Bart Hobijn

What Will Homeland Security Cost?

- As the government and the private sector increase their spending on security measures, concerns have arisen over the magnitude and economic effects of these expenditures.

- A review of the evidence, however, suggests that public- and private-sector outlays for increased security will be relatively small—roughly $72 billion per year, or 0.66 percent of the nation's GDP in 2003.

- Fears that private-sector productivity will decline significantly as firms shift resources to protection appear ill-founded. Firms' security initiatives will lower labor productivity levels by no more than an estimated 1.12 percent.

- Indirect costs of homeland security—notably, the delays related to heightened airport security and the diversion of research and development funds from productivity-enhancing technologies—are also likely to prove modest.

Increased spending on security measures—high on the agenda of the government and much of the private sector—will undoubtedly have an effect on the economy. If firms devote sizable amounts of time and money to the protection of their businesses, they will reduce their overall productivity. Furthermore, if the government's spending on homeland security is significant, it could lead to a rise in the cost of capital and wages and reduce investment and employment in the private sector. Finally, the homeland security efforts could have many indirect economic effects, such as the costs of increased airport waiting times and long-run productivity effects resulting from a reallocation of research and development (R&D) spending.

In this article, we attempt to quantify the economic effects of the homeland security efforts of the public and private sectors, focusing specifically on the costs of these efforts. In practice, it is difficult to classify which expenditures are related to homeland security. For this reason, we use the broadest possible definition: all expenditures *possibly* aimed at either preventing damage due to terrorist attacks or at preparedness for the response to potential attacks. This broad definition suggests that the figures presented here should be interpreted only as estimates of the maximum effect of homeland security on the economy.

From this perspective, our study can be interpreted as the cost side of a cost-benefit analysis. To estimate the costs of homeland security, we focus on three main questions. The first involves the

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likely magnitude of government expenditures on homeland security. To answer this question, we review the historical as well as the proposed expenditures on homeland security by the federal, state, and local governments and compare them with historical spending on other programs and items.

The second question concerns whether firms will spend significant amounts of time and money on security and protection. To offer insight into this issue, we estimate the share of inputs that firms devoted to protective services before

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2001 and consider what effect doubling this share would have on firm productivity levels. This technique is similar to the one used by the Council of Economic Advisers (CEA, 2002) to assess the productivity effect of homeland security.

The final question involves the size of the many indirect effects of homeland security. Of the many possible effects, we examine two in particular: the costs associated with increased waiting times at airports and the possible effect on long-run productivity growth attributable to a shift in R&D expenditures. The answer to this question turns out to be the most speculative of the three.

Despite our broad definition of homeland security expenditures, our results suggest that the amounts of public- and private-sector spending are likely to be relatively small: the total annual direct costs of the homeland security efforts are estimated to be $72 billion, or 0.66 percent of GDP in 2003. Moreover, the homeland security efforts in the private sector are estimated to lower labor productivity levels by at most 1.12 percent. Consequently, the reallocation of resources due to homeland security is unlikely to have any large and long-lasting effect on the economy. Furthermore, spending on homeland security should not evaporate the "peace dividend" of the 1990s (that is, push defense expenditures back to their Cold War levels and force the federal government to run large budget deficits). Even when we include homeland security spending, the proposed defense budget will still make up a smaller fraction of GDP than it did in any year from 1947 to 1994.

Spending on Homeland Security

Public Sector

The term homeland security was only introduced formally after the September 11 terrorist attacks. However, the federal government had previously been funding several anti-terrorism programs, many of which span several agencies. In 1995, the National Security Council was assigned to coordinate these programs and the Office of Management and Budget (OMB) was appointed to supervise their budgetary aspects. In practice, however, most agencies did not specifically account for expenditures as being "terrorism-related" until 1998.[1] The 1998 National Defense Authorization Act requires each administration to provide an annual report on the funding of programs to combat terrorism. Since 1998, OMB has provided Congress with an annual overview of terrorism-related expenditures, which include funds to combat terrorism, to prepare for a response to weapons of mass destruction, and to protect critical infrastructure.[2]

The federal government's recent expenditures on anti-terrorism/homeland security as a percentage of GDP are presented in Chart 1. In the six years before September 2001,

CHART 1
Federal Anti-Terrorism/Homeland Security Expenditures as a Percentage of GDP
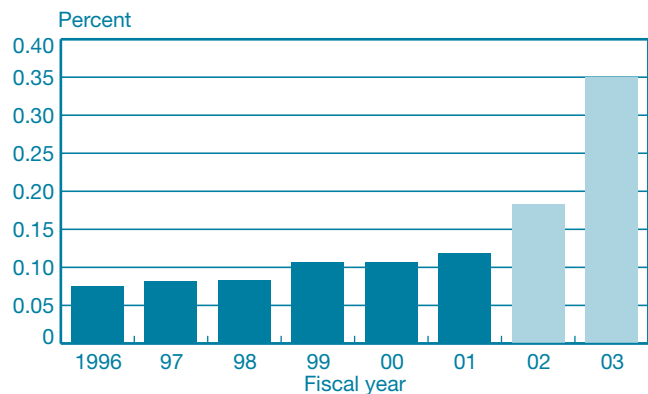
Sources: U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts data; 1996 and 1997 data: General Accounting Office (1997); 1998-2001 data: Office of Management and Budget (2001); projections for 2002 and 2003: House Budget Committee and White House press releases; GDP projections for 2002 and 2003: Congressional Budget Office testimony (2002).

