the predicted and announced consolidation for 2011 are the same for each country. In all countries, the predicted adjustment for 2011 in particular is much smaller than currently envisaged, and for Germany a further fiscal loosening is actually indicated as the predicted policy.

33. **This reflects the authorities' aversion to large output gaps, as evidenced by their preferences, as well as the fact that the larger fiscal multiplier affects the entire path of the output gap, with the size of this effect on the output gap largely determined by the size of the sustainability gap (which determines the scale of fiscal consolidation measures to be taken over time)**. Differentiating equations (18)-(20) with respect to the fiscal multiplier confirms that for the values of α observed in our country examples, raising the fiscal multiplier does indeed reduce the predicted amount of fiscal tightening in any given year. And the magnitude of this negative "semi-elasticity" depends heavily on the relative size of the initial sustainability gap in comparison with the initial output gap. Given the substantial response to the relatively modest increase in the fiscal multiplier used in this sensitivity exercise, it would appear that the concern about the size of adjustment in 2011 is warranted.

F. Concluding Remarks

34. **This paper presents a tractable inter-temporal model that helps us examine in detail issues related to country preferences and the pace of fiscal consolidation**. The calibrated model is shown to give a reasonable approximation to announced fiscal tightening plans in a number of European countries, and the model provides useful insights into some of the key questions on the minds of policy makers as fiscal consolidation begins in earnest in many advanced countries.

35. **In general, front-loading of adjustment is predicted by the model, but it is also the case that fully closing the sustainability gap takes place over a long horizon, with the focus appearing to be on making continuous progress in reducing the sustainability gap rather than on closing it in a limited time period**. In all cases, authorities' preferences are heavily tilted in favor of closing output gaps rather than closing sustainability gaps,

which also helps prolong the timing for elimination of sustainability gaps. The model also predicts that under current preferences, even modest increases in the fiscal multiplier would render current plans much too ambitious for the tastes of country authorities, and hence suggests that some reservations about the ambitious consolidation plans announced in a number of countries, particularly for 2011, may be warranted.

36. **Of course, as with any long run projections, caveats apply**. This is particularly with regard to the estimates of the sustainability gaps, which have wide error margins—and ironically this also argues for an approach based on a sustained credible reduction of the sustainability gap over a relatively long horizon, which allows for more clarity on the actual evolution of aging pressures etc over time.

Reference

Alesina, A., R. Perotti, J. Tavares, M. Obstfeld, and B. Eichengreen, 1998, "The Political Economy of Fiscal Adjustments," Brookings Papers on Economic Activity, Vol 1998, No 1 (1998), pp.197-266.

Chalk, N.A., 2002, "Structural Balances and All That: Which Indicators to Use in Assessing Fiscal Policy," International Monetary Fund, Working Paper No. WP/02/101.

Christiano, L., M. Eichenbaum, and S. Rebelo, 2010, "When is the Government Spending Multiplier Large?" unpublished paper, Northwestern University.

Coenen, C., M. Mohr, and R. Straub, 2008, "Fiscal Consolidation in the Euro Area: Long-Run Benefits and Short-Run Costs," European Central Bank, Working Paper Series, No 902, May 2008.

Cournede, B., 2007, "The Political Economy of Delaying Fiscal Consolidation," OECD Economics Department Working Papers, No 548, OECD Publishing.

van Ewjik, C., N. Draper, H. ter Rele, and E. Westerhout, 2006, "Ageing and the Sustainability of Dutch Public Finances," CPB Netherlands Bureau for Economic Analysis, The Hague.

European Commission, 2009, "The 2009 Ageing Report: Economic and Budgetary Projections for the EU-27 member States (2008-2060)," European Commission, Directorate General for Economic and Financial Affairs, European Economy No. 2/2009.

European Commission, 2009, "Sustainability Report 2009," European Commission, Directorate General for Economic and Financial Affairs, European Economy No 9/2009.

International Monetary Fund, 2010, "Will it Hurt? The Macroeconomic Effects of Fiscal Consolidation," Chapter 3 of World Economic Outlook: Recovery, Risk, and Rebalancing, October 2010 (Washington: International Monetary Fund).

Guichard, S., M. Kennedy, E. Wurzel, and C. Andre, 2007, "What Promotes Fiscal Consolidation: OECD Country Experiences," OECD Economics Department Working Papers, No 533, OECD Publishing.

ANALYTICAL NOTE 9: COSTS AND BENEFITS OF ELIMINATING MORTGAGE INTEREST DEDUCTIBILITY[1]

A. Introduction

1. **Mortgage interest deductibility represents a substantial subsidy to home owners in the Netherlands.** Owner-occupiers can deduct all interest payments on mortgages from taxable income.[2] The cost of servicing mortgages is deductible from taxable income, creating a budgetary cost of around 11 billion euro, or about 2.2 percent of GDP. The subsidy has been estimated to worth about 20 (van Ewijk et al. 2010) to 25 (Ter Rele and van Steen, 2001) percent of the implicit price of owner occupied housing.

2. **Evidence for the Netherlands and other economies suggests that mortgage interest deductibility is inefficient with respect to social goals and very regressive.** Mortgage interest deductions were originally promoted on the grounds that increased home ownership would generate wider benefits, such as an increased sense of community and a more stable a secure environment in which to raise children. However, there is little evidence that mortgage interest deductibility is effective at the margin of enabling greater home ownership. Instead, it encourages those who can already have access to housing finance to consume more housing services than they otherwise would. Hence, it is a quite regressive subsidy, benefiting mainly those on higher incomes.[3] More generally, because the subsidies are tied to the consumption of housing, they distort the allocation of resources, creating a welfare loss.

3. **The mortgage interest deductibility creates a clear incentive for households and financial intermediaries to expand balance sheets.** To maximize the benefits of the deductibility, households have a clear incentive to maximize loans relative to the value of the house, and to not pay down the principle. Indeed, LTVs on new mortgages are now as high as 110-120 percent (depending on measurement and data sources), and many loans are zero amortization products. Financial intermediaries have a clear incentive to expand loan books and provide products that maximize benefits to households.

4. **The pressures on fiscal balances as a result of the crisis raise the question as to whether the implicit subsidy could be better directed**. Although most households can

---

[1] Prepared by Alasdair Scott.

[2] Some imputed rent is added to taxable income, which reduces the implicit subsidy, but the current levels of imputed rent are generally considered to be far below the values that would be required to make the interest deductibility neutral from a consumption choice perspective. Other policies affecting household decisions about housing include (i) a 6 percent transactions tax, (ii) exemptions of net home equity (the value of a house less the value of the mortgage) from wealth tax, (iii) rental subsidies, and (iv) zoning regulations on land available for housing construction.

[3] See, inter alia, Glaeser and Shapiro (2002) and Rouwendal (2007).

benefit from housing subsidies, they (or future generations) pay for it through taxes. The implicit subsidy from mortgage interest deductibility has been rising in real terms and now represents about 7 percent of total public revenues. The total cost of the tax treatment of housing is estimated to be in the region of 17 billion euro,[4] which is more than the fall in revenues experienced as a result of the downturn from 2008 to 2009. The subsidy could be used instead to increase provision of government services or reduce taxes (both of which could be directed more progressively than the mortgage interest deduction if so wished) or reduced public debt.

