$Y^*$ represents full employment output. Output above this level will lead to inflation, output below will mean high unemployment. $Y^*$ is therefore the optimal level of real output.
Random shocks to \( M^d \) will shift the \( M^d \) leading to changing interest rates under a money supply target \((M^*)\) or changing money supplies under an interest rate target \((r^*)\). So the monetary authority can fix either the quantity of money \((M^*)\) or the interest rate \((r^*)\) but not both at the same time. Why? Because the Fed does not control money demand.
Random (stochastic) shocks (disturbances) to the goods market will shift IS curve. Statistical analysis confines the range of shift as given in the graph.
In a stochastic (changing) environment the monetary authority cannot always achieve $Y^*$. So the policy goal is to minimize deviations around $Y^*$. When stochastic disturbances emanate from the goods sector and the Fed pursues a monetary target the range of possible output values is given between $Y_L$ and $Y_H$ as in the graph.
When stochastic disturbances emanate from the goods sector and the Fed pursues an interest rate target the range of possible output values is given between $Y_L$ and $Y_H$ as in the graph.

It is easily seen that when the shock comes from the goods sector that a money supply target is optimal. Why? Because a money supply target allows the interest rate to change and the crowding out (in) effect to help mitigate the effects of the shock.
If the source of the random disturbances is in the financial sector (money and bond markets) then output will fluctuate around shifting LM(M*) curve but not around the LM(r*) curve. Why? Because when the Fed targets the interest rate, it prevents changes in the financial sector from being transmitted to the goods sector. An interest rate target stops the monetary transmission mechanism from operating.
Output can be as high as $Y_H$ and as low as $Y_L$ under the money supply target but will be equal to $Y^*$ under the interest rate target. It is easy to see that when the shocks emanate from the financial sector the optimal policy is to target the interest rate.