Note: Fiscal years run from fourth quarter to third quarter.

the government had spent about 0.1 percent of GDP on its anti-terrorism program. Immediately before September 2001, the approved spending to combat terrorism was $12 billion for fiscal year 2002, which again would have been about 0.1 percent of GDP. In response to the attacks, however, Congress supplemented the budget, allowing the Bush Administration to spend approximately $20 billion on homeland security.

In the February 4, 2002, budget proposal, the President's current budget sets aside $38 billion for homeland security expenses for the 2003 fiscal year. Projections by the Congressional Budget Office (2002) indicate that this amount would represent 0.35 percent of GDP. Consequently, in response to the terrorist attacks, the federal government has tripled the amount of its homeland security expenditures as a share of GDP.

Accordingly, it is reasonable to question the size of homeland security expenditures relative to other budget items. Among these many items, defense expenditures offer the best basis for comparison. A major concern is that the additional expenditures on homeland security will erase the peace dividend of the 1990s (see, for example, *BusinessWeek* [2001] and Baily [2001]). Of the $38 billion earmarked by the Bush Administration for homeland security in fiscal year 2003, $7.8 billion is part of the defense budget. The proposed total defense budget for 2003 is $379 billion and will represent about 3.5 percent of GDP. Hence, if one were to add to the defense budget the additional $30 billion in nondefense homeland security spending, homeland security expenditures and national defense outlays would account for about 3.8 percent of GDP. This share would

be about the same as the share of national defense outlays in 1995 and would still be lower than it was in any year between 1947 and 1994 (Chart 2). Therefore, the concern that homeland security will eliminate the peace dividend of the 1990s seems unfounded, at least for the currently proposed spending levels.

The Bush Administration plans to devote its homeland security budget to five main objectives: support of first responders in preparation for future terrorist threats, improvement of the U.S. response to biological terrorism, improvement of border controls, tightening of aviation security, and enhancement of information-sharing on potential terrorists (Chart 3).[3] Bear in mind that many of these objectives involve significant subsidies to state and local governments to support their efforts to prepare for and prevent possible attacks.

The overall expenditures that state and local governments will incur due to increased security measures in response to the September 11 attacks are less transparent than those of the federal government. This lack of transparency could be a source of delays in local security efforts (*New York Times* 2001). Although we do not know how much state and local governments will allocate to homeland security, two surveys shed light on their possible expenditures. A survey by the National Governors Association, conducted in December 2001,

Share of National Defense Outlays in GDP
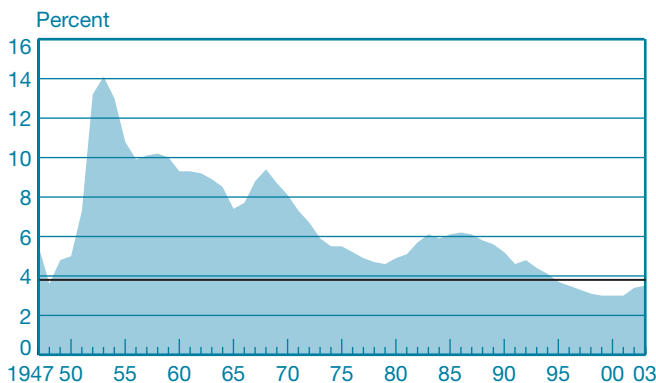
Sources: Congressional Budget Office (2002); author's calculations.

Note: The shaded area represents defense outlays as a percentage of GDP; the solid line represents the 3.8 percent of GDP that is the share of the combined defense and homeland security budgets in fiscal year 2003.

Composition of 2003 Homeland Security Budget
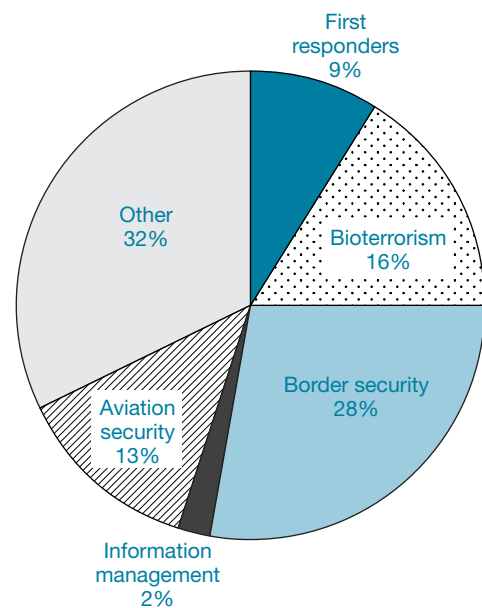
Source: Office of Management and Budget (2002).