5. **However, eliminating mortgage interest deductibility could also risk depressing private demand and damaging the banking sector in the short run**. A sudden elimination of mortgage interest deductibility could cause a severe house price downturn. Falling asset values could depress private demand at a time when growth is fragile and the economy is only just showing signs of recovery. Moreover, as discussed in the FSAP, financial institutions in the Netherlands are unusually exposed to the Dutch mortgage market. A fall in house prices, if large enough, could put balance sheets under stress and cause banks to tighten lending conditions, to the detriment of activity in the rest of the economy.

6. **This note compares the potential long-run benefits of removing mortgage interest deductibility with potential short-run costs for private demand**. Most papers on the mortgage interest deductibility in the Netherlands have focused on the welfare and distributional costs of the subsidy.[5] By contrast, this note is in the spirit of Mankiw and Weinzierl (2005) in attempting to illustrate the *macroeconomic* dimensions of eliminating the deductibility. It is a complement to more detailed but partial equilibrium assessments of eliminating housing subsidies such as CPB (2010).

7. **The optimal elimination of mortgage interest deductibility will balance the short-run costs with long-run benefits**. Depending on the way by which the mortgage interest subsidy is recycled, potential supply side benefits could arise from increased labor participation and/or greater capital accumulation. However, house prices would likely fall with the elimination of the deductibility. In the short run, this could have a negative effect on private demand. Although the model used here is too crude to provide precise estimates of an optimal path for the elimination of mortgage interest deductibility, several plausible factors suggest that its elimination should be gradual.

8. **The main factors affecting short-run costs include negative spillovers from house price falls on aggregate demand and rigidities in housing supply**. Short-run costs will be greater to the extent that:

---

[4] Van Ewijk et al. (2010).

[5] See, inter alia, OECD (2004), IMF (2006), and van Ewijk et al. (2006).

- Falling house price falls produce spillover effects on current consumption; and

- Housing supply is inelastic.

9. **Long-run benefits will be greater to the extent that the way the revenue is recycled generates increased supply**. In the model used here, the most efficient policy is to reduce capital taxation.

B. Key Features of the Model

10. **The analysis uses a small dynamic general equilibrium model calibrated to the Dutch economy**.[6] For clarity and simplicity, a number of simplifying assumptions are made. First, the economy is assumed to be closed; there is no trade.[7] Second, there is no nominal side; we abstract from nominal rigidities and monetary policy. Third, there are no real rigidities, such as from habits and investment adjustment costs. [8]

11. **The economy contains households, a production sector, and a government**.

- On the demand side, households in a closed economy invest (building up capital for use in production), consume non-durable goods, and enjoy the services from owning a durable good (housing). More specifically, all households have identical preferences for a CES basket of nondurable consumption goods, *C*, and housing stock, *D* (for "durables" or "dwellings"). They are assumed to be infinitely lived and forward looking.[9] Hence, consumption decisions follow conventional forward-looking Euler equations, given budget constraints. Expectations are a crucial element in the determination of the responses to the elimination of the deductibility, as households assess the potential benefits of the policy shock against the immediate effects.

- On the supply side, capital and labor are combined in a Cobb-Douglas production function to generate output, with income returned to households in the form of rents paid on these factors. Rather than explicitly model production of houses in a second sector, a reduced-form house price equation is used that embeds the assumption that

[6] More details are provided in a companion technical paper. Simulation code in the Troll programming language is available on request.

[7] This reflects an assumption that the openness of the economy does not substantially affect the results below: housing is a nontradeable good. Changes in the real exchange rate would affect the relative price of nondurable goods, to the extent that some nondurables are imported, but the assumption is that this is of second order importance. Some of the benefits of reduced taxes or higher public spending might leak out in an open economy setting.

[8] This is mainly a modeling choice to preserve simplicity and transparency—consumption habits and investment adjustment costs could be added easily.

[9] This has the implication that public debt is not net wealth. Hence, changes in debt will have no effect on the economy, so debt reduction scenarios are not considered in this paper.

factor productivity for the production of houses is less than for the production of other goods (that is, given a demand shock, house prices change more than other prices, so the *relative* price of houses changes).[10]

- A government taxes consumption, wage and capital income, while redistributing these revenues as transfers and making its own expenditures. In particular, the government subsidizes interest payments on housing, thereby affecting the user cost of housing, which households take into account when deciding how much to spend on nondurables and housing services.

12. **The mortgage rate deductibility is modeled as a subsidy on mortgage interest rates and directly affects the user cost of housing**. In essence, mortgage interest deductibility reduces the amount of labor income that is taxable. However, the deductibility is not quite that simple in the case of the Dutch economy.[11] Rather than attempting to explicitly model all the tax distortions affecting housing decisions, one convenient way of modeling the deductibility is in the form of a subsidy on mortgage interest rates, τ^{rd}. In the model, mortgages carry the interest cost rd, which contains a risk premium over the riskless $\left(1-\tau^{rd}\right)r^{d}\right)$. Lowering τ^{rd} therefore increases the effective mortgage rate closer to the market rate.

13. **The direct effect of eliminating the mortgage interest deduction will be to reduce income available to households for other expenditures**. The size of the effect depends on the size of the subsidy, the mortgage rate, and the size of the mortgage stock, which in turn depends on the proportion of households holding mortgages and the average loan-to-value ratio.

14. **A second effect of eliminating the mortgage interest deduction will be to cause households to substitute away from houses toward other consumption**. The user cost of housing factors in depreciation, expected capital gains, the net mortgage interest rate, and the subsidy itself:

$$user\ cost\ of\ housing = \underset{+}{f}\left(\underset{+}{\delta^{d}}, \underset{-}{E\left[\frac{p_{t+1}^{d}}{p_{t}^{d}}\right]}, \underset{+}{r_{t}^{d}}, \underset{-}{\tau_{t}^{rd}}\right),$$

[10] This short-cut implicitly assumes that the shock will not have a material impact on the relative prices of factor inputs across production sectors.

[11] For example, there are limitations to the mortgage rate interest deductibility (deductibility lowered for capital gains made on the previously-owned house, no interest deductibility for part of the mortgage related to consumption spending). Also, in conjunction with the interest rate deductibility, houses themselves are taxed.

where δ^d denotes the depreciation rate on dwellings and p^d the relative price of dwellings. The decision about desired housing stock in any given period can be then related to current consumption by taking into account the user cost and preference parameters such as the elasticity of substitution. Although housing demand can be written in terms of a forward-looking Euler condition, it can be summarized neatly in terms of a simple intratemporal decision rule that describes how consumers allocate spending between (nondurable) consumption *flow*, *C*, and (durable) housing *stock*, *D*, given their choice about overall expenditures in any period:

$$\underset{+}{D} = \underset{+\ \ -}{f(C, ucd)},$$

where ucd denotes the user cost of housing. The direct effect of a reduction in the mortgage interest rate subsidy will therefore be to shift expenditures toward nondurable consumption. The *net* effect on aggregate demand will depend on the responses of desired capital investment, government consumption, and the extent to which nondurable consumption is reduced or raised.

15. **Changes in the mortgage interest subsidy have effects via the government budget constraint**. For the government, the subsidy is worth $T^{rd} = \tau^{rd}.r^d.M$ in foregone revenues, where *M* is the size of the mortgage stock. The flow government budget constraint in the model requires that tax revenues and changes in public debt have to balance debt servicing and government expenditures, net of the mortgage deductions. Consequently, any reduction in deductibility will afford a reduction in taxes or debt or an increase in expenditures.