suggests that state governments expect the costs of homeland security for 2002 to be as high as $4 billion. Of this amount, $3 billion would be required to improve emergency communications systems and bioterrorism preparations, while the remainder would be used for critical infrastructure

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protection. A survey by the U.S. Conference of Mayors, in January 2002, indicates that additional security costs for all cities with a population of 30,000 or more could be as high as $2.1 billion for 2002.[4] By comparison, the City of New York forecasts $3.8 billion in spending on its police department in 2002.[5]

Thus, by combining the results of these surveys, we arrive at a preliminary estimate of about $6.1 billion to fund homeland security efforts on a state and local level. However, there is a large overlap between this amount and the federal homeland security budget. The federal budget includes $4.8 billion to support local first responders and bioterrorism preparedness. Consequently, the net expenditures of state and local governments on homeland security will likely be about $1.3 billion, which would be a very small expense when compared with the $1,276 billion in state and local government expenditures in 2001. Furthermore, the additional security expenditures of state and local governments might be lower going forward, because their initial expenditures largely represent one-time investments in necessary equipment. In fact, the U.S. Conference of Mayors suggests that 50 percent of additional security expenditures by cities are capital expenditures.

These figures suggest that homeland security expenditures are relatively small compared with those of other government programs. Thus, those who argue that fiscal discipline should have a high priority in response to September 11, as Baily (2001) does, need not be concerned about homeland security expenditures having a major effect on the budget.[6]

Private Sector

Besides an expansion of the public sector, another concern is that the private sector will devote a large part of its time and resources to protective rather than productive activities. Such a shift in resources would raise unit production costs and lower productivity. Although we cannot estimate exactly how much money and time firms will allocate to increased security, we can measure how much they have spent in the past on security initiatives. After determining that amount, we can consider the effect on firm productivity of a hypothetical doubling of these resources.

There is no separate accounting of firms' expenditures on anti-terrorism security.[7] The closest we can get to measuring these expenditures is to consider the much more general classification of "protective services." Box 1 describes the parts of labor, capital, and intermediate inputs classified as protective. Clearly, protective services encompass much more than terrorism-related security. They vary from fire protection to the protection provided by crossing guards. This classification of all protective services inputs as related to homeland security suggests that our results are best interpreted as an estimate of the maximum effect of homeland security on the private sector.

Box 1
Protective Services in the Private Sector

- **Labor: Protective Services Occupations**[a]
  Category 33 of Standard Occupational Classification; mainly firefighters, police officers, correctional officers, private detectives, and security guards.

- **Capital: Electronic Security Systems**[b]
  Electronic access control, anti-burglary, closed-circuit television, fire protection, systems integration, and home automation.

- **Services: Protective Services Industry**[c]
  Establishments engaged primarily in providing one or more of the following: 1) investigation and detective services, 2) guard and patrol services, 3) pick up and delivery of money, receipts, or other valuable items, with personnel and equipment to protect such properties while in transit.

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[a]Source: U.S. Department of Labor, Bureau of Labor Statistics, Occupational Employment Survey.

[b]Sources: Security Industry Association of America, *Research Update; Security Sales Magazine.*

[c]Source: U.S. Department of Commerce, Bureau of Economic Analysis, Input-Output Tables.

Furthermore, there are areas not included in the list of protective services inputs to which firms might devote more resources in response to a heightened threat of terrorism. For instance, the capital measure includes only electronic security systems and not items such as fencing. However, Anderson's study (1999) of the costs of crime in the United States suggests that the value of these additional types of capital is small relative to that of the electronic security systems included in the analysis. In addition, the data do not account for time spent by nonprotective services employees on terrorism preparedness. Finally, the measures of security-related inputs used here do not account for the increased information security measures that firms will take to protect their computer networks and resources, nor do they include the expenditures that firms incur by investing in the establishment of operational and informational back-up sites.

Although there is no direct evidence on these unaccounted-for inputs, some preliminary findings exist. O'Hanlon et al. (2002) suggest that the total annual homeland security cost for the private sector will be about $10 billion; this amount includes the security measures accounted for here as well as the unaccounted-for items. More specifically, data presented in a report by RBC Capital Markets (2001) indicate that before September 11, prepackaged security software made up about 2 percent of firms' software expenditures, and security-related computer equipment represented about 0.3 percent of total computer equipment expenditures. Total Internet security expenditures made up a larger part of inputs because these data do not take into account expenditures on custom-made and in-house software applications, personnel assigned to Internet security-related activities, and computation time devoted to software protection rather than to other applications.

To evaluate the importance of protective services workers in private employment, we consider two measures. The first is the share of workers in protective services (Table 1). Here, we see that the 2000 share of these personnel in private employment is about 1.12 percent.[8] The approximately one million security guards account for about 80 percent of these workers in the private sector. What is relevant for measuring the effect of these workers on productivity, however, is not only their share in

Table 1

Share of Inputs Devoted Directly to Protective Services
Percent

Sector	Employment[a]	Wage Bill[a]	Replacement Value of Capital[b]	Capital Service Flows[b]	Intermediate Services
Business	1.12	0.71	0.52	0.46	—
Nonfarm business	1.13	0.71	0.54	0.44	—
Manufacturing, total	0.16	0.13	0.13	0.04	0.76
Durables	0.16	0.13	0.15	0.05	0.92
Nondurables	0.16	0.14	0.12	0.04	0.60
Government	17.26	17.53	0.38	—	—
Federal	2.94	2.98			
Police officers	0.63	0.52			
Security guards	0.13	0.08			
State[c]	17.04	16.55			
Police officers	2.15	2.49			
Security guards	0.29	0.19			
Local	25.09	28.32			
Police officers	10.31	12.00			
Security guards	0.25	0.17			

Sources: U.S. Department of Labor, Bureau of Labor Statistics, Occupational Employment Statistics (2000); U.S. Department of Commerce, Bureau of Economic Analysis, Fixed Assets Tables; *Security Sales Magazine*; Security Industry Association of America, *Research Update* (2001, second quarter).

Note: Data are constructed for 1999.

[a]Labor input data are for 2000 and for all workers in protective services occupations.

[b]Protective capital is assumed to consist of electronic access control, anti-burglary, closed-circuit television, and fire protection systems, as well as systems integration and home automation.

[c]Correctional officers represent the majority of protective services individuals working for state governments.

employment, but also their share in the total wage bill. Since protective services employees tend to earn an hourly wage that is about 63 percent of the average, their share in the total private wage bill is lower than their share in total employment. More precisely, these workers earn only 0.71 percent of the wage bill; by comparison, lawyers account for only 0.32 percent of the labor force, but earn 0.96 percent of the wage bill.

If businesses would have had to replace their capital stocks in 1999, then only about half of 1 percent of that replacement cost would have been spent on electronic security systems. Moreover, of the portion of 1999 output that can be accounted for as produced by capital inputs, only 0.46 percent was attributable to these systems. In technical terms, these figures imply that the share of electronic security systems in the total private capital service flows is 0.46 percent.

To estimate the effect of homeland security on private-sector productivity, we now consider a scenario in which this sector doubles the security-related capital and labor inputs to productivity.[9] This scenario is similar to the one employed by the Council of Economic Advisers (2002). The effect of such a scenario depends on the type of productivity considered. The Bureau of Labor Statistics measures two types of productivity: labor productivity, the amount of output produced per hour worked, and multifactor productivity (MFP), the amount of output produced per unit of input, where a unit of input is measured as a combination of labor and capital. Box 2 describes the productivity concepts applied in this study and the productivity calculations performed.

Box 2
Calculations of Productivity Effects

The Bureau of Labor Statistics measures two types of productivity. Here, we describe how the homeland security efforts can affect both measures.

Notation and Assumptions

Δy is the growth rate of output,
Δl is the growth rate of labor inputs,
Δk is the growth rate of capital inputs.

The main assumption is that firms will double their security-related capital and labor inputs while output levels remain the same. That is, $\Delta y = 0$, while Δl is the share of security-related labor inputs in overall labor inputs and Δk is the share of electronic security systems in the total capital input level (capital service flows).

Labor Productivity (ALP)

Definition: Labor productivity is the amount of value-added output produced per hour worked.

Effect: The growth rate of average labor productivity is the difference between the growth rate of output and that of the labor input, that is, $\Delta ALP = \Delta y - \Delta l$. For the scenario considered here, this implies that ΔALP is minus the share of security-related labor inputs in the overall hours.

Multifactor Productivity (MFP)

Definition: Multifactor productivity is the amount of output, measured as value added, produced per normalized unit of inputs. Units of inputs are measured as a combination of capital, that is, equipment and structures, and labor. Labor is measured in wage-adjusted hours. Wages are adjusted based on the assumption that workers who make a wage that is twice as high would be twice as productive, which should be adjusted for in accounting for the hours that they work.

Effect: The growth rate of multifactor productivity equals the growth rate of output minus a weighted average of the growth rates of the capital and labor inputs, that is, $\Delta MFP = \Delta y - w\Delta l - (1 - w)\Delta k$, where the weight w is determined by the nominal output share of labor. For the scenario considered here, this implies that $\Delta MFP = - w\Delta l - (1 - w)\Delta k$.

Multifactor Productivity (Capital, Labor, Energy, Materials, and Services) (MFP-KLEMS)

Definition: MFP-KLEMS is the amount of gross output produced per normalized unit of inputs. Units of input are measured here as a combination of capital, labor, energy, materials, and services. The Bureau of Labor Statistics measures labor here in terms of hours worked.

Effect: The same as multifactor productivity, with the additional effect that firms might also increase the business services they buy to cover some of their security activities. Therefore, in this case, homeland security measures affect productivity through the capital and labor input channels, as well as through business services inputs.

Notes: The value-added concept of output refers to total output minus the value of all the intermediate inputs a firm buys. See U.S. Department of Labor, Bureau of Labor Statistics (1997, Chapters 10, 11) for more details on productivity definitions and statistics. Stiroh (2001) presents a more formal discussion of some of the terms involved.