C. Parameterizing the Model

16. **The model is calibrated to match broadly the recent behavior of the Dutch economy**. Table 9-1 lists parameter values. Table 9-2 lists steady-state expenditure shares of (domestic) demand; income shares; tax revenues, debt, and spending (all as ratios to domestic demand) and associated implied average tax rates. The household discount rate is assumed to be 0.99, as standard, producing a riskless interest rate of 4 percent per annum. The share of national income returning to capital is 0.4, which is higher than in many other economies, and will make responses to changes in capital accumulation larger (such as in the case of a reduction in capital taxation, as below). Fixed capital is assumed to depreciate at a rate of 6 percent each year, while the housing stock depreciates at nearly 1.3 percent (this value approximates maintenance, insurance, and transactions costs; see van Ewijk et al. 2010).

17. **The effective interest rate that homeowners pay on mortgages reflects the implicit subsidy**. This parameter is calibrated so that the foregone tax revenue matches the estimate of 2.2 percent of GDP. The average loan-to-value ratio is imposed at the current

value for the Netherlands at 50 percent of GDP.[12] Given the assumptions about parameters that affect the mortgage interest rate, the required value is 0.7.[13]

18. **Effective tax rates are calculated to match fiscal revenues and expenditures**. Total tax revenues are allocated to four tax types: labor income taxes, capital income taxes, consumption taxes, and lump-sum (non-distortionary) taxes. Lump sum taxes are treated as the residual after allocating to the first three to ensure total tax revenue is accounted for. Actual lump-sum taxes net out transfers (social security and benefits).

19. **Housing supply is assumed to be relatively inelastic**. Whereas estimates of housing supply estimates are as high as 4 in other advanced economies, estimates for the Netherlands are much lower, probably reflecting tight zoning regulation of the Dutch housing market.[14] The shares of capital and labor in housing production imply a relatively high importance of land as a fixed factor; these parameters are calibrated so that the elasticity housing supply is 0.65, the same as the long-run elasticity in CPB (2010).[15]

[12] The average is steadily rising, as the loan-to-value ratio of new mortgages is in the region of 110-120 percent of GDP (depending on measurement and sources).

[13] This looks like a very large value, but note that the model is quarterly. Hence, the equivalent mortgage interest subsidy rate at annual frequency to compare with those from other studies is 0.7/4 = 17.5 percent.

[14] See also OECD (2004).

[15] Vermeulen and Rouwendal (2007) find that residential investment is almost fully inelastic with respect to house prices in the short run. Hence, in CPB (2010), the short-run elasticity is zero. For simplicity, this model has no short-run rigidities; these could be added, but a view would need to be taken on all relevant short-run rigidities, not only those that applied to housing supply, which would increase the complexity of the model and reduce the transparency of the analysis.

Table 9-1. Parameter Values in the Model[16]

Description		VALUE
Discount rate		0.99
Share of income to capital		0.40
Share of capital in production of housing		0.20
Share of labor in production of housing		0.20
Share of land in production of housing	(implied)	0.60
Depreciation rate on capital		0.015
Depreciation rate on housing		0.003
Weight on housing in CES consumption bundle		0.10
Elasticity of substitution between consumption and housing		0.50
Loan-to-value ratio of total housing stock		0.50
Pre-subsidy premium in mortgage rates over riskless rate		0.007
Government expenditure target (share of GDP)		0.30
Government debt target (share of GDP)		0.45
Mortgage interest subsidy rate		0.
Effective average labor income tax rate		0.30
Effective capital income tax rate	(implied)	0.28

[16] NB: the model is calibrated for quarterly frequency.

Table 9-2. Steady-State Values of the Model

Description	Value
Nondurable consumption, share of output	0.47
Housing investment, share of output	0.16
Capital investment, share of output	0.10
Government expenditure, share of output	0.27
Public debt servicing, share of output	0.004
Tax revenue, share of output	0.291
Labor income tax revenue, share of output	0.180
Capital income tax revenue, share of output	0.111
Mortgage interest subsidy, share of output	0.022
Risk-free interest rate, percent (annualized)	4.0
Market mortgage rate, percent (annualized)	6.8
Rental rate of capital, percent (annualized)	13.9

20. **In the baseline specification, housing services and nondurable consumption are not highly substitutable**. The elasticity of substitution of housing services and nondurable goods has an important bearing on the impact of eliminating the MID: a low elasticity will generate larger spillovers onto nondurable consumption. Evidence from the U.S. suggests that housing services and nondurable goods are consumed virtually in fixed proportions and are not willingly substituted.[17] However, CPB (2010) uses a Cobb-Douglas specification. The assumption in this model is that the elasticity is 0.5.

D. Long-run Benefits from Eliminating MID

21. **The long-run benefits from removing mortgage interest deductibility depend on the efficiency with which the implied subsidy is redirected**. Table 9-3 shows, from left to right, the steady-state percentage changes in output, nondurable consumption, housing investment, and house prices in response to complete elimination of the deductions. In addition, the final column shows the percentage change in the consumption aggregator, which has no equivalent in the national accounts data, but is a measure of household utility. There are three variations, depending on how the subsidy is recycled: (i) increased government consumption; (ii) increased transfers; and (iii) reduced capital income taxes.

22. **In this model, and given the baseline calibration, the first-best policy is to recycle the mortgage interest subsidy back as lower capital taxes**. Lowering capital income taxes raises saving and capital investment, boosting output in the long run. The fiscal policy encourages a relative shift away from putting resources into housing capital to putting them into productive capital instead. With higher permanent income and the relative shift in capital allocation, nondurable consumption increases even more than output. In absolute terms, housing investment nonetheless also increases, given the scale of the increase in output. Concomitantly, house prices also rise. The results are sensitive to changes in parameter values, but nonetheless illustrate some implications that might not be clear from a partial equilibrium analysis.

[17] For example, Iacoviello (2004) estimates the elasticity of substitution to be as low as 0.1.

Table 9-3. Long-run Effects of Eliminating Mortgage Interest Deductibility
(Percentage deviation from starting values)

Policy instrument:	*Effect on:*			
	Output	Nondurable consumption	Housing investment	House prices
Government consumption	0.00	5.78	-4.30	-6.37
Lump-sum transfers	0.00	10.07	-2.10	-3.13
Capital income taxes	4.76	12.37	-0.61	-2.06

23. **Other policies do not boost welfare in the simulations by as much because they have no long-run effects on output**. The fiscal choices shown here are deliberately starkly different, and more for illustration rather than prescriptive purposes. Government expenditure is assumed to be entirely nonproductive (a proportion could be assumed to be invested in ways that are known to generate positive externalities, such as infrastructure and R&D), so this policy is not very efficient. Without any increase in permanent income, the result is substitution from housing investment to nondurable consumption. Returning the subsidy to households as a lump-sum transfer is better in welfare terms (on the assumption that government expenditures do not enter households' utility.)[18]

24. **Hence, based on the assumptions in the model, eliminating mortgage interest deductibility could raise productive potential by as much as 2½ percent**. The efficiency implications of redirecting the mortgage interest subsidy depend crucially on assumptions made about the type and amount of distortions from spending, transfers, and other taxes. Used completely inefficiently, long-run benefits would be zero.

E. Short-run Costs of Eliminating Mortgage Interest Deductibility

25. **The short-run costs on aggregate consumption from removing mortgage interest deductibility will depend crucially on how households react to falling house prices**. In the case of a fiscal strategy that raises long-run potential output, households will increase overall consumption due to the rise in permanent income.[19] But, in the short run, the direct

[18] In the current calibration, the elasticity of labor supply is zero, so that the effects of a decrease in labor income tax are the same as decreasing lump-sum taxes net of transfers.