TABLE 2

Effect of Homeland Security Efforts on the Level of Productivity
Percentage Change

Scenario	Type of Productivity	Business	Nonfarm Business	Manufacturing	Durables Manufacturing	Nondurables Manufacturing
Doubling of security-related labor inputs	ALP	-1.12	-1.13	-0.16	-0.16	-0.16
	MFP	-0.49	-0.49			
	MFP-KLEMS			-0.06	-0.07	-0.05
Doubling of security-related capital inputs	ALP	0.00	0.00	0.00	0.00	0.00
	MFP	-0.14	-0.15			
	MFP-KLEMS			-0.01	-0.01	-0.01
Doubling of security-related business services inputs	ALP					
	MFP					
	MFP-KLEMS			-0.10	-0.11	-0.08
Additional airport delays	ALP		-0.09			
	MFP		-0.08			
	MFP-KLEMS					
Total effect	ALP	-1.12	-1.22	-0.10	-0.11	-0.09
	MFP	-0.63	-0.71			
	MFP-KLEMS			-0.17	-0.19	-0.14

Source: Author's calculations.

Note: ALP is labor productivity; MFP is multifactor productivity; MFP-KLEMS is multifactor productivity (capital, labor, energy, materials, and services).

Our calculations of homeland security's effect on productivity assume that businesses increase their inputs by doubling the resources devoted to their protective activities. These inputs are assumed to be unproductive, however, in the sense that they do not lead to any measurable output. Table 2 reports the estimates of doubling various inputs to labor productivity as well as to multifactor productivity. Note that all of the effects presented are effects on the productivity *level* and not on the growth rate.

The largest productivity effect from doubling all security-related labor inputs would be the effect on labor productivity in the nonfarm business sector: we estimate that productivity would be lowered by about 1.13 percent. The effect is lower for MFP because the MFP measure takes into account the fact that protective services personnel earn below-average wages, and it adjusts for the labor share. Doubling security-related labor inputs would lower multifactor productivity only by about half of 1 percent. This effect is still most likely an overestimation of homeland security's actual effect, not only because we are assuming that the private sector would double the number of protective services workers, but also because all of these

workers are not protecting private-sector businesses; some are providing security services to the government and consumers. Furthermore, many of these workers guard against incidents other than potential terrorist attacks.

Next, doubling the number of installed electronic security systems would lower multifactor productivity only by an estimated 0.15 percent in the business sector, and it would have virtually no effect on manufacturing productivity levels. Finally, the effect of doubling security-related service inputs to manu-facturing would lower MFP by approximately 0.1 percent.

In sum, doubling all inputs directly related to security in the business sector would most likely lower MFP by 0.8 percent or less and would lower labor productivity by at most 1.12 per-cent. This estimated effect is of a magnitude similar to the effect reported by the Council of Economic Advisers. The CEA estimates that the homeland security efforts will reduce output over five years by 0.6 percent relative to its level without the efforts. Note that the CEA's calculation does not only include the shift in productivity estimated here. It also includes the effect of a decrease in expected investment—and therefore a decline in the future capital stock—due to this downward shift

in productivity. It is important to realize, however, that it might take some time before the productivity effect calculated here is realized: firms need time to implement additional security measures.

Although the scenario depicted here is comparable to the one offered by the CEA, it is still reasonable to ask how likely it is that firms will actually double security-related inputs. One way to answer this question is to compare the cost of this doubling with the $10 billion in private-sector homeland security costs estimated by O'Hanlon et al. (2002). Doubling the number of protective services workers in the business sector alone would already cost more than $25 billion annually at

Our calculations of homeland security's effect on productivity assume that businesses increase their inputs by doubling the resources devoted to their protective activities.

2000 wage levels. If we add to this amount the $102 billion replacement value of the electronic security systems in place in the United States, measured in 2000 dollars, we see that the implementation costs of doubling the security-related inputs vastly exceed the estimates of O'Hanlon et al.[10] Thus, our estimates are best interpreted as an upper bound on the impact of homeland security on private-sector productivity.

Another relevant question concerns the possible magnitude of the 1.12 percent drop in labor productivity. The most straightforward way to approach this question is to ask, at the current input levels, how much could workers assigned to homeland security have produced in measured output? In other words, suppose that there had been a 1.12 percent increase in hours used for productive purposes; by what amount would business-sector output have increased? Business-sector output in 2001 was about $8,600 billion. Increasing the labor input by 1.12 percent would have added about $70 billion to this amount—about twice as much as the federal government plans to spend on homeland security in fiscal year 2003.

Two caveats should be observed when considering the above analysis. First, the growth-accounting exercise performed here assumes that the relative productivity and prices of the various inputs remain the same. If the homeland security efforts have a large effect on the economy, they would likely affect prices as well, and our analysis would be less germane. However, because the results suggest that the effect will be rather small, it is unlikely that prices will change so drastically as to affect the results significantly.