[19] In what follows, the focus is on the responses of consumption. A practical reason is the model implies immediate increases in capital investment, which might be considered unrealistic. This is because supply is fixed for the first period—capital is predetermined and labor supply is inelastic. Production clearing implies that if consumption and residential investment fall, the extra output has to be accommodated by increased capital investment demand. Instead, we might expect that demand falls would lead to reduced output, with output

(continued…)

effect of the withdrawal of the subsidy is to reduce disposable income. Aside from that, there might be extra short-run negative "spillover" effects from reduced house prices on consumption. In this model, these effects are proxied by assumptions about the elasticity of substitution between housing services and nondurable consumption. If the elasticity is high, the spillover effects on nondurable consumption are small. If the expenditures are complements, as is the case in the calibration here, households sacrifice nondurable consumption so as to preserve housing utility.

26. **Short-run costs also depend on supply conditions**. The same factors that imply that house prices rise relatively quickly given increases in demand—land as a fixed factor, zoning restrictions, and other adjustment costs—also imply that house prices would fall relatively severely given an increase in the user cost of housing. In essence, the impact of the policy change would be less if the capital stored in the form of housing could be easily unbundled and converted into capital stock for production. On the assumption that such conversion costs are very large, the price fall will be greater. These rigidities are approximated by the low elasticity of housing supply.

27. **In the baseline calibration, a complete elimination of mortgage interest deductibility in one step results in a sharp decrease in the value of the housing stock**. Figures 9-1 to 9-4 show the results of a complete, unanticipated, immediate elimination of the deductibility, on the assumptions that the revenue is used to reduce capital income taxes.

- The direct effect of the elimination is to raise the user cost of housing. The expected depreciation of house prices adds to the effect of eliminating the subsidy. In addition, market real interest rates rise with the expectation of increased permanent income, although they will return to original levels eventually (Figure 9-1). House prices fall by nearly 15 percent on impact, but will eventually recover to the level shown in Table 7-3 (Figure 9-2). Similarly, residential investment and nondurable consumption are below the starting level over the short and medium run, before eventually recovering (Figure 9-3). Wealth is reallocated from housing stock to fixed capital (Figure 9-4).

- These results are merely suggestive, and depend critically on a number of parameters. A lower housing supply elasticity would result in a more severe fall in house prices. Smaller shares of housing in the consumption basket would reduce the spillovers onto nondurable consumption. A lower elasticity of substitution between nondurable consumption and housing would raise the spillovers. The long-run supply response of output would be smaller if capital's share of income were lower (in the case of the reduction of capital taxes).

---

accumulated as inventories and/or reduced capacity utilization resulting in a negative output gap, as currently exists.

- Further, the model does not include financial mechanisms that might amplify the effects of the shock. In Aoki et al. (2004) and Kannan et al. (2009), when house prices fall, "banks" face pressures on balance sheets and raise financing rates to protect against defaults. In such models, a shock that causes mortgage interest rate premia to rise will raise the user cost of housing, raising downward pressure on house prices further, and thereby "accelerating" the downturn in house prices. Here, spillovers are proxied by the substitution elasticity of demand, but a more detailed specification of credit mechanisms could illustrate other macroeconomic implications, such as stress on the banking system. [20]

28. **Long-run supply responses are similar to those in other studies on the potential effects of eliminating MID, but the effects on prices are somewhat less.**

- The long-run responses on supply are comparable to those in van Ewijk et al. (2010) for a labor supply shock.

- Estimates of the impact on house prices are generally somewhat more benign than other studies. Ter Rele and van Steen (2001) estimate that the effect of government subsidies is to raise house prices by as much as 25 percent for higher income cohorts. Mechanically, their estimates would imply a much larger fall in house prices were the subsidy to be eliminated. CPB (2010) estimates the initial impact to be in the order of -15 percent, troughing at -25 percent, and rising with time to -20 percent.

- It can be difficult to directly compare the results here with those in other studies. [21] Some of the differences are likely explained by different assumptions about elasticities. In particular, if the short-run elasticity of supply is close to zero, as argued in Vermeulen and Rouwendal (2007) and used in CPB (2010), then the price response could be much larger.

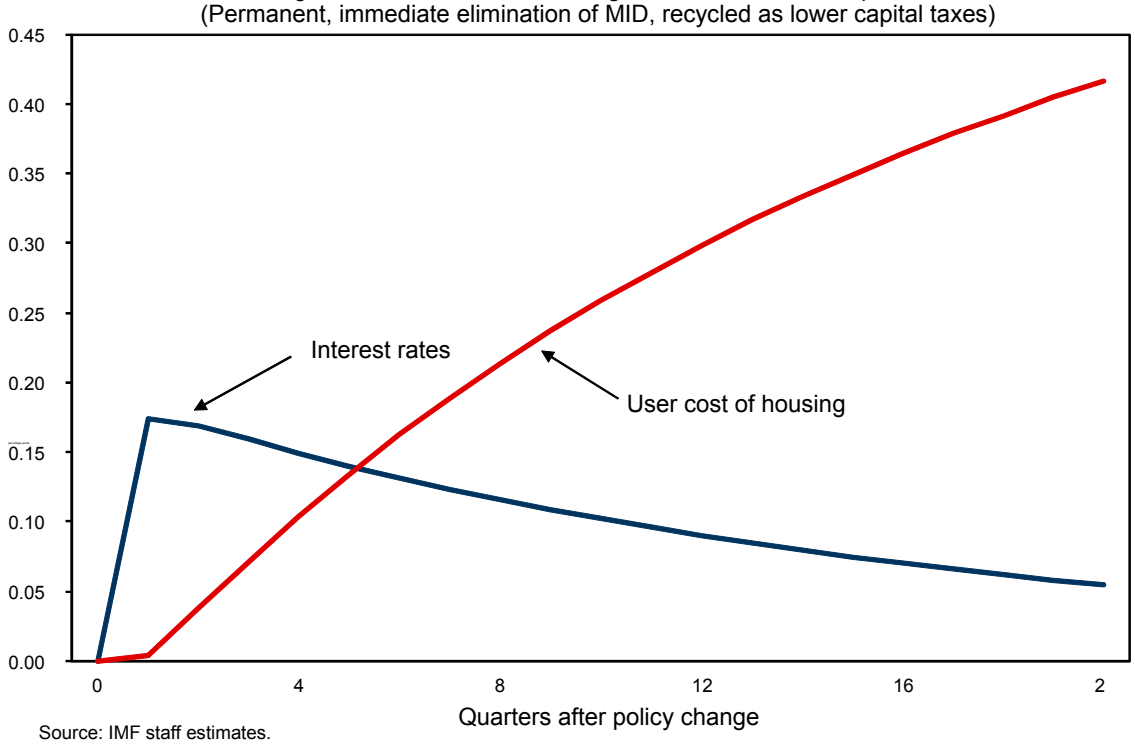
- More generally, different conclusions are unsurprising when comparing partial with general equilibrium analyses. Crucially, it is important to be clear how the subsidies are to be re-used—in the scenario used here, households benefit is not simply from lower taxes, but the higher incomes generated from lower taxes. As in Mankiw and Weinzierl (2005), this "second-round" effect is not small. What households lose from having subsidies taken away is at least made up for by higher permanent incomes—although not proven here, it seems plausible that this should play a role in supporting

[20] Empirical work with Dutch data (not reported) shows that nondurable consumption is strongly associated with house prices and real mortgage credit. Estimating reduced-form Euler equations implied by Iacoviello's (2004) model indicates that the data seem to be consistent with the existence of credit-constrained behavior in Dutch consumption choices.

[21] For example, the scenario in CPB (2010) is a combination of shocks, including deregulation of the rental market and abolition of the transactions tax, rather than only the elimination of the MID, as here.

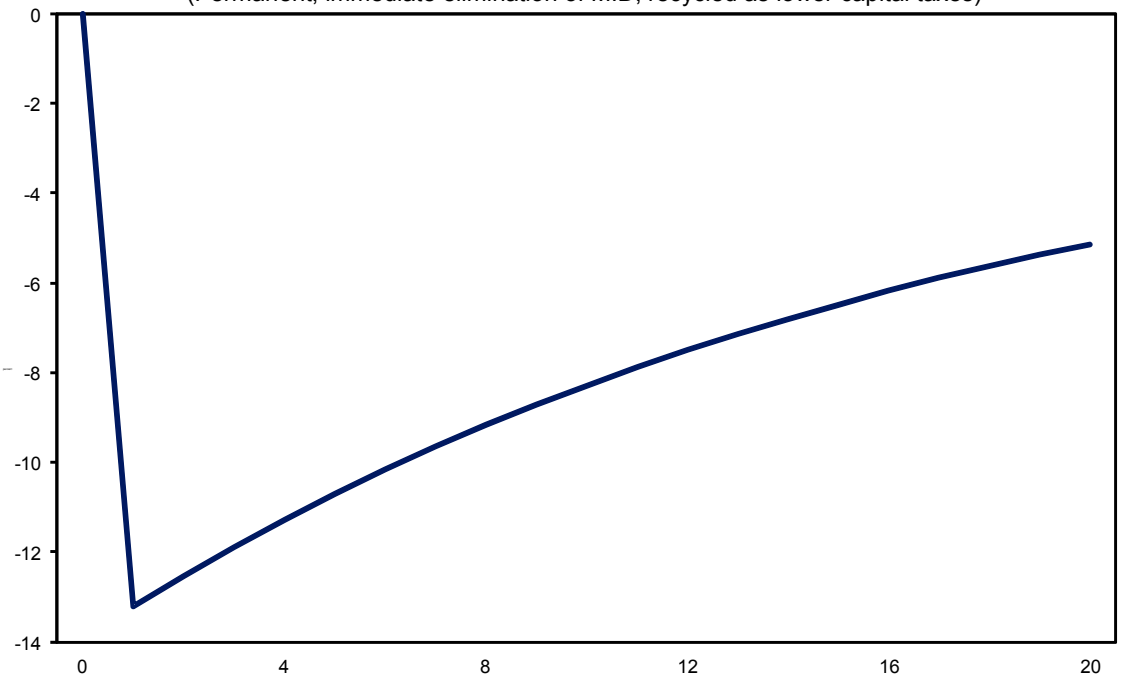
house prices, compared with the results from partial equilibrium analyses. Hence, simply looking at the size of the subsidy is a potentially misleading guide to the potential effects on the housing market of removing the deductibility.

Figure 9-1. User Cost of Housing and Interest Rate Responses
(Permanent, immediate elimination of MID, recycled as lower capital taxes)



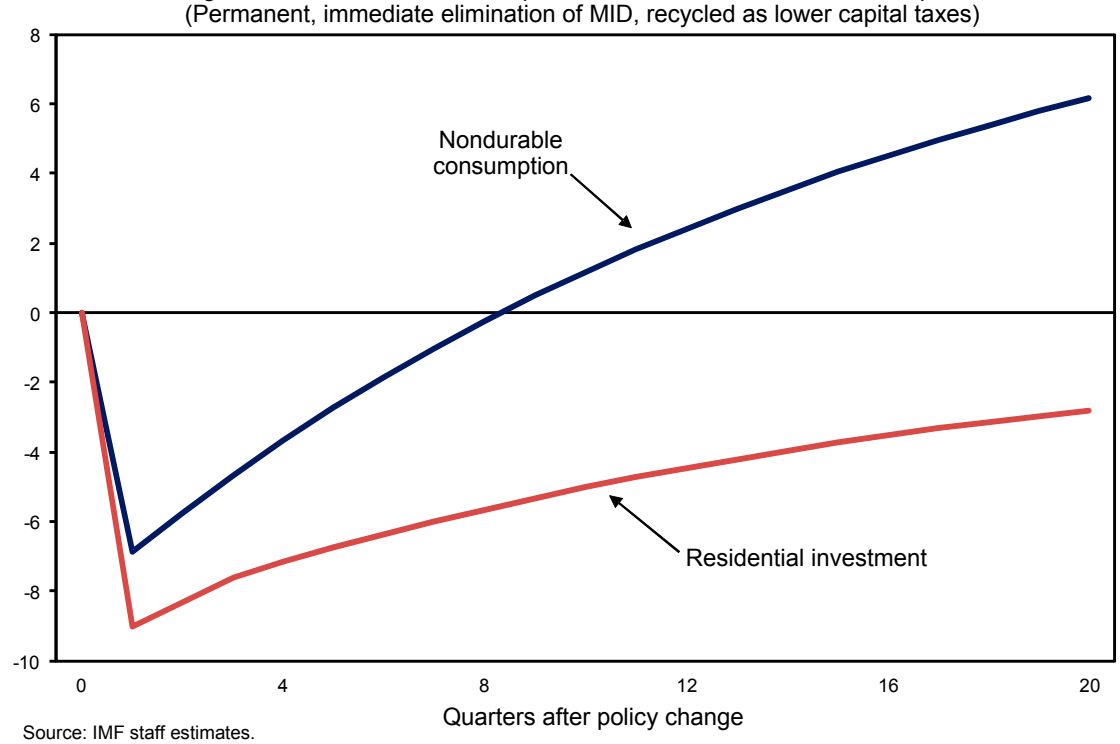
Source: IMF staff estimates.

Figure 9-2. House Price Responses
(Permanent, immediate elimination of MID, recycled as lower capital taxes)



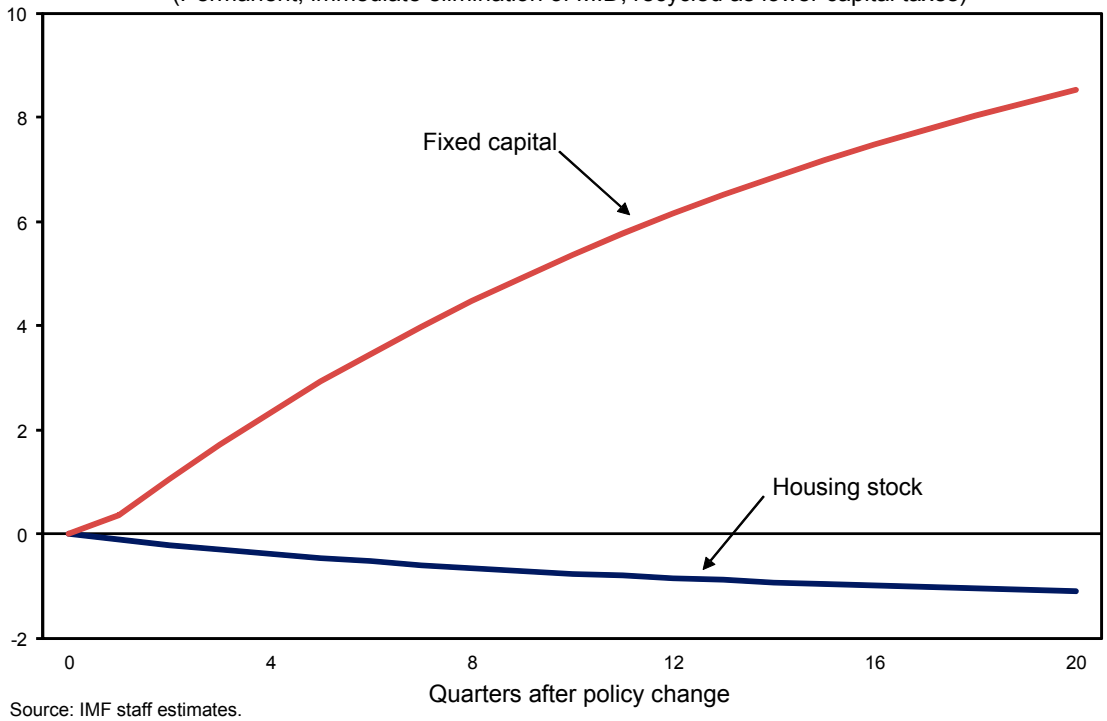
Source: IMF staff estimates.