Second, the 2001 Aviation and Transportation Security Act will shift a large part of the responsibility for airport security from the private to the public sector. This shift might lead to an increase in private-sector productivity because it will remove a large portion of unproductive overhead costs from the private sector's payrolls and capital expenditures. The efforts of companies to allow the FBI to oversee some of their employee screening (*Wall Street Journal* 2002) would have a similar effect.

Overall, homeland security's estimated effects on productivity should be rather small. In fact, because our results are likely to overestimate these effects, the actual effects on private-sector productivity will most likely be even smaller.

Total Direct Costs of Homeland Security

Our estimates of homeland security spending in the public sector combined with estimated costs in the private sector suggest that the total annual direct costs of these efforts will amount to $72 billion, or 0.66 percent of 2003 GDP (Table 3).

TABLE 3
Total Annual Direct Costs of Homeland Security

Scenario	Cost (Billions of Dollars)	Cost (Percentage of 2003 GDP)[a]
Federal homeland security budget	38.0	0.35
Additional homeland security spending by state and local governments	1.3	0.01
Doubling of security-related labor inputs	25.0	0.23
Doubling of security-related capital inputs	7.8[b]	0.07
Total direct costs	72.1	0.66

Source: Author's calculations.

[a]Based on Congressional Budget Office (2002) estimates of 2003 GDP.
[b]Based on an amortization of the $102 billion 2001 replacement value of electronic security systems at a 6 percent interest rate for twenty years.

Indirect Effects of Homeland Security Measures

Although the homeland security efforts of the public and private sectors could have many indirect effects on the economy, evidence of these effects thus far has been somewhat speculative. Here, we discuss two effects that have received much attention in recent months: the possibility that the tightening of airport security will increase waiting times at airports, and the fear that homeland security will draw resources away from research and development efforts and lower the rate of technological change, in turn reducing the outlook for long-run productivity growth.

Aviation Security Effects

Part of the proposed homeland security budget, $4.8 billion to be precise, is to be spent on the improvement of aviation security. The 2001 Aviation and Transportation Security Act led to the installment of a new Transportation Security Administration, which will be responsible for the screening of passengers and baggage. At the heart of the legislation is the federalization of airport security, which involves the federal government hiring 30,000 airport security workers to perform these screenings. The law also provides funding for the purchase of equipment necessary to screen all checked baggage for explosives as well as for strengthening cockpit doors and placing more air marshals on flights.

All of these costs are already accounted for in the direct cost estimates of public-sector expenditures. However, there is a major concern that tightening security at airports will significantly increase the amount of passenger waiting time before flight boarding. (Chart 4 compares the loss in hours due to increased airport security for the ten regions with the largest time loss due to traffic congestion.) Navarro and Spencer (2001), for example, argue that the bulk of the costs of increased aviation security—$8 billion to $32 billion annually—will be attributable to this additional waiting time. Their calculation is based on the assumption that about 550 million passengers will spend an additional ninety minutes in the airport before boarding their flights and that their time is worth between $10 and $40 an hour.

However, by using more detailed data, we obtain an estimate of the cost of increased airport delays that is on the lower end of the range reported by Navarro and Spencer. First, the estimate that increased security will lead to a ninety-minute delay per passenger probably exaggerates the time loss. Poole (2001) has already observed that the new security standards
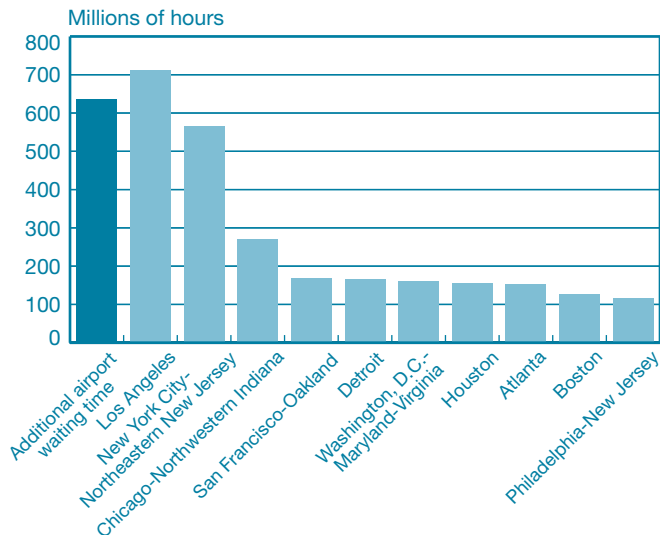
Sources: Air Transportation Association of America, 2001 annual report; Texas Transportation Institute, Urban Mobility Study (2001).

Note: Data are for 1999. "Additional airport waiting time" is assumed to be one hour per 1999 revenue passenger.

imposed are not much higher than those in major international airports around the world. This observation suggests that airport waiting times in the United States would become similar to those in other countries. Moreover, data from Delta Airlines on expected waiting times for curbside check-in, ticketing, and security checks at ten major U.S. airports indicate that none of these waiting times exceed sixty minutes during peak hours and all of them were fifteen minutes or less during off-peak hours (Chart 5). Hence, it seems reasonable to assume that the average passenger faces an extra hour of waiting time, rather than ninety minutes, due to increased security standards. This will be the scenario upon which our calculation in this section is based. Note that, given the data in Chart 5, this still seems a rather high increase, suggesting that the estimate presented here can again be considered an upper bound.