Figure 9-3. Nondurable Consumption and Residential Investment Responses
(Permanent, immediate elimination of MID, recycled as lower capital taxes)



Source: IMF staff estimates.

Figure 9-4. Housing and Fixed Capital Responses
(Permanent, immediate elimination of MID, recycled as lower capital taxes)



Source: IMF staff estimates.

F. Timing the Elimination of Mortgage Interest Deductibility

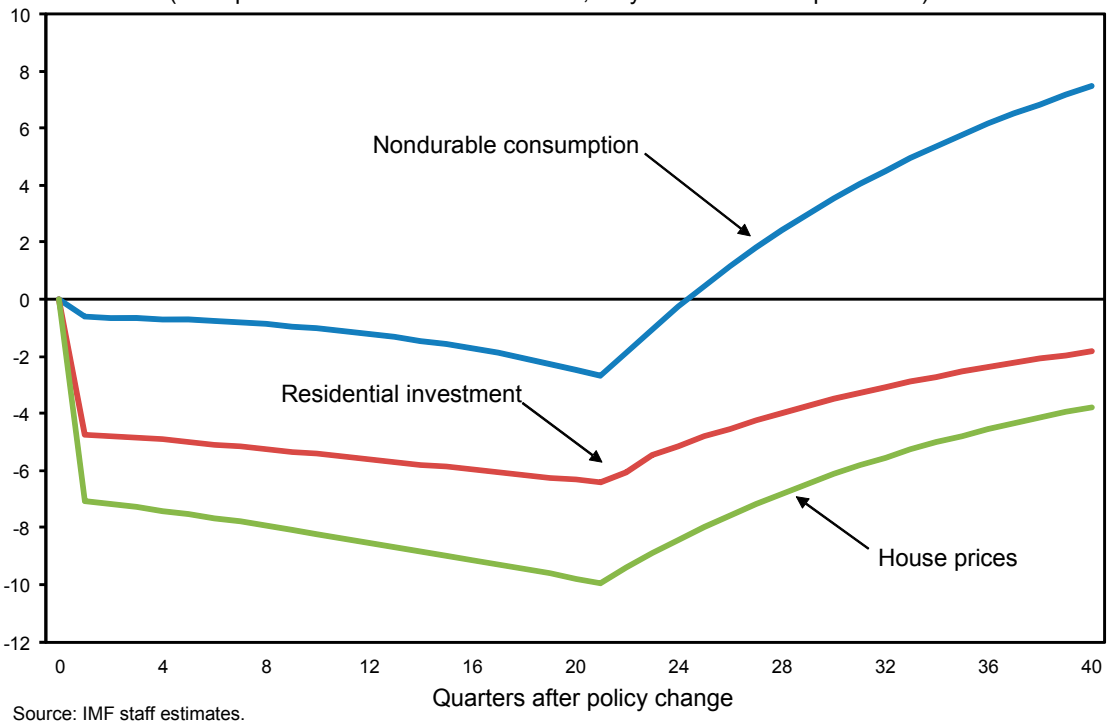
29. **A sharp reduction in house prices poses risks**. Although the elimination of mortgage interest deductibility could bring significant fiscal and supply benefits, a legitimate concern is that an immediate, unanticipated and complete elimination of the mortgage interest subsidy could have severe effects on house prices, housing wealth, and aggregate consumption. In particular, analysis of Dutch banks in the FSAP indicates that this could result in an increase in non-performing mortgages, which could damage the banking sector and further affect real activity. This suggests that the elimination of the mortgage deductibility should be gradual.

30. **"Grandfathering" the elimination is desirable**. A credible preannouncement of policy changes would help to avoid a sharp fall in housing values (and, in reality, reduce costs of adjustment, given nominal contracts). Figure 9-5 illustrates the case. Instead of an immediate and completely unanticipated change as presented previously, consider reactions when the change is announced to come into effect five years into the future. Even though credit-constrained agents are not themselves forward looking, their consumption falls by less, because the immediate fall in housing values is not as severe. Hence, aggregate consumption falls by less. The trade-off is that consumption does not rise as quickly. These results assume that the policy announcement is completely credible and understood, but nonetheless illustrate that preannouncement could have important short-run benefits.

31. **Gradual elimination would lower risks**. The model used here is too crude to be used to precisely calculate an optimal path for the elimination of the subsidy. Nonetheless, a simple exercise illustrates the trade-offs between eliminating the deduction swiftly and a more gradual reduction. Instead of the immediate and complete elimination shown in Figures 9-1 to 7-4, consider gradual elimination in constant steps over the course of 5 years (reducing once per year) to zero deductibility. Each of these reductions in deductibility is anticipated and perceived to be permanent. Figure 9-6 shows that this staggered reduction would avoid sharp falls in consumption and prices. On the other hand, as above, the potential benefits are not realized as quickly.[22]