There are two types of flyers. The first are business travelers; the time they spend at the airport is measured as a labor input and thus an increase in their waiting time affects productivity. The second are leisure travelers; they fly on their own time, which is not accounted for as a productive input.

Consider business travelers. Based on data from the Travel Industry Association of America (2000), one can estimate that of the 636 million passengers boarding planes in 1999, a bit

Chart 5
Estimated Security-Check Waiting Times at Ten Major U.S. Airports

Minutes
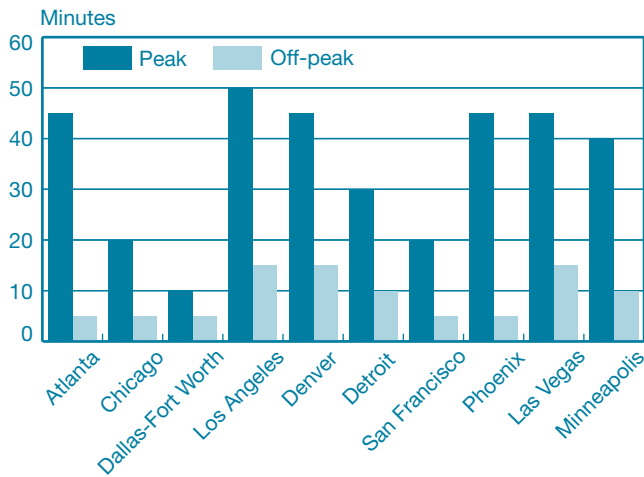
Source: Delta Airlines.
Note: Data are for May 16, 2002.

more than one-third were business travelers. The same data suggest that the average annual household income of these business travelers was $76,100, compared with a mean of $55,000 for the U.S. population. Therefore, airport delays would have led to a loss of about 215 million productive hours. If we assume that all of these business travelers were employed in the nonfarm business sector, there would have been a loss of 0.09 percent of the total hours input and a loss of 0.12 percent of the wage-adjusted labor input for the nonfarm business sector in 1999. The productivity effect of such a loss appears in Table 2.

Now, suppose that leisure travelers will also spend an additional hour waiting. Their waiting time, however, is not a productive input and, as such, does not affect productivity. In its calculation of the cost of traffic congestion, the Texas Transportation Institute (2000) valued an hour in 1999 to equal $12.40. Thus, if we were to value the hours lost by leisure travelers due to an additional hour of waiting time in 1999, their lost time would be worth $5.3 billion. Add to this amount the value of time lost by business travelers, about $6.4 billion, and the total value of this time lost would have been $11.8 billion. To put this figure in perspective, it is slightly lower than the $12.5 billion regional cost of congestion in the Los Angeles area, also estimated by the Texas Transportation Institute. This $11.8 billion in lost time is also at the lower end of the range of $8 billion to $32 billion reported by Navarro and Spencer (2001).

Furthermore, there are two other reasons why these results might overestimate the cost of delays. First, unlike time spent in traffic, time spent waiting at airports can be used for other, productive activities, such as shopping, dining, and working. The latter is especially true for business travelers, who can work using cell phones and laptops. Second, if business travel becomes a huge inconvenience, firms will continue to reduce business trips, as they have been doing since September 11. Although such a substitution effect would reduce the amount of time spent waiting in airports, it would also have a negative effect on output by reducing demand for many of the services used by business travelers.

Long-Run Productivity Effects

The above analysis suggests that the homeland security efforts will have a small effect on the *level* of productivity. However, could they also affect our outlook for the *growth* of productivity? This possibility was raised immediately after September 11, when *BusinessWeek* (2001) suggested that the homeland security efforts might indeed have a long-run effect on economic growth.

Evidence from many recent studies, such as Jorgenson and Stiroh (2000) and Oliner and Sichel (2000), suggests that the engine of the growth spurt of the economy in the late 1990s was the unprecedented investment levels, especially in computers and related equipment. The innovations in computer technology underlying these investments are driven by research and development programs. Hence, if the homeland

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security efforts were to reduce the R&D expenditures associated with these technologies, the productivity growth rate might be lowered.

There are two main channels through which private-sector R&D might be affected by the homeland security efforts. First, homeland-security-related R&D might displace R&D expenditures on productivity-enhancing technologies. Moreover, if the demand for homeland-security-related equipment increases, it might lead to a shift in the private R&D

portfolio from innovations that improve output-producing technologies to security-related technologies that do not produce any measurable output. Second, a decrease in overall productivity would lower the returns to the innovations obtained from the R&D efforts.

We begin by discussing the second channel. Because our analysis suggests that the overall productivity effect of the various homeland-security-related programs will likely be fairly low, homeland security does not seem to be a deterrent to future R&D efforts. Hence, this channel will probably not play a significant role in influencing private-sector R&D.