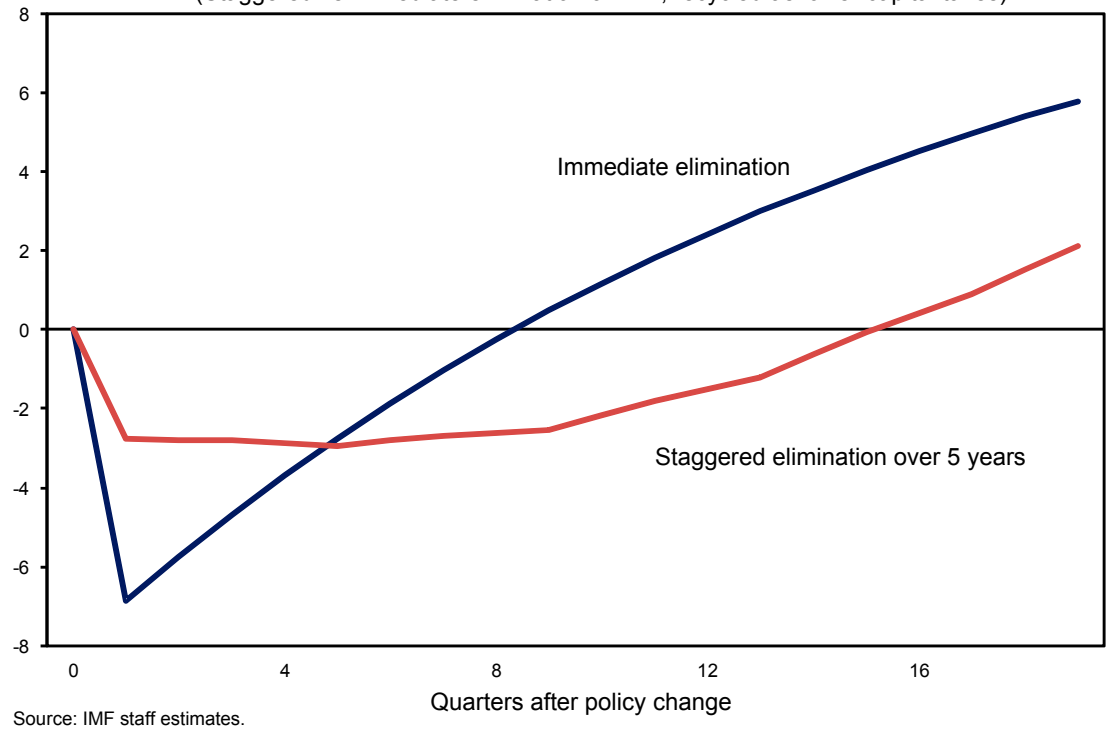
[22] Two examples from history also suggest that gradualism is desirable. Sweden reduced the tax deductibility over a short span of time, from 1985 to 1991. The marginal effects of this policy change are very difficult to isolate, as many other tax changes were made during this period. Further, the second reduction in mortgage deductibility was enacted at the same time as the U.S. entered recession. Nonetheless, the example suggests that large step changes over a short period of time might compound existing financial vulnerabilities. By contrast, the U.K. completely eliminated the deduction, from 1974 to 1999, by implementing a nominal cap on the size of mortgage loans that qualified for tax deductibility. (See IMF (2006) for more details.) By phasing out the deductibility over many years, the policy change was less vulnerable to business cycle interactions and allowed time for households to fully factor the future path of deductibility into their decisions. Moreover, the nominal cap (as compared to cuts in real deductibility) lessens the risk of house price falls.

Figure 9-5. Responses to Anticipated Shock
(Anticipated elimination of MID at *t* +20, recycled as lower capital taxes)



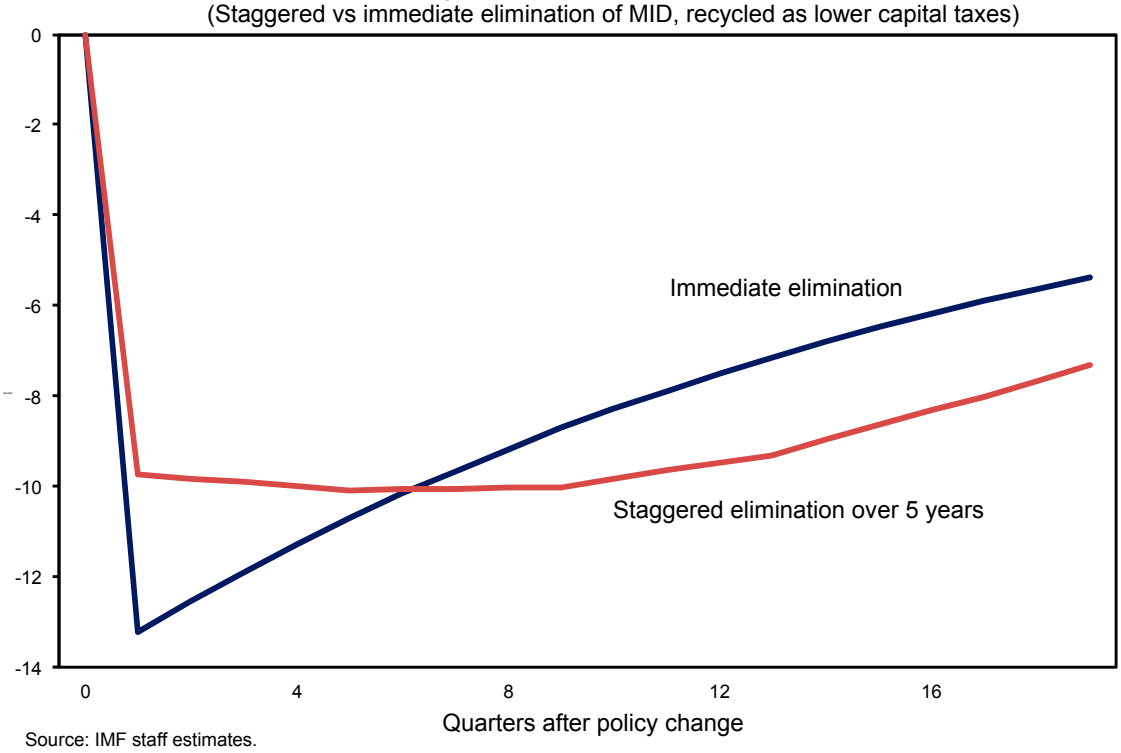
Source: IMF staff estimates.

Figure 9-6. Consumption Responses
(Staggered vs immediate elimination of MID, recycled as lower capital taxes)



Source: IMF staff estimates.

Figure 9-7. House Price Responses
(Staggered vs immediate elimination of MID, recycled as lower capital taxes)



Source: IMF staff estimates.

G. Conclusions

32. **Mortgage interest deductibility is costly**. Mortgage interest deductibility is a highly regressive subsidy that lowers the user cost of housing.

33. **Redirecting the mortgage subsidy could boost output**. The implicit revenues are large and could be potentially be otherwise used to boost potential output.

34. **Immediate unanticipated elimination brings risks**. Empirical evidence for the Netherlands and studies of other economies indicates that changes in housing wealth have potentially important spillover effects onto aggregate consumption. An immediate unanticipated elimination of the deductibility would likely induce a sudden fall in house prices and aggregate demand.

35. **Elimination should be gradual and preannounced—but not too slow**. A credible preannouncement of changes to the deductibility would allow households time to make plans. Gradual elimination would reduce the impact on other components of demand. However, the longer the elimination is put off, so too are the potential benefits from redirecting the subsidy.

References

Aoki, Kosuke, James Proudman, and Gertjan Vlieghe, 2004, "House prices, consumption, and monetary policy: a financial accelerator approach," *Journal of Financial Intermediation* 13, pp. 414-35.

Ewijk, Casper van, Martin Koning, Marcel Lever, and Ruud de Mooij, 2006, "Economische effecten van aanpassing fiscale behandeling eigen woning" CPB Paper No. 62.

Ewijk, Casper van, Bas Jacobs, and Ruud de Mooij, 2010, "Welfare effects of fiscal subsidies on home ownership in the Netherlands," manuscript.

Dijk, Machiel van, and Gerbert Romijn, 2010, "Hervorming van het Nederlandse woonbeleid," CPB Special Publication 84.

Glaeser, Edward L., and Jesse M. Shapiro, 2002, "The benefits of the home mortgage interest deduction," NBER Working Paper 9284.

International Monetary Fund, 2006, "House prices in the Netherlands: determinants, concerns and considerations related to phasing out the tax deductibility of mortgage interest payments," in Kingdom of the Netherlands—Selected Issues.

Kannan, Prakash, Pau Rabanal, and Alasdair Scott, 2009, "Monetary and macroprudential policy rules in a model with house price booms," International Monetary Fund Working Paper WP09/251.

Mankiw, N. Gregory, and Matthew Weinzierl, 2005, "Dynamic scoring: a back-of-the-envelope guide," manuscript.

OECD (2004), OECD Economic Survey of the Netherlands, 2004: Housing Policies.

Poterba, James, 1984, "Tax subsidies to owner-occupied housing: an asset market approach," *Quarterly Journal of Economics* 99(4).

Rouwendal, Jan, 2007, "Mortgage interest deductibility and homeownership in the Netherlands," Department of Spatial Economics, VU University Discussion Paper 2007-050.

Verbruggen, Johan, Henk Kranendonk, Michiel van Leuvensteijn en Michel Toet, 2005, Welke factoren bepalen de ontwikkeling van de huizenprijs in Nederland, CPB Paper No. 81.

ter Rele, Harry, and Guido van Steen, 2001, "Housing subsidization in the Netherlands: measuring its distortionary and distributional impacts," CPB Discussion Paper No. 002.

Vermeulen, Wouter, and Jan Rouwendal, 2007, "Housing supply in the Netherlands," CPB Discussion Paper No 87.

Equations for the model

The model is coded in nonlinear levels. In general, upper case denotes a flow or a stock, while lower case denotes a relative price or rate. (All superscripts are in lower case.) Because the model is a simultaneous system, there is technically no such thing as a "consumption equation". However, an attempt is made below to attribute endogenous variables to equations to aid interpretation. For example, in the case of the first equation, the household flow budget constraint can be seen as "determining" capital stock, conditional on households' decisions about consumption (saving).

Flow budget constraint (*K*):

$$K_t = \left(1 + (1-\tau^k).r_{t-1}^k - \delta^k\right).K_{t-1}$$

$$+(1-\delta^d).p_t^d.D_{t-1} - p_t^d.D_t$$

$$-\tau_{t-1}^{rd}.r_{t-1}^d.M_{t-1}$$

$$+(1-\tau^w)\,.\;W_t.(1-\lambda).L_t$$

$$-C_t + \Pi_t - T_t^l$$

Mortgage stock (*M*):

$$M_t = \theta.\mu.p_t^d.D_t$$

Consumption Euler equation (*C*):

$$\left[\phi.(\iota.C_t)^\rho + (1-\phi).\left((1-\iota).D_t\right)^\rho\right]^{\left(\frac{1}{\rho}-1\right)}.C_t^{\rho-1}$$

$$= \left[\phi.(\iota.C_{t+1})^\rho + (1-\phi).\left((1-\iota).D_{t+1}\right)^\rho\right]^{\left(\frac{1}{\rho}-1\right)}.\beta.(1+r_t).C_{t+1}^{\rho-1}$$

Intratemporal decision rule for housing for forward-looking agents (*D*):

$$D_t^{\rho-1} = \left[\frac{\phi.\iota^\rho}{(1-\phi).(1-\iota)^\rho}\right]^{\frac{1}{1-\rho}}.\left[\frac{1}{p_t^d.\chi_t^d}\right]^{\frac{1}{1-\rho}}C_t^{\rho-1}$$

Residential investment by forward-looking households (*ID*):

$$ID_t = D_t - (1-\delta^d).D_{t-1}$$

Output (Y):

$$Y_t = Z_t K_{t-1}^{\alpha} L_t^{(1-\alpha)}$$

Profits (Π):

$$\Pi_t = C_t + IK_t + ID_t + G_t - W_t L_t - r_{t-1}^k . K_{t-1}$$

Real wages (W):

$$W_t = (1-\alpha)\frac{Z_t K_{t-1}^{\alpha} L_t^{(1-\alpha)}}{L_t}$$

Real rental rate of capital (r^k):

$$r_t^k = \alpha \frac{Z_{t+1} K_t^{\alpha} L_{t+1}^{(1-\alpha)}}{K_t}$$

Fixed capital investment (IK):

$$IK_t = Y_t - C_t - ID_t - G_t$$

Real interest rate (r):

$$r_t = \left(1 - \tau_{t+1}^k\right).r_t^k - \delta^k$$

Mortgage interest rate (r^d):

$$r_t^d = r_t + \kappa$$

User cost of housing (χ^d):

$$\chi^d = \left(1 - \frac{1-\delta^d}{1+r_t}.\frac{p_{t+1}^d}{p_t^d}\right) + \mu.\left(\frac{1+\left(1-\tau_t^{rd}\right).r_t^d}{1+r_t} - 1\right)$$

Supply schedule for housing (p^d):

$$p_t^d = \left(Z_t^d\right)^{\left(\frac{-1}{\gamma_1+\gamma_2}\right)}.(ID_t)^{\left(\frac{1-\gamma_1-\gamma_2}{\gamma_1+\gamma_2}\right)}.\left(\frac{W_t}{\gamma_2 Z_t}\right)^{\left(\frac{\gamma_2}{\gamma_1+\gamma_2}\right)}.\left(\frac{r_{t-1}^k}{\gamma_1 Z_t}\right)^{\left(\frac{\gamma_2}{\gamma_1+\gamma_2}\right)}$$

Housing sector productivity (Z^d):

$$Z^d = (1 - \gamma_1 - \gamma_2).\frac{Y_t}{Y_{t-1}}$$

Government spending (G):

$$G_t = \overline{G_t}.GDP_t$$

Government debt (B):

$$B_t = \overline{B_t}.GDP_t$$

Mortgage interest subsidy (T^{rd}):

$$T_t^{rd} = \tau_{t-1}^{rd}.r_{t-1}^{d}.M_{t-1}$$

Labor income tax revenue (T^{w}):

$$T_t^{w} = \tau_t^{w}.W_t.L_t$$

Capital income tax revenue (T^{k}):

$$T_t^{k} = \tau_t^{k}.r_{t-1}^{k}.K_{t-1}$$

Flow government budget constraint (T^{l}):

$$T_t^{l} + T_t^{w} + T_t^{k} + B_t = G_t + (1 + r_{t-1}).B_{t-1} + T_t^{rd}$$

Gross Domestic Product (GDP):

$$GDP_t = C_t + p_t^d.ID_t \ + IK_t + G_t$$

Parameters

α	0.40	Capital share in production
β	0.99	Discount rate
δ^k	0.015	Depreciation rate on capital stock
δ^d	0.003	Depreciation rate on dwellings stock
ϕ	0.90	Weight on nondurable consumption in consumption bundle
ι	0.90	Tuning parameter for consumption shares
ρ	-1.0	$1/(1-\rho)$ = elasticity of substitution of nondurables and housing
μ	0.5	Loan-to-value-of-total-housing-stock ratio
κ	0.007	Spread on mortgages over base rate
γ_1	0.20	Share of capital in production of housing
γ_2	0.20	Share of labor in production of housing

Exogenous variables (depending on shock configuration)

$\bar{B}$	Government debt target
$\bar{G}$	Government spending target
L	Labor supply
T^l	Lump-sum net tax/subsidy
Z	Total factor productivity
τ^k	Capital return tax rate
τ^{rd}	Mortgage interest rate subsidy rate

Exogenous variables

B	Government bond stock
C	Aggregate (nondurable) consumption
D	Aggregate housing stock
G	Government spending
GDP	GDP
ID	Aggregate residential investment
IK	Aggregate capital investment
K	Aggregate capital stock
M	Mortgage stock
p^d	Relative price of housing
r	Market interest rate
r^d	Mortgage interest rate
r^k	Rental rate on capital
T^w	Labor income tax revenue
T^k	Capital income tax revenue

T^{rd}	Mortgage interest subsidy
TW	Total wealth
W	Real wage
Y	Output
Z^d	Productivity of housing supply
Π	Firms'net profits
χ^d	Cost of capital for housing