Although it is not easy to gauge the magnitude of the first channel, we can make a reasonable estimate. We do not know how much of the private-sector R&D expenditures will be shifted from improving computers and other inputs that yield measurable output to improving security systems, yet we do know what the U.S. government proposes to spend on homeland security R&D. The 2003 budget includes "an aggressive $2.4 billion research and development program to develop technologies that will strengthen our bioterrorism response capabilities" (Office of Management and Budget 2002).

This proposed $2.4 billion in additional spending is relatively small compared with total R&D spending in the economy. In 2000, the U.S. public and private sectors spent about $265 billion on research and development; defense R&D was $24 billion, or about 9 percent of the total. If we added the currently proposed $2.4 billion of bioterrorism response R&D to this $24 billion, we would find that defense R&D spending would have been only 10 percent of total R&D spending in 2000. This percentage would be one of the lowest shares reported since the National Science Foundation began collecting data on defense R&D expenditures in 1972. Hence, the proposed research and development expenditures are not likely to be of such a magnitude as to impede private-sector R&D initiatives.[11]

Conclusion

Our evidence suggests that the economic costs of homeland security will be relatively small, and that they are unlikely to have major effects on the fiscal discipline of the government or on productivity in the private sector. Proposed government spending on homeland security is expected to account for about 0.35 percent of GDP in 2003—an amount only one-tenth the size of national defense outlays. In conjunction with this spending, even if the private sector were to double its security-related inputs, we estimate that the total annual direct costs of homeland security would be only $72 billion, or 0.66 percent of 2003 GDP. Moreover, such a doubling of inputs would at most reduce the private sector's labor productivity level by 1.12 percent.

We attach two caveats to our conclusion. First, our results do not suggest that the damage of the September 11 terrorist attacks is negligible; the findings focus solely on the economic effects of the expenditures undertaken to prevent and prepare for future incidents. Second, the results do not suggest that homeland security is unimportant. Our study is essentially only the cost side of a full cost-benefit analysis. The benefits of homeland security are, unfortunately, not always easy to measure: one simply cannot observe how many terrorist activities have been prevented because of increased security.

Clearly, it is difficult to put a value on the heightened sense of safety that the homeland security program provides. Nevertheless, given its relatively small expenses, even if the program prevented just one major incident over the next few years, the return on homeland security expenditures would be high.

1. The most comprehensive study of federal funding of anti-terrorism programs before 1998 was conducted by the U.S. General Accounting Office (1997).

2. On October 8, 2001, the Office of Homeland Security was established by executive order to develop and coordinate the federal homeland security program. The National Homeland Security and Combating Terrorism Act, introduced on May 2, 2002, calls for the establishment of a formal Department of National Homeland Security at the cabinet level.

3. O'Hanlon et al. (2002) recommend pursuing a slightly broader agenda that would increase federal spending on homeland security to $45 billion to $50 billion annually.

4. The U.S. Conference of Mayors notes that this figure is still preliminary, pointing out that it is a revised estimate, published in January 2002, of an October 2001 estimate of $1.5 billion for 2002 plus the last three months of 2001. This revision was necessary because the January survey suggested that cities had already spent more than $500 million on additional homeland security measures from September 11, 2001, through January 1, 2002.

5. See Office of Management and Budget of the City of New York (2002).

6. One might also ask how U.S. expenditures on combating terrorism compare with similar expenditures of other industrialized countries. Unfortunately, this question is difficult to answer because—as was the case in the United States prior to 1998—most countries do not account for their counter-terrorism expenditures separately.

7. O'Hanlon et al. (2002) propose that the Bureau of Economic Analysis account for security-related expenditures in its National Income and Product Accounts.

8. We use the terms "private" and "business" interchangeably because the data do not allow us to distinguish between private and public enterprises.

9. To consider a tripling of these inputs—assuming that the federal government will roughly triple the share of GDP devoted to homeland security—one would simply multiply the results presented here by 1.5.

10. Here, we amortize the $102 billion of capital expenditures involved in doubling the number of electronic security systems. Amortization at a 6 percent interest rate over twenty years yields an annual expense of $7.8 billion.

11. In principle, one can identify many other possible indirect effects of homeland security on the economy. Unfortunately, quantification of these effects is difficult and at best speculative.

One concern is that firms' increased uncertainty about their supply and distribution channels, as well as their demand, would induce them to target higher inventory levels. Preliminary evidence on inventory investments after September 2001 suggests that this reaction has not occurred (U.S. Department of Commerce 2002). Another concern is that increased trade costs might hamper trade and growth (see, for example, World Bank [2001] and Organisation for Economic Co-Operation and Development [2001]). Although anecdotal evidence suggests that trade costs have increased in the aftermath of September 11, there is no conclusive evidence of whether this increase will be permanent. For example, Andrea and Smith (2002) provide evidence that immediately after September 11, the Ontario-Michigan border-crossing times increased significantly, but by December 2001, these times had returned to levels that did not impede car manufacturing by disrupting logistical channels.